



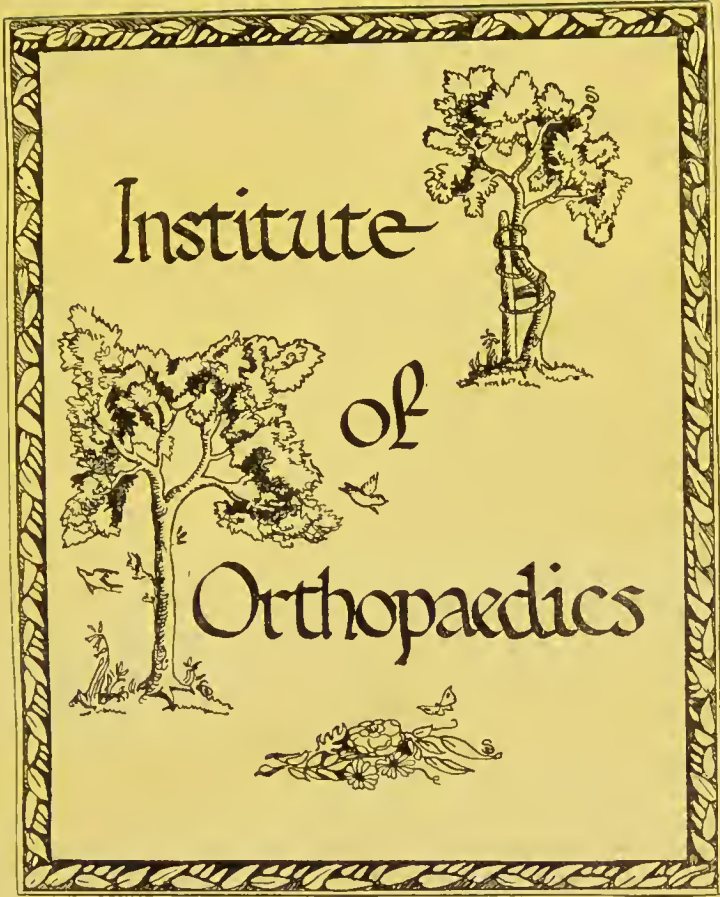
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TREATISE ON THE SPINE.



A

# TREATISE

ON

THE INJURIES, THE DISEASES,

AND

THE DISTORTIONS

OF THE

# SPINE;

FOUNDED ON AN ESSAY TO WHICH THE  
JACKSONIAN PRIZE, FOR THE YEAR 1826,

WAS ADJUDGED BY THE  
ROYAL COLLEGE OF SURGEONS.

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By R. A. STAFFORD,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS; SURGEON TO THE SAINT MARY-LE-BONK  
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LONDON :

LONGMAN, REES, ORME, BROWN, GREEN, AND LONGMAN,  
PATERNOSTER-ROW.

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1832.



1994

*[Faint handwritten text at the bottom edge]*

# DEDICATION.

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TO

WILLIAM LAWRENCE, Esq. F.R.S.

PROFESSOR OF ANATOMY AND SURGERY TO THE ROYAL COLLEGE OF  
SURGEONS; SURGEON TO ST. BARTHOLOMEW'S HOSPITAL,

&c. &c. &c.

MY DEAR SIR,

THE constant and unvaried friendship you have manifested towards me, during a long course of years—the many favours I have received at your hands, and the valuable information I have acquired, both from your observations and example—induce me to dedicate to you this small volume. It would ill become me to pass an encomium on such an occasion upon a man whose talents and acquirements are so universally acknowledged.

It only remains, therefore, that I request you to accept the assurances of my warmest gratitude and most perfect esteem, remaining always,

My Dear Sir,

Your most obliged

And faithful Friend,

R. A. STAFFORD.

28, OLD BURLINGTON STREET,

April 10th, 1832.

## PREFACE.

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MY object in the present work has been rather to state the facts which have come under my own observation than to relate the opinions of others. I have had neither leisure nor inclination to make a mere compilation, or even to enter into long disquisitions on subjects, which, from the imperfect knowledge we at present possess of them, could only terminate in doubt. It will be seen, therefore; that I have obtained my information chiefly from the bed-side of the patient—the examination of the diseased parts after death—or from the morbid preparation.

With regard to the arrangement of the work, I have followed that proposed by the Jacksonian Committee of the College. First treating on the Congenital Diseases of the Spine; then the Injuries; the Diseases and Distortions of the Vertebræ; and, lastly, on those of the Medulla and its Membranes. I am fully aware that many parts of it may be considered too general, but to have entered into a detail of the minutiae on some of the subjects connected with it, as, for instance, on the anomalous formations, and the particular description of each distortion which may occur, would have occupied several volumes. I have therefore purposely avoided it, and have endeavoured to compress and simplify the matter as much as possible, confining myself only to the most important diseases affecting the Spine.

I here beg to offer my best thanks to those



gentlemen who have kindly allowed me to obtain information from cases under their care, or who have given me a particular account of their treatment.

R. A. S.



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ON THE  
INJURIES, THE DISEASES, AND THE DISTORTIONS  
OF THE  
SPINE,  
&c. &c.

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CHAPTER I.

*Anomalous Formations of the Spinal Marrow—Spina Bifida—its Diagnosis—Symptoms—Combinations—Seat of the Disease—the Cause—Structure of the Parietes of the Tumor—Analysis of the Contents of the Tumor—Distribution of the Nerves—Prognosis—Treatment—Palliative Remedy—Radical Cure—The Mode by which the Radical Cure is effected—Spontaneous Cure—Cases.*

DURING the period of utero-gestation, the Spine, like other structures of the body, is liable to be malformed; and when such an occurrence takes place, it usually arises from an incomplete formation of some of its parts; as, for instance, a partial or total absence of the spinal marrow, or a defect in the bony column protecting it.

The malformations which have been found to occur in the development of the Medulla Spinalis, are:—1st, Its total absence—2d, A total want of the nervous system—3d, A simultaneous absence of the brain and marrow—4th, An imperfection of the spinal marrow—5th, A greater or less extent of division of the spinal marrow into two halves—6th, A double formation of the spinal marrow—7th, A variety in its length and thickness—and 8th, A central cavity in its substance. Specimens of almost all these varieties are to be seen collected in our museums; and M. Ollivier\*, to whose excellent work upon this subject I beg to refer the reader, has both cited cases from various authors, and related several which came under his own observation of each description. It is not my intention, however, to treat upon all the aberrations of structure which occur in the foetal spine, as this of itself, involving a question of such magnitude, would occupy at least the pages of a whole volume. I shall therefore at once pass over to the more immediate subjects which gave origin to this work:—Spina Bifida; the Injuries, the Diseases, and the Distortions of the Spine; and the Diseases of the Medulla Spinalis.

\* *Traité de la Moelle Epinière.*

## SPINA BIFIDA.



SPINA BIFIDA is a congenital disease, and may perhaps be looked upon as one of those aberrations of nature in the formation of the fœtus which are commonly classed under the denomination of monstrosity. This malformation is said to have been first observed by the Arabian physicians, who from their imperfect knowledge of its morbid structure, and their ignorance of its real nature, considered it to arise from a double formation of the spinous processes, and accordingly gave it the name of Spina Bifida, or Bifurcated Spine. From the numerous dissections, however, which have been since made of this disease, it has been discovered that it is owing to a deficiency of the spinous processes or the rings of the vertebræ. The membranes of the medulla are deprived of their bony covering at one particular part, and consequently, not having their natural support, become thrust through the opening by the preternatural

secretion of fluid contained in the canal. From this cause a pouch or tumor, is formed upon the spine, which by Sauvages\* was denominated hydrorachitis, by Pinel† hydrorachis, and by Frank hydrorachia. ‡

The tumor which presents itself in Spina Bifida, at the birth of an infant, is of a soft, fluctuating, and elastic nature, either pellucid or opaque, varying in size, shape, and colour. As to size, sometimes there is at first no projection whatever; a livid or red spot only marks the situation of the malformed part, which gradually enlarges: sometimes it is not more than half an inch to an inch in diameter, and at other times it has amounted to twelve inches, or even more. Upon the average, however, it may be considered to vary from the size of a chesnut to that of a small orange. The shape and colour also of the tumor differ as much as its size, for the one must be governed by the extent of the malformation, and the other by the state of its parietes, at birth. If it should happen that only one spinous process, or ring, is deficient,

\* Nosolog. Meth.

† Nosog. Phil.

‡ De Cur. Hom. Morb.



or that there is a small aperture in the sacrum, then most probably it would be of a rounded shape, arising by a pedicle; but if more of the spinous processes, or rings, are wanting, so in proportion would it become oblong, or assume any other shape, according to the circumstances of the case. The usual colour of the tumor is that of the natural skin, but it is not uncommon to find it graduating from the palest red to its deepest shade, and it is sometimes brown, or even of a livid hue. The surface of the skin is generally smooth and shining, but occasionally it is rough, with points of ulceration or gangrene upon it. In a case which Brunner\* mentions, it was so smooth and shining that he says the mother of the infant could see her face, and the kind of garment she had upon her, in it; and he therefore compares it to a mirror. We can easily imagine that when the delicate skin of a new born infant is rendered thin by great distention, and the fluid contained in the tumor is of a dark colour, the rays of light would be reflected from it, and this appearance produced; for we continually see, even in the adult, that blisters, where there is extravasated blood in

\* *Miscell. Curios.* Dec. 3. Cap. i. p. 249.

them (particularly those arising from pinches) present this polished and reflecting surface.

The usual symptoms which attend upon spina bifida are paralysis of the lower extremities, with the power of motion and sensation more or less deficient—want of power to retain the fæces and urine—frequent diarrhœa—deformed limbs—convulsions—emaciation—or general weakness. There is no one of these symptoms, however, which is invariably present, as may be remarked in Cases I. and III. In the one the child is five years old, and is as stout and healthy as any child of its age, and in the other, although it died, (which can hardly be attributed to the spina bifida), the motion and sensation were as perfect as natural, and no other defect or bad symptom was present.

From the period when life first commences, the tumor in spina bifida, if left to itself, gradually increases in size, in proportion as the secretion of its internal surface or that of the membranes of the medulla increase, and at length it becomes of such a magnitude that it bursts, from ulceration or gangrene of its walls, and thus its contents are evacuated, and

death speedily terminates the miserable existence of the patient. The period of time before it arrives at this crisis, is uncertain. In some instances the tumor has burst during parturition\*—in others from one to ten days, and sometimes even months and years have elapsed before this catastrophe has taken place.

Numerous authors have related cases where the subject of this disease has lived much beyond the period of infancy ; from twenty to thirty, and even to as advanced an age as fifty. In two of the cases related at the end of this essay it may be seen that the patients have arrived at from three to five years ; and Mr. Stanley mentions in his Lectures that he knows of a case where the individual is in his twenty-second year. The tumor in these cases remains stationary, neither increasing nor diminishing, and its walls become thickened, firm, and opaque.

Spina bifida, as it has been before observed, is frequently combined with other malformations and diseases ; such as club-feet, hydrocephalus, &c. When hydrocephalus accompanies it, the fluid in the

\* Tulpius, Obs. Med, 1685, p. 230.

ventricles and the theca vertebralis is often continuous, and it has been observed in some cases that when pressure is made by the hand upon the tumor its size will be diminished, and by this means either symptoms of compression of the brain will be produced, or the fontanelles be distended. It is hardly necessary to say, that the usual explanation of these cases is, that in the one the calamus scriptorius is ruptured by the gravity of the fluid in the ventricles, and thus the communication is accounted for; and that in the other, the membranes of the brain being continuous with those of the spine, the fluid in this manner finds its way between the arachnoid membrane and pia mater. Portal\* has endeavoured to prove that there is a canal more or less large in different individuals, in the substance of the spinal cord, which communicates with the fourth ventricle, and that the fluid finds its way through this channel from the tumor to the brain. He first discovered this canal in a case of spina bifida, but he acknowledges that he could not trace it farther than the cervical portion, and therefore, although he seems to be of opinion that there is a connexion, he proves by his own dissection there is not.

\* Hist. del. Acad. 1770, p. 237.

Morgagni\* has related three or four cases where the tumor in Spina Bifida was connected with hydrocephalus. In one which occurred to Genga, and was also seen by Lansici, when the head was compressed it became diminished in size, and the water flowed out from an aperture in the tumor which was at the sacrum. In two other cases, one of which occurred to Brunner†, and the other to Meyer, the like effect was produced. In the one, the tumor was cut out, and when the fluid flowed through the opening made, the head of the infant became immediately diminished in size, and in the other, the tumor burst of its own accord, and the same result ensued. This is a fact which has been doubted by some authors, but Case II. clearly proves it to be true. In this instance the head was nearly as large as the body, but when the tumor sloughed off the fluid escaped through it for some months; it gradually diminished in size, and became no larger than natural.

Although, as it has been said before, there is generally a connexion between the tumor and the hydrocephalic head, yet this is not always the case,

\* De Sed. et Caus. Morb. 12.

† Opt. Cit.



for Brunner\* relates an instance where they both occurred at the same time, and no communication could be discovered. After having given a very elaborate description of the brain, which was of immense size, and having told us that the water was found in the ventricles, he proceeds to the examination of the tumor in the back. He says that when it was cut into, the medulla spinalis appeared quite naked, and that air could not be transmitted by the blowpipe from the tumor to the brain, nor from the brain to the tumor.

In some instances where the tumor in spina bifida has subsided, either by a process of nature or by artificial means, it has been observed that hydrocephalus ensues. Greew, and others, mention cases of this description. Greew saw one case where, the aperture being healed, hydrocephalus of a great size followed, and Case IV. illustrates this fact. When this occurs, the latter disease terminates the existence of the patient.

This disease is also accompanied sometimes by a tumor of the like nature upon the head: Richter†

\* *Miscell. Curios.* p. 253.

† *Chir. Bibl.* p. 186.

and Mr. Earle\* have remarked this, and it is exemplified in the child described in Case IV. Here, as generally is the case, the greatest part of the os occipitis is deficient. A double tumor of this character also occurs upon the spine, having the intermediate part quite perfect, and in this combination the fluid contained in the one tumor can be pressed into the other. There are other malformations, likewise, frequently combined with spina bifida: in short, after reading Case II., we cannot be surprised at any deformity that may accompany it.

We now come to the seat of Spina Bifida: it has been usually described as a lumbar tumor, but it may occur in any part of the spinal column, from the cervical portion to that of the sacrum, and various authors relate well-authenticated cases where each part, and sometimes the whole of the canal, has been defective and involved in the disease. It is not necessary, however, to cite these cases; we have examples sufficient of a later date, and our museums teem with preparations illustrative of this fact. In some we see the whole spine defective in its spinous processes and rings; in others, two parts of the column are malformed, leaving the

\* Cooper's First Lines.

intermediate space perfect, and in others again, the cervical, the dorsal, lumbar, and the sacral. The cause of this imperfection of the vertebræ must be no doubt owing to the cessation of ossification, and to the imperfect closure of their rings during utero-gestation, and this is precisely analogous to all those malformations which originate from the want of union of the two halves of the fœtus while in progress of formation; such as a portion of the back part of the occipitis being deficient, cleft palate, hare-lip, and an incomplete junction of the parietes of the abdomen at the linea alba. Spina Bifida is often combined with one or other of these anomalies, and there is a preparation in the College of Surgeons which well illustrates the analogy between them. In the same fœtus there is spina bifida in the dorsal region, and an incomplete closure of the parietes of the abdomen, and thus the peritoneum and the intestines protrude.

The progress of the ossification of the vertebræ seems also to have advanced in different degrees in different cases; sometimes there is only a slit, with one or two spinous processes deficient; sometimes half, and at others the whole of the ring is deficient; occasionally, also, the bodies of the



vertebræ have been known to have a fissure in them, so that the contents of the abdomen could be seen. Wepfer\* and Saltzman† take notice of this fact, and it also may be observed in Case II. Here not only the intestinal canal could be seen, but the fæces were voided through the tumor. The following history of the skeleton‡ of a child who died of spina bifida, is a good illustration of the different degrees of ossification of the vertebræ in this disease:—the greatest part of the os occipitis is defective, and the foramen magnum, all but its anterior part, does not exist; the first four cervical vertebræ have no arches, but the bodies are perfect: the fifth and sixth cervical vertebræ are perfectly formed, all but a small portion of their arches and the whole of the spinous processes; the seventh cervical and first dorsal have only their bodies; the second, third, fourth, fifth, sixth, and seventh dorsal, are perfectly formed, except the spinous processes, and all the rest of the vertebræ are quite deficient in their arches and spinous processes; the canal of the sacrum is quite exposed, and there is no os coccygis.

\* Misc. Cur. Dec. 3. An. 7, Obs. 158.

† Cooper's First Lines.

‡ Museum, St. Bartholomew's Hospital.

There can be but little doubt that the primary cause of spina bifida is an interruption of the ossification of the vertebræ during utero-gestation, but the cause of this interruption is involved in great obscurity. Whether it may be attributed, as some have imagined, to the mother of the infant having received an injury during pregnancy, and thus, by the uterus having received a shock, the progress of fecundation may be disturbed,—or whether, as others have asserted, it may arise from a malformation or improper action of that organ, cannot be determined. It is certainly true, however, that the mothers of the infants that are born with this disease generally ascribe it to a hurt or fall; and the mother of the child described in Case II. is a very remarkable instance of this, for she not only bruised her back, but lost the power of her lower extremities, from a fall when three months gone in pregnancy.

Our next inquiry is, can the cessation of the ossification of the vertebræ be owing to the water in hydrocephalus descending down the canal of the spine, or to a dropsy of the membranes of the medulla, which, occurring before the bones are quite formed, obstructs their growth, by which either the rings are not formed at all, or are prevented

from being united to one another? This certainly may be one of the causes, and it is not at all uncommon for a fœtus to be born with hydrocephalus when only seven months (and even much less) old; and from the progress of ossification of the vertebræ it might be reasonably concluded that if the membranes of the medulla became distended before their complete development, they would be but imperfectly formed and pushed asunder. This seems to have been the case in that infant, the vertebræ of whose skeleton have been before described: it had hydrocephalus as well as spina bifida, and the rings of some of the dorsal and lumbar vertebræ were entirely wanting, and the others were quite forced back against the ribs. We cannot, however, assign the above as the only, though it may be perhaps one of the causes of spina bifida, for we frequently see a tumor arising by a pedicle, and coming through a very small aperture of the canal of the spine.

Burgius, and other authors, remarked that the same mother would at one time bring forth a healthy child, and perfectly formed, and at another, one with spina bifida. The same mother, according to this author, in her first parturition brought forth a healthy daughter, and in her second she had a boy

affected with spina bifida ; in her third a perfectly formed girl, and in her fourth another child with spina bifida. From this account one would think it depended upon some peculiar state of health of the mother during her pregnancy ; but it is a subject so far beyond the reach of our philosophy, that it is impossible for us to affix any precise cause.

The tumor in spina bifida protrudes itself between the muscles on each side of the spine, and its parietes usually consist of the arachnoid membrane immediately lining it, with nerves scattered upon it, as will be hereafter described, the dura mater of the spine, the ligamentous matter of the canal, and the common cellular substance and skin. The contents of it is generally a thin limpid fluid, mostly clear, and sometimes more or less tinged with blood, and from the analysis of Bostock and Marcet the following may be considered to be its component parts.

BOSTOCK.		MARCET.	
Water . . . . .	97.8	Water . . . . .	988 60
Muriate of Soda . . . . .	1.0	Mucus . . . . .	2.20
Albumen . . . . .	0.5	Muriates . . . . .	7.65
Mucus . . . . .	0.5	Carbonate of Soda . .	1.35
Gelatine . . . . .	0.2	Phosphates . . . . .	0.20

This fluid is most frequently contained between the arachnoid membrane and pia mater, but occasionally it has been known to exist between the arachnoid membrane and dura mater, and sometimes between both at the same time. Portal\*, with others, speak of its having been contained in a canal which they all assert exists in the substance of the medulla; but the correctness of this fact is doubted by anatomists. In all those cases† which were drawn on purpose to represent the distribution of the nerves, the fluid was contained between the arachnoid membrane and pia mater; but in drawing I.‡ it existed in separate cells or cysts. In this case, when the tumor was punctured, all the fluid was not evacuated at once, but there remained behind small distended bladders of it, unconnected with the common cyst. This was seen more particularly in one on the right side, which being itself about the size of an orange, was obliged to be punctured, to let out its contents. Upon examining the tumor after death, there were found two large cysts, and a number of smaller ones, about the size of a pea, existing in the parietes of the tumor. The large cavity in drawing No. I. was no doubt the

\* Opt. Cit.

† Vide Prize Essay for 1826, College of Surgeons. Drawing V.

‡ Ibid.



common cyst connected with the vertebral canal, with its neck, or the part joining immediately with the spine, filled up by newly-organized lymph, and thus closing up the communication. The smaller one of the two was quite impervious, and its internal surface was smooth : it appeared to be continuous with the external membrane, or what would have been the dura mater of the other cyst ; and it is probable that it had been connected originally with it, and afterwards closed up, and then, if this conjecture be right, the fluid must have escaped through the arachnoid membrane and dura mater. The other cells also were quite impermeable, and it would be almost impossible to account for their existence.

It is a question from whence the fluid is secreted in spina bifida ; whether from that part of the membranes which is confined to the tumor itself—whether from the membranes of the medulla spinalis—or from the ventricles of the brain. Certainly there are some cases where it would appear that it depended upon the internal surface of the tumor alone, for the aperture through which it is protruded, in the vertebral canal, is so small that it will hardly admit of a hair being passed through it, and it is not likely, therefore, that in this case it can be supplied in any other way than from its own surface. No

doubt, in the first instance, the canal is full of fluid, and the membranes are forced through the orifice ; but after this the internal walls of the tumor probably take on an action of their own. There are some who think spina bifida is always connected with hydrocephalus, and that the fluid descends from the ventricles of the brain into the tumor: Morgagni\* seems to lean towards this opinion ; but so numerous have been the cases of spina bifida, unconnected with hydrocephalus, that it is quite untenable. It certainly is true that they frequently exist together, and are connected with one another ; but in some cases it appears, that after a certain period, when a large portion of the spine is not defective, that neither the ventricles nor the membranes of the medulla, but the walls of the tumor itself, are the source of the fluid it contains.

The changes of structure which the membranes undergo during the progress of the disease, are generally inflammation, enlargement, stretching, and thickening ; and the different degrees of these alterations depend upon the different degrees of activity of the disease. In those cases where the

\* Opt. Cit.

tumor fills rapidly and bursts, or where the infant dies soon after birth, we find only inflammation, with enlargement; but when the fluid contained in it accumulates slowly, and the infant lives for some months, or longer, then the parietes are observed to be thickened, without much inflammation. The integuments and skin are liable to undergo those changes which are common to all other parts of the body. Thus, for instance, they are sometimes inflamed, sometimes ulcerated, and sometimes gangrenous; which arises from their great distention.

When we consider that in spina bifida the medulla spinalis is deprived of its natural bony covering, and that the arachnoid membrane which envelops it is completely forced away from it, it is easy to imagine there must be either some alteration of its structure, or peculiar distribution of its nerves. Even so far back as Tulpius\* this was remarked; for he says, in several instances, when speaking of spina bifida, that the nerves were so entwined with one another, that a scalpel could scarcely be used without endangering life. Burgius, Brunner, Morgagni, Camper, Abernethy, and various others, have also taken notice of the same fact: each

\* Obs. Med.



of these saw either the medulla altered in its structure, a change of its course in the vertebral canal, or an unusual distribution of its nerves.

The usual origin of the spinal nerves, in their healthy state, (speaking of them as a body, and not individually) is that they arise, by two series of filaments, from the anterior and posterior surfaces of the cord. Both of these proceed outwards, and being first separated by the ligamentum denticulatum, at length approach each other, and form two fasciculi of nerves; these pass through the dura mater by separate openings—the posterior fasciculus forming a ganglion, and the anterior being united to it by cellular tissue. After this point they join and form the proper spinal nerves, which again divide and subdivide, and supply the whole muscular part of the body.

In spina bifida it appears that either part or all the filaments which form the posterior spinal nerves, corresponding to the solution of continuity of the vertebral canal, are distributed upon the internal walls of the tumor, and that they generally terminate there. These arise from the cord in various ways; sometimes only by single filaments, which pass out of the aperture of the canal through the

fluid contained in the tumor, unattached to any thing until they arrive at its parietes, where they are dispersed. This is particularly well illustrated by the drawing\*, No. V. fig. 1: here we see two of the nerves arising and distributing themselves in this manner. Sometimes, again, the posterior spinal nerves come out of the opening in the canal, and instead of going straight through the fluid, pass round the internal surface of the tumor, and thus form a network of nervous filaments. Burgius mentions a case of this description, where the internal surface of the tumor was so surrounded by nervous columns and fibres, that it resembled the internal structure of the auricles and ventricles of the heart. In other cases there arises a kind of peduncle in the middle of the tumor, of a nervous mass, resembling a mushroom, of which the stalk is formed of filaments of nerves bound together by cellular tissue, and the head by their extremities spread out and ending upon the upper and internal surface of the tumor. Brunner has particularly taken notice of this variety of distribution; and from the drawing†, No. V. fig. 2, one would almost imagine he was alluding to the same case.

\* Vide Drawing in the Library of the College of Surgeons, and Preparation, Museum St. Bartholomew's Hospital.

† Ibid.

The posterior spinal nerves, which are distributed upon the internal walls of the tumor, do not always pass through the aperture connected with the vertebral canal ; but sometimes they pierce as it were the tumor, and then distribute themselves on the internal surface. There are two preparations of this description in Mr. Llangstaff's Museum : in the one they pierce the tumor at its back part, and pass straight through the fluid ; in the other they also pierce the back part of the tumor, but they immediately curl round its walls.

There appears to be some degree of regularity of the distribution of the nerves when spina bifida occurs at the upper part of the canal ; for here the posterior nerves are only involved in the disease, whilst, at the lower portion, the whole cord is continually influenced by it. Thus we see in some cases only a few nervous filaments erring in their course, while in others we find the whole bundle of nerves, which form the cauda equina, going out of the canal and attaching themselves to the top of the tumor, and returning into it again, as may be observed in drawing\* V. fig. 3.

\* Vide Drawing, College of Surgeons, and Preparation, Museum St. Bartholomew's Hospital,

Sometimes, again, we find that the whole of the medulla is brought out of its course through the aperture of the canal, and that it completely ends in the tumor, leaving the canal below quite hollow. Various authors, among whom are Brunner, Hoin, Apinus, and Sandifort, relate cases of this description; and, no doubt, if the owner of the preparation from which the drawing V. fig. 2, was taken, would permit a farther dissection to be made of it, we should find the canal of the sacrum quite hollow, and that the peduncle in the middle, and the nerves around, was the whole of the cauda equina terminating in the tumor; for it so exactly resembles that case before mentioned, described by Brunner, that one naturally would expect to find the same result.

It does not appear, however, that the medulla, or the lower part of the canal, always deviates from its course, or that the nerves are altered in their distribution; for it may occasionally be seen that no alteration whatever takes place, and that neither itself nor its nerves are changed either in their arrangement or in their structure. This is exemplified by drawing V. fig. 4\*. Here we see the bundle of nerves, forming the cauda equina, following their usual course.

\* Vide Drawing, College of Surgeons, and Prep., Museum St. Bartholomew's Hospital.

The medulla spinalis also in spina bifida, at the part where the malformation of the canal occurs, becomes changed in its structure in various ways ; sometimes it has been found inflamed—sometimes not so large as natural—and sometimes of a firmer consistence ; sometimes, again, it has been rendered completely soft—and at other times has been found altogether deficient.

So important are the parts involved in the disease, and so necessary is it that so vital and delicate an organ as the medulla spinalis and its membranes should have their natural support and protection from external violence, that we may consider the prognosis to be much more against than in favour of the cure of spina bifida. It is true that a few cases have been related where the palliative treatment has succeeded in retarding and giving temporary relief to the disease, and where the consolidation of the parts over the malformation of the vertebral canal has taken place by the radical treatment of it, so that a kind of cure has been effected ; but so rarely that we cannot, in the most favourable cases, even prognosticate a happy termination. Spina Bifida also is so frequently combined with some other disease or malformation, that it is but seldom



that an opportunity is afforded us of relieving it ; and even during the process, when there is a prospect of cure, there is so much danger from inflammation of the parietes of the tumor, or the medulla spinalis, that in many instances the patients have been known to die from one of these causes while under treatment. Again, not unfrequently also, when the parts have become consolidated, hydrocephalus ensues, as in Case IV., and death has been the result. The general conclusion, therefore, is, that Spina Bifida is a disease which seldom admits of cure.

It was not till of late years that any means were adopted even to attempt a radical cure of this complaint. The ancients, considering it a disease beyond the art of surgery, only used palliative measures, such as fomentations, discutients, &c. ; but the moderns, being aware that if they did not succeed in curing it, it must eventually be attended with the same result—the death of the patient—thought it worth while, under these circumstances, to try other remedies. Those which have been proposed are—ligatures, setons, compression, and puncture.

Among those who recommend the ligature, Mr.

B. Bell\* stands the foremost, and was the last person of any eminence who proposed it. The advantages which he expected to reap from the application of it may be learned from his own words. "Might not," says he, "some advantage be derived from applying a ligature round the base of the tumor, not merely with a view to remove it, but also to draw the bottom of the cyst so closely together that it may act as a proper support beneath?" After it has fallen off he proposes to apply a truss upon the part, as in hernia. It does not appear, however, that he has ever had an opportunity of trying the effect of his proposition; but from the experience of those who have gone before him, we cannot judge very favourably of it: indeed, when we consider the usual distribution of the nerves in this disease, and the uncertainty of the course of the medulla spinalis, we cannot wonder at the failure; for if we allow even that the tumor always arises by a pedicle, (which it seldom does) and that it could be always tied at its base, we could not with any degree of certainty pronounce that we should not include a part of the medulla itself, or some of its nerves, in the ligature. This is not, however, the only reason why such a remedy would be dangerous:

\* B. Bell's Surgery, vol. 1, p. 242.

when the tumor fell off, from the application of the ligature, we could not be sure that its sides would adhere; in which case the medulla spinalis would become exposed: by these means inflammation of itself and its membranes might be brought on, the almost immediate consequence of which would be death.

Desault\* proposed another remedy—a seton, with the view of allowing the gradual escape of the fluid without admitting the air, and at the same time of exciting adhesive inflammation in the parietes, the consequence of which would be consolidation of the parts; but this appears to have been a suggestion merely, for he does not mention having tried it. Objections similar to those which were brought forward in deprecating the application of the ligature, may be also adduced against this mode of treatment: we should always run the risk of wounding the medulla spinalis and nerves, and the seton, being a constant source of irritation, might in the end occasion the death of the patient.

Counterirritants, such as issues and setons, so distant as not to affect the tumor with inflammation,

\* *Traité des Malad. Chir.* tom. 2, p. 11.



were proposed by Richter: he thought that the fluid by these means might be absorbed, and that a radical cure might be accomplished. However plausible this theory may appear, he seems to have forgotten that this process can be effected solely by the consolidation of the walls of the tumor; and that the fluid above being absorbed, and the parietes remaining not being thickened, little or no protection would be afforded to the medulla spinalis.

The only methods which have been employed with any real advantage, in the cure of spina bifida, are compression and puncture; and for the introduction of both of these we are indebted to Mr. Abernethy\*: Sir Astley Cooper, however, was the first who had the good fortune to carry them into effect. Mr. Abernethy proposed applying gentle pressure upon the tumor from its commencement, with the idea of giving that support to the dura mater which it had lost from the deficiency of its bony covering; and at the same time of producing, if possible, the absorption of the fluid. He himself never had an opportunity of trying this method; but Sir Astley Cooper employed it in one case with great advantage, which I shall here take the liberty of quoting.

\* Surgical and Physiological Essays, Part III. page 134. Anno 1797.

“ James Applebee, Baldwin-street, Old-street, was born on the 19th of May, 1807, and his mother, immediately after his birth, observed a round and transparent tumor on the loins, of the size of a large walnut. On the 22d of June, 1807, the child was brought to my house, and I found, that although it had spina bifida, the head was not unusually large ; and the motions of its legs were perfect ; and its stools and urine were discharged naturally. I applied a roller around the child’s waist, so as to compress the tumor, being induced to do so from considering it as a species of hernia, and that the deficiency of the spine might be compensated for by external pressure. The pressure, made by the roller, had no unpleasant influence on its voluntary powers ; its stools and urine continued to be properly discharged ; but the mother thought, that the child was occasionally convulsed. At the end of a week, a piece of plaster of Paris, somewhat hollowed, and that hollow partly filled with a piece of loose lint, was placed upon the surface of the tumor ; a strap of adhesive plaister was applied, to prevent its changing its situation ; and a roller was carried around the waist, to bind the plaster of Paris firmly upon the back, and to compress the tumor as much

as the child could bear. This treatment was continued until the month of October, during which time the tumor was examined about three times a week, and the mother reported, that the child was occasionally convulsed. When the child was five months old, a truss was applied, similar in form to that which I sometimes use for umbilical hernia in children, and this has been continued ever since. At the age of fifteen months it began to make use of its limbs ; it could crawl along a passage and up two pair of stairs. At eighteen months, by some accident, the truss slipped from the tumor, which had become of the size of a small orange, and the mother observed, when it was reduced, that the child appeared in some degree dull ; and this was always the case, if the truss was left off for a few minutes, and then re-applied. At fifteen months he began to talk ; and, at two years of age, he could walk alone. He now goes to school, runs, jumps, and plays about, as other children. His powers of mind do not appear to differ from those of other children. His memory is retentive, and he learns with facility. He had the measles and small-pox in the first year, and the whooping-cough at three years. His head previously, and subsequently to the bones closing, has preserved a due proportion to other parts of the body. The tumor

is kept by the truss entirely within the channel of the spine; but when the truss is removed, it soon becomes of the size of half a small orange. It is therefore necessary, that the use of the truss should be continued. When the truss is removed, the finger can be readily pressed through the tumor into the channel of the spine\*.’’

In this case, although simple pressure succeeded, yet it might not be attended with equal advantage in all, as symptoms of compression of the brain, or some other bad effect, might be produced. We may observe, also, that this method of treatment does not effect a permanent cure, but is only, as Sir Astley Cooper very properly termed it, palliative; for as soon as the truss is removed the sac of the tumor fills again, and becomes as large as before. Its parietes, likewise, do not increase to that degree of thickness as to form a permanent support to the medulla spinalis; and therefore, as there is no consolidation of the parts, we cannot expect a radical cure.

Frequently, puncturing the tumor, making gentle pressure upon it, and healing up the wound, so as to

\* Med. Chir. Trans. vol. 2, p. 323.

prevent the admission of air, as recommended by Mr. Abernethy, is the most effectual, and perhaps the only possible way, of performing a radical cure of spina bifida. This mode of treatment Mr. Abernethy first tried in a very unfavourable case, as the skin of the tumor was diseased, and so much distended that it would not contract when the fluid was let out. The tumor was punctured every fourth day, and the wound closed by means of sticking-plaister: a compress was afterwards laid over the whole, and a slight degree of pressure made upon the part by laying rather broad straps of adhesive plaister over the compress: this was continued for six weeks: at length, the plaister being rubbed off the wound, the fluid escaped through the orifice, and in a few days the child died. Soon after, Sir Astley Cooper met with an infant, aged fifteen weeks, who was the subject of spina bifida, and had a soft, elastic, transparent tumor upon the loins, about the size of half a billiard-ball. He punctured the tumor with a needle instead of a lancet, evacuated its contents every fourth day, and applied a roller round the body, so as to make pressure upon it. By tracing the progress of this case, we find that the fluid in the tumor rather increased than diminished for the first month; but



after this time it gradually decreased, and its walls became solid: the child afterwards went through the usual complaints of infancy without harm.

Since this period many others have adopted this plan of treatment; some with, others without the like success: all agree, however, that this is the only effectual mode of treatment. The following case, which came under my own observation, and which perhaps is as interesting as any yet published, well illustrates both the progress and the process by which the radical cure of spina bifida is effected.

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### CASE I.

MARY COTTERILL, æt. 11 days; Dec. 10, 1826.—  
A child of eleven days old has a large swelling\* situated on the lower part of the back, beginning opposite the fifth lumbar vertebra, and occupying all the posterior surface of the sacrum. The tumor is about fourteen inches in circumference, tense and elastic to the feel, and evidently containing a

\* Vide Drawing, No. I. in the Library of the College of Surgeons.

fluid. The integuments on the right side are very much inflamed, and at several parts of it points of ulceration have commenced. When the child was born the swelling was about one-third less than it now is ; it has been daily increasing. In other respects the child looks well, is healthy, and seems to suffer little. As the fluid must soon have made its escape, from the ulceration of the integuments, under which the child must evidently sink, it was thought right to puncture the tumor with a needle, in order to let out its contents, and allow of the gradual escape of the fluid. This was accordingly done.

12th.—Only a few drops of fluid escaped through puncture made yesterday ; and to-day a small opening was made with a lancet, and about two ounces of straw-coloured serum was drawn off ; a small piece of sticking plaister was applied over the opening.

14th.—The tumor was again punctured, and nearly three ounces of fluid discharged.

15th.—The plaister was removed, and about two ounces more of the fluid were allowed to escape ; the redness of the tumor was greatly gone, and the inte-

guments had begun to contract ; the child appeared more lively.

18th.—The tumor was more distended, and its parietes considerably thickened ; two openings were made, and a little blood escaped.

20th.—The swelling was almost as much distended as when first seen ; a small trocar was introduced, and about four ounces of bloody serum drawn off ; after the fluid was evacuated, the parietes of the tumor were found very much thickened ; the child was restless, and did not take the breast so well.

22d.—The tumor was less inflamed, and the distention not so great ; four ounces more of the fluid were drawn off by the trocar, and two or three straps of plaister bound tightly round the swelling, with a roller applied round the body : since the 20th the child had been much easier, and the fluid this day was thicker, and seemed to be mixed with pus.

26th.—This day appearances were very much improved. The tumor was evidently much decreased, and the parietes were still thickening : almost the whole of the fluid was evacuated this day : several straps were applied, with a roller as



well: the fluid was of a very fœtid nature, with small flocculi: the health of the child improved.

28th.—About the same quantity of fluid was drawn off (two ounces) but still of a fœtid nature.

Jan. 11, 1826.—Since the last report small quantities of the same fœtid matter had been drawn off, and the tumor was evidently much decreased in size: the adhesive inflammation was going on, so that its sides were becoming much thicker: the left nates is much more defined: the health and appearances of the child were greatly improved.

Feb. 1.—Since the 11th January the swelling had been occasionally punctured, and the discharge of a thin serous nature.

About the 8th of this month the mother came to say the child was very ill. On visiting it, it seemed to have fever; the skin was hot and dry, the pulse quick, and the bowels costive: whether these symptoms were present from the irritation of the tumor, can hardly be decided. It was ordered aperients and antimonials, and in three days died in convulsions.

At the death of the patient the tumor had become nearly flat, (as represented in drawing, No. II.\*)" being only about an inch above the level of the surrounding parts; the skin was corrugated, and the tumor felt nearly solid.

At the post-mortem examination of the tumor the appearances were as follows:—

On making a division of the tumor, along the course of the spine, there was found to be a deficiency of part of the rings and spinous processes of the two last lumbar vertebræ, and the space had been filled up by newly-organized matter. The walls of the tumor were from about half an inch to an inch and a half in thickness, in different parts of it. The cavity itself of the tumor was complete without any adhesions, and about two inches in diameter: its internal surface was very irregular, having a thickish coating of lymph upon it: besides which, two or three layers of organized matter could be peeled from the part beneath. Upon making a minute dissection of the neck of the tumor, two filaments of nerves could be traced

\* Vide Drawing in the Library of the College of Surgeons.

through the newly-organized lymph, from the medulla spinalis into the cavity of the tumor, as seen in the drawing, No. III.\* The parietes of the tumor were condensed and thickened; and in the substance of the newly-organized matter were found little cavities, about the size of horse-beans or peas, containing a limpid fluid; and the skin covering the tumor was much corrugated and thickened. At the upper part of the tumor, immediately beneath the skin and cellular substance, were observed two or three strata of condensed membrane, about the thickness of a five-shilling piece: this is beautifully shewn in the drawing, No. IV.†: it had no doubt been the original boundary of the cavity of the tumor in which the fluid had been contained, and most probably was composed of arachnoid membrane and dura mater. From this original wall to the cavity of the tumor was the newly-organized matter, which, in different parts of it, was from half an inch to an inch and a quarter in thickness. On the right of this cavity there was another cyst, composed of a substance like thickened dura mater, about the size of a billiard-ball, quite impervious, and its internal surface smooth: the wall of this cyst

\* Vide Drawing in the Library of the College of Surgeons.

† Ibid.

could be traced into, and appeared to be a continuation of the external layer, or what would be the dura mater of the other tumor. This cavity was probably formed between the arachnoid membrane and dura mater, as on dividing the septum between the two, it was much thinner than the original parietes of the other cavity, and appeared to be bereft, as it were, of one layer of membrane.

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Here we may observe that the process by which the soft parts become consolidated, is very gradual: before this tumor was punctured, its parietes were nearly as thin as a bladder, and were much distended, being fourteen inches in circumference. For the first three times after puncture the tumor became as much distended as before, and but little alteration of its walls was perceived; but upon the fourth, fifth, and sixth days, the parietes began to thicken, and at length to contract, and so on until the 11th of January, when the tumor was evidently much diminished in size, and the adhesive inflammation going on. From this time to the 1st of February, a gradual thickening of the parietes, and diminishing of bulk of the tumor, was taking place, when, in a few days, the child died of fever, and the appearance of the

tumor was exactly the same as represented in the drawing, No. II.\*

From the history and dissection of this case, as well as of those treated by Sir Astley Cooper and others, we may safely come to the conclusion that repeatedly puncturing the tumor, so as to let out the fluid as often as it collects, is the only mode at present known by which a permanent cure of spina bifida may be effected. Sir Astley Cooper used a needle for this purpose, though this method will not always succeed, as the fluid is so thick that it cannot pass through so small an aperture: under these circumstances it will be necessary to make a valvular opening in the parietes with a lancet, and when the fluid is evacuated, to close up the lips of the wound with adhesive plaister, so as to heal it up by the first intention. By this means also the air will be excluded, which is of the utmost consequence, for it has been observed that in almost all those cases in which the tumor has burst of its own accord, or the wound has not healed, the air being admitted, the patients have died very soon after;—a proof how necessary it is to use every precaution to prevent its entrance. After having evacuated the tumor, a soft linen compress should be laid

\* Vide Drawing in the Library of the College of Surgeons.



upon it, and straps of adhesive plaister applied over this, so as to make gentle pressure, and a roller wound lightly round the body at first; and this pressure should be gradually increased till at length a truss may be applied, as in Sir Astley Cooper's cases. If, however, as frequently happens, convulsions are caused, or any other bad symptom produced, then pressure should be applied only to that degree the patient can bear. The tumor should be punctured every, every other, or every third, fourth, or fifth day, or indeed as often as the fluid collects; and it is advisable that this should be done before it arrives at its original size, for by the constant stretching of the skin it might lose its power of contractility, and the cure be retarded, or perhaps totally prevented.

During the progress of the treatment the general health of the patient should be carefully attended to; the diet should be milk, as being the more nutritious, the least likely to disturb the digestive organs, and the best calculated for the age of the patient: the bowels also should be kept open and regulated.

Having given a slight history and description of the disease, and spoken of its combinations—of its

probable causes, of its anatomy, and of its treatment—we now come to the changes it undergoes while under the palliative remedy, or the spontaneous and radical cure.

In the palliative remedy of spina bifida, which is by making pressure upon the tumor, the only change that can be said to take place is a general thickening of its parietes, the common integuments and membranes; but where there is no absorption of the fluid, there can be but little lessening of the size of the tumor, unless the truss is applied.

From the history of the foregoing case, and of those which will hereafter be related, it is clearly proved that both a spontaneous and artificial cure of spina bifida can take place. The mode by which the spontaneous cure is effected, is by the tumor becoming so large that it at length bursts, and its contents are evacuated; its walls then collapse, and the aperture through which the fluid passes is closed up by coagulated lymph, and heals: the tumor becomes again distended and bursts—its parietes collapse—and the wound heals in the same manner as before. This phenomenon is repeated as often as the tumor fills, and during this



time coagulated lymph is thrown out from its internal surface; the walls become thicker and thicker after each rupture, till at length they are consolidated. It was this process which Mr. Abernethy and Sir Astley Cooper imitated, when they repeatedly punctured the tumor, evacuated its contents, and healed up the wound, to perform a radical cure of spina bifida. Nature, however, in this instance, seems to prevail over art: it is very common, that when spina bifida is cured, hydrocephalus ensues; she has provided against this occurrence—for by leaving an aperture covered by vesicles, upon the top of the tumor communicating with the canal, as soon as the fluid collects these burst, and it is evacuated: thus hydrocephalus is prevented: this may be observed in both the cases here related of spontaneous cure. The rupture of these vesicles undergoes exactly the same process as the rupture of the tumor; they are distended, burst, and heal.

The mode in which the consolidation takes place, in the radical cure of spina bifida, is probably, according to the history and dissection of Case I., as follows:—that as the fluid contained in the tumor diminishes in quantity, the skin and the membranes

composing the walls of the tumor become thickened and contracted ; adhesive lymph is thrown out from the internal surface of the tumor, which becomes organized also, and so the cavity of the tumor is in progress of time closed up. That this is the process by which the cavity is filled up, is farther proved from the coating of lymph that was found upon its internal surface, and the layer of organized matter that could be peeled from it ; for if we observe the walls of the tumor, as represented in the drawing, we can distinctly trace the line of demarcation between what were the original parietes, and the newly-organized matter deposited in them. It has been conceived by some that the process of the radical cure of spina bifida is as in hydrocele, the walls being glued together by adhesive inflammation ; but the length of time it takes to effect the cure, the constant filling of the tumor, and the gradual manner in which the parts become consolidated, are quite sufficient to preclude this opinion—not to mention the fact that the walls of the tumor were in no part in contact. No doubt that in like manner lymph is thrown out, which produces the adhesion of parts in general ; but in the case of spina bifida, the cavity of the tumor seems to be filled up layer after layer with coagulable lymph, which is ultimately organized.

Whether the defective portion of bone ever becomes ossified, or whether any ossific matter is laid down towards its reparation, appears very doubtful; neither is there a case recorded, nor a dissection of the disease in existence, where a radical cure has been effected, that can quite satisfy us upon this point. Hoffman\*, and others, mention cases of cure, but they give us no dissection of the parts after death. The only facts, therefore, known to the author at present, which can at all elucidate this point, are those which have occurred in Sir Astley Cooper's practice †, and those in Cases I. and II.; all of which would rather incline one to believe that the soft parts alone were consolidated. In the dissection of Case I., which had been treated by puncture, the neck of the tumor, and the aperture in the canal, were closed up by newly-organized lymph; but not the slightest vestige of ossific matter was to be found. In Case II., the subject of which is living, the parts certainly, at the base of the tumor, feel very solid; but the extent of its circumference prevents us from ascertaining the exact state of the part where the aperture in the spinal canal occurred. There is an occasional oozing from this tumor,

\* Dec. 2. An. 5, p. 432.

† Vide Prep. in Museum St. Thomas's Hospital.

which no doubt is supplied from the vertebral canal, for it is not probable that so large a quantity could be secreted from these vesicles alone. In Case III., also, there is an aperture in the tumor and vesicles, and the water oozes continually from it, which can only be attributed to a communication with the spinal canal.

These three cases would confirm us in the opinion that the parietes of the tumor only become consolidated, and that no bony concretion whatever is formed; indeed, it is not probable there should be any, when we consider the cause of spina bifida; for it is owing rather to a cessation of the ossification, in the process of osteogeny, during uterogestation, than to a disease of the bone.

It has been much doubted whether spontaneous cure of spina bifida ever takes place, as it has been supposed, and it generally is the case, that immediate death ensues upon the bursting of the tumor. That it is possible for a spontaneous cure of spina bifida to occur, is, however, past all doubt, as will be seen by the history of the following cases. We may observe that one of the tumors, although it had been punctured, sloughed off, and the aperture in

the spinal canal was exposed; and that the other tumor burst of its own accord. Both patients are now living, and the parts are consolidated.

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## CASE II.

### CASE OF SPINA BIFIDA.

ALFRED SEYMOUR CHURCH, *æt.* two years and three months.—There is situated on the lower part of the back, over the inferior lumbar vertebræ and superior portion of the sacrum, a tumor of firm consistence and of rather unequal surface, about the size of half an orange; it is moveable, and of a darker colour than the adjacent integuments: when pressed upon or moved, the fæces are instantly evacuated. The spine, above the tumor, is slightly curved outwards; the inferior extremities are singularly deformed, and can be twisted almost in any direction: the flesh is flabby. When sitting, the right leg rests on the outer or fibular side, and with the thigh forms nearly a semicircle: the left leg rests on the inner or tibular side, and the



toes of both feet point to the right. The head is scarcely enlarged, and the skull is firmly ossified, except at the anterior fontanelle. His faculties are good, and he has only as yet cut six teeth. The testes still remain in the abdomen. The urine dribbles away as fast as secreted, and causes an excoriation of the prepuce and scrotum. He was born with an imperforate anus : an artificial opening was made into the rectum, through which the fæces are now voided. The nates are not, as usual, separated by a sulcus or division, but present a continuous surface. At the time of birth (which occurred between the seventh and eighth month) his mother states that there was a large soft tumor or bag occupying the site of the present tumor, and hanging considerably over the nates ; his head was greatly enlarged (nearly as big as the rest of the body) and the integuments of the forehead hung over the face. The accoucheur made several punctures in the bag, and discharged much fluid : the contents were four times subsequently evacuated, at the interval of two or three days ; the sac then sloughed off, and the fæces were evacuated through the ulcerated opening. The intestines could be seen through it. During the progress of the healing of this sore, much fluid constantly



drained off for some months, and the size of the head gradually diminished, and now there are small vesicles on the top of the tumor, which occasionally break and discharge a thin limpid fluid, and then heal. His mother attributes the malformation of his head and back to a fall she received when nearly three months gone with child, by which she struck the corresponding parts of her own body, and the deformity of the inferior extremities to her having been frightened, and thrown down, about a week afterwards, by a man who had a similar deformity of legs. After this she suffered greatly during the remainder of her pregnancy with severe pains in the head and back, and the weakness of her legs was so great as to prevent her standing.

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This case is perhaps the most remarkable that ever occurred of spina bifida, as it combines in it almost all the facts of importance that have ever been recorded, both by the ancients as well as the moderns: first, as to the immense size of the tumor;—secondly, as to its combinations: there was hydrocephalus of great magnitude—deformed limbs—deficiency of the nates, with imperforate

anus, and diminished nervous power ;—thirdly, as to the progress of ossification of the vertebræ : the rings were not only defective, but the bodies also, and the intestines, could be seen through the tumor which communicated with them, as the fæces were evacuated through it ;—fourthly, as to the subsidence of the hydrocephalus when the tumor sloughed off—the possibility of which fact has been doubted ;—fifthly, as to the reason suggested by the mother for the origin of the disease ;—sixthly, as to the spontaneous cure—another fact hardly credited ;—and seventhly, as to its present state and the age of the patient.

This case is not only interesting as relates to the spontaneous cure, but as it establishes the assertion at the beginning of this Essay—that spina bifida is a species of monstrosity.

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### CASE III.

May 4th, 1826.—This child is about four years and a half\* old, and as stout and healthy as

\* Now nine years.

any other child of that age. It has a tumor situated upon the third lumbar vertebra, equal in size to a pullet's egg, having rather a broad base and an inflamed appearance. It feels solid, and does not diminish in size upon pressure, and there is a constant discharge of a watery fluid from an aperture situated upon the top of it. The child suffers no inconvenience from it, and runs and plays about like other children. The parents (who are ignorant people) are very shy of giving any account of it, and they will not permit a drawing of it to be made. All that could be learned from them was, that the infant was born with a tumor like a bladder upon the loins, and that it increased till at length in a few months it burst. From this period the walls became hardened and thickened, and a watery fluid was constantly discharged from it up to the present time.

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This is another case of spontaneous cure of spina bifida, and here, as well as in the one preceding, nature seems to have provided an outlet for the fluid—thus preventing hydrocephalus.

## CASE IV.

## SPINA BIFIDA.

— POTTER, æt. three weeks. There is a degree of disfiguration and swelling of the dorsal vertebræ, and the integuments have ulcerated. The ulcer is as big as a shilling, but oval-shaped, and the surrounding integuments are purple. No spinous processes can be felt, and the transverse ones are widely separated, leaving a hollow cavity, over which the ulcerated integuments are stretched. During the first two weeks after the child's birth the inferior limbs were perfectly motionless, but since that period the toes have begun to move, and their motion has daily increased; so that if the sole of the foot be now tickled, it is very perceptibly felt. When the child was born, the mother describes the swelling to have had the appearance of a bladder filled with water. She did not perceive the precise time when the fluid was evacuated, but in a few days it appeared more flattened, and the ulceration then commenced. The child has all the appearances of health. The ossification of the occipital bone has been remarkably imperfect, not being larger than a shilling; so that the contents of the cranium, from

their gravity and want of resistance, give the head a very oval form. The ulcer of the back is dressed with simple ointment, and a pasteboard is made to fit accurately, and support the head at its back part.

Dec. 20th.—The sore on the back has now completely cicatrized, and the spinal cavity is covered anteriorly with a firm skin. Since the ulcer has healed the head has begun to enlarge, and the eyes to squint. The head is fitted with a cap and bandage, so as to give it great support : whenever these are removed the infant appears uneasy, and screams : when they are renewed it becomes tranquil. A blister to be put on the neck, and kept open.

The child died with the usual symptoms of hydrocephalus. The cranium was very considerably increased in its dimensions, and on removing the upper coronal portions, the ventricles were found so much distended with water that in some places the medullary matter forming their walls was altogether wanting. The brain was very firm, and the cavities enormously enlarged. On the choroid plexus was found a fine specimen of an hydatid. On dissecting the tumor on the back, the whole of the canal of the spine,



except a small portion where the separation of the vertebræ commenced, was destroyed, and the integuments adhered, forming what had been the sac.

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As the radical cure of spina bifida is always attended with some degree of danger, there are, perhaps, some cases where we should not be warranted in attempting it. If the tumor is small, and does not increase in size—if its parietes are not inflamed, and it is not painful—if the health of the patient be good, and he suffers no inconvenience from it—then, perhaps, the palliative treatment may be most judicious: but if on the other hand the tumor is increasing in size, or its walls are inflamed or painful, or the constitution is suffering from local irritation, the radical treatment for the cure of this disease is most advisable.

There are some cases where, from bad symptoms, and a complication of diseases, there is scarcely any hope of cure: such as when they are accompanied with hydrocephalus, bursting of the tumor, and paralysis of the lower extremities. It is true that in two former instances a cure has been



effected, but they may be almost considered as exceptions to a general rule. In these cases, where the patient cannot recover, the only course is to use palliatives, and to make the way as easy as possible to the grave.

# INJURIES OF THE SPINE.

## CHAPTER II.

### CONCUSSION.

*Diagnosis — Symptoms—Prognosis—Treatment—Cases—Morbid Appearances.*

THE injuries and accidents affecting the spine, which may be produced by any sudden or violent force applied directly or indirectly upon it, are—Concussion, Fracture, and Dislocation.

Of these three concussion is of the most frequent occurrence, as less force is required to produce it, and it may be caused not only by a blow being received immediately upon the part, but also from a distant shock, such as jumping from a great height and coming down upon the feet, &c. It arises, however, most commonly, from a blow being inflicted upon the vertebral column; and when the concussion is complete, all the parts immediately below the injury, and the muscles which are sup-

plied by nerves arising from the inferior portion of the medulla, are perfectly paralysed. The bladder is unable to expel its contents, and either the rectum cannot discharge the fæces, or there is an involuntary expulsion of them. The paralysed limbs likewise lose all sensation, so that they may be pinched, incised, or even burnt, without the patient having the slightest consciousness of it. When, however, the concussion is not complete, the paralysis is imperfect. The sensation of the limbs may remain, and yet they may have lost all power of *motion*, and on the contrary, motion may exist, while sensation may be entirely lost. This loss of power may also vary: it may equally affect both limbs—there may be imperfect motion, and sensation at the same time, or only one limb may suffer the loss of either of them, whilst the other may remain perfect.

Although in concussion of the spine the inferior extremities of the body are usually alone paralysed, yet it not unfrequently happens that the superior parts likewise suffer more or less from it, although the blow may have been inflicted on the vertebral column beneath that portion of the medulla from whence they receive their supply

of nerves. Thus, for instance, the middle of the back may have been struck, and yet the nerves, supplying the upper extremities, as well as those supplying the lower limbs, may lose their power. Such cases are not uncommon, and the following is one which occurs to my recollection :—A man received a violent kick from a horse on the most projecting point of the dorsal vertebræ. He instantly became paralysed in the lower extremities, and the arms likewise lost all power of motion, and partially that of sensation. Here the blow was received below where the nerves arise which supply the arms, and thus the superior extremities became paralysed rather from the general shock than from any injury done to the medulla immediately at that part. When, however, the upper extremities are influenced by the shock, they generally suffer in a much less degree than the lower, only perhaps partially losing their motion or sensation, and this may occur in one or in both of them at the same time; they usually, also, recover their powers much more quickly. It does not always follow, however, after a blow has been received on the spine, that all the parts below shall become paralysed. Sometimes only the muscles suffer which are supplied by nerves from the injured part, as was the case in the following instance :—

A pack of goods fell upon a man who was brought to St. Bartholomew's Hospital, which had struck him between the scapulæ, at about the seventh cervical and first and second dorsal vertebræ: his arms became immediately and totally paralysed, and there was a partial loss of power in the muscles of respiration. Neither the inferior extremities, the bladder, nor the rectum, were in the least degree affected. It is probable, in this case, that the origins only of the nerves which supplied the arms were injured. In addition to these, injuries of the spine cause other anomalous symptoms, as may be seen in the following case:—

#### CASE.

Oct. 1831.—About eight years from the above date, a man, belonging to the town of Penkridge, in Staffordshire, fell from the top of a waggon-load of hay. He was taken up in a perfectly helpless state, and was immediately carried to bed: he had struck his back upon the second, third, and fourth lumbar vertebræ, which were considerably displaced laterally, the body leaning to the right side, leaving but little doubt that the spine at that part had suffered fracture. He was perfectly paralysed below the

injury ; the fæces escaped involuntarily, and the bladder could not expel its contents ; the arms likewise were partially paralysed, in both the powers of feeling and motion. The treatment of the case I am unacquainted with, but he has kept his bed ever since, and his present state is as follows :—The muscles of the right arm are so contracted that it is closely fixed to the side ; the forearm from the same cause, rests upon the humeral part ; the wrist is bent on the forearm, and the fingers are firmly clenched in the palm of the hand : the sense of feeling also is partially lost ; the left arm is affected in the same manner, but not in so great a degree ; the right leg has both the power of motion and feeling ; the left leg has the power of feeling, but not that of motion ; the sphincter muscle of the rectum remains paralysed, the fæces still escaping involuntarily, and the bladder only expelling half its contents.

The various symptoms just related are certainly very extraordinary, and had it not been for the discoveries of modern physiologists they could not have been accounted for, and even as it is some of them are still involved in great obscurity. For example, how can we for certain explain why, in



one case, the arms alone should be paralysed; in another only the bladder and rectum, and one leg partially; and in a third, that the parts above the place where the blow was received should suffer as well as those below? Such phenomena cannot be satisfactorily accounted for, and the only attempt at elucidation we can offer is, that the origins of those nerves, or that particular part of the substance of the medulla with which they are connected, supplying the parts affected, have more particularly suffered.

Since the discoveries of Sir Charles Bell and M. Magendie, the cause of the unequal diminution of the power of motion and sense of feeling in concussion of the spine can, however, be more easily explained. They have indisputably proved that the anterior and posterior roots of the spinal nerves possess two different functions:—the anterior, that of motion, and the posterior, that of sensation. Sir Charles Bell was the first who pointed out these important facts, whilst M. Magendie appears to have confirmed them. By the experiments they have made, it is shown that if the anterior roots of the nerves of the spinal cord be divided, the power of motion of the muscles which they supply is en-

tirely lost, and if the posterior roots be severed, the sense of feeling no longer remains. These facts will at once explain many of the symptoms which are met with, in injuries and diseases of the spine, which before could not be understood. For instance, if the limbs should lose the power of motion, we now know that that part of the spinal marrow is most injured from whence the nerves of motion spring, and, *vice versâ*, should sensation be lost, the posterior part of the cord is the chief seat of mischief.

In concussion of the spine, the patient immediately after the injury, as in all cases where the nervous system has received a violent shock, becomes almost lifeless—a marble coldness pervades the whole frame, but more particularly the paralysed limbs. He cannot lie in any other position than on his back;—his pulse is weak and faltering; and he is frequently almost unconscious of what is passing around him. In fact the whole frame is in a state of collapse: in this situation he remains for a few hours, when reaction gradually commences. The warmth of the body returns until it amounts to a state of fever. The pulse rises, becoming quick, hard, and full; the tongue is furred, and great

thirst is felt. The patient has more or less pain in the injured part, and sometimes delirium supervenes. If the injury be received high up, there is dyspnœa, in consequence of the muscles of respiration being paralysed, and, as I have before stated, the parts below suffer paralysis, according to where the injury was received.

Although the above symptoms commonly happen, yet they do not invariably occur; the pulse does not always become quickened, nor does it always become increased in fulness; it not unfrequently remains stationary without any perceptible change from the natural standard of health: it sometimes even becomes slower than natural, being reduced in beat as low as 60, or even as 40. The temperature of the body likewise does not always increase; the animal heat may be much the same as before the accident took place. In many instances also, if a thermometer be applied to the paralysed extremities, they will be found to be some degrees lower in temperature than those which do not suffer from the injury.

There are other symptoms besides the above consequent upon injuries of the spine. The bladder

is not only paralysed, but the urine contained in it generally becomes decomposed, and fœtid and calcareous matter is frequently deposited. From this cause the mucous surface often inflames and ulcerates, by which the death of the patient is accelerated. This is a very curious fact; for it would appear from such a circumstance that the nerves of the organ had some influence over its contents. Thus, if from any cause the bladder loses its power, from a deficiency of nervous influence, the urine immediately upon being secreted from the kidney, undergoes, in some measure, that change which it would do when it has entirely passed from the body. It would seem, therefore, that when the energy of this organ is diminished or entirely lost, that it resembles in some degree an inanimate vessel. It would not be possible to account for these symptoms unless the nerves had some power over the contents of this organ, which would prevent decomposition.

Another symptom similar to that in the bladder occurs in the intestines: the bowels become constipated and inflated, which is occasioned, no doubt, by the decomposition of the fæces, through a failure

of action in the parts. In the bladder the loss of nervous power can be at once accounted for. It is supplied by its active nerves from the third and fourth sacral, which must be affected in a greater or less degree by concussion of the spine; but in the intestines, this does not admit so readily of explanation, as they receive no supply of nerves immediately from the spine. We must not forget, however, that the anterior branches of the spinal cord (which are the nerves of motion) communicate with the grand sympathetic nerve, and that it is more than probable that the power of motion is conveyed by these means to the alimentary canal; that is to say, the muscular coat of the intestines receives the power by which it is enabled to perform the peristaltic motion, from this source. Experiment alone can prove the truth of this suggestion. The symptoms, however, which occur in severe injuries of the spine lead one to draw such a conclusion, and more particularly as it is not probable this connexion of the nerves of the spine with the sympathetic could exist, without being destined for some purpose, or to perform some particular function. If, therefore, the injury be very severe, and the paralysis complete, whatever power is conveyed must be either totally or partially lost,



by which circumstance the symptoms just mentioned may be explained.

There is another symptom also which is peculiar in injuries of the spine, when the accident occurs in the neck ; this is, priapism, which is generally present when the injury is received opposite the first four or five cervical vertebræ. Some of the cases I have here related, will illustrate this symptom, and M. Dupuytren and others have long observed the fact. It is supposed by some that the effect is produced by concussion of the cerebellum, which frequently takes place at the same time. In some cases it certainly may do so, but those who suffer death by hanging are said generally to have this effect produced, which would confute the idea that it was produced by concussion of the cerebellum alone, unless indeed it might be accounted for by the congestion of this organ.

The prognosis of concussion of the spine must depend upon the severity of the injury, and the part of the vertebral column upon which it was received. If the blow which causes it be given above the third cervical vertebra, and the concussion be complete; then instant death will be the consequence,



as the phrenic nerve which supplies the diaphragm is paralysed as well as the intercostal, and other muscles of respiration. If the blow is given on the cervical vertebræ, below the origin of the phrenic nerve, the completeness or incompleteness of the concussion may in some measure determine the point; if the former, the patient usually dies in less than a week, and if the latter, he may by judicious treatment struggle through it. The same also is the case through the whole column; the nearer to the brain the shock is received the greater the danger, and the more complete the paralysis the less chance of recovery.

The extent of the mischief done to the medulla and its membranes can be judged of by the symptoms: if both the motion and sensation of the extremities are lost, then the whole substance of the cord, at the part where the shock was given, is involved in the injury, but if either motion and sensation only be deficient, that part of the cord only has suffered from whence the nerves which give that power arise. Under these latter circumstances a favourable termination of the case may be prognosticated. The prognosis also of concussion of the spine must depend very much upon the extent

of the permanent mischief that is done to the medulla spinalis and its membranes. If any of the membranes be ruptured, or blood is effused between them or in the substance of the cord, or if there should be much subsequent inflammation, under such circumstances there can be little hope of recovery.

The treatment of concussion of the spine must be adapted to the three different stages in which it presents itself to our notice. 1st. That immediately after the receipt of the injury ; 2d. The inflammatory stage ; 3d. That when the active symptoms have subsided. In the first stage, immediately after the receipt of the injury, the patient is usually so exhausted from the violence of the shock, that he is in a state of collapse. All that can be done at this time is, to place him on his back in a warm bed, and to administer stimulants, such as brandy, camphor, carbonate of ammonia, &c. until reaction commences. When reaction has taken place, antiphlogistic measures should be immediately resorted to. If the fever runs high, and the pulse be quick, full, and hard, the patient should lose blood from the arm. If, however, the symptoms are not sufficiently violent to demand very active treatment, he should

be repeatedly cupped opposite the injury, purgatives also should be given, first to act briskly, then moderately upon the bowels. The feverish symptoms will be best allayed by the exhibition of antimonials combined with nitre, and small doses of saline purgatives. When the activity of the inflammation is diminished, blisters may be applied (and repeated as often as the preceding ones have healed) on each side of the spine, with the greatest advantage, until all inflammation has entirely subsided. During the treatment the patient should take nothing but farinaceous diet, and it is of the utmost consequence that the spine be kept as still as possible, for each movement, by increasing the inflammation, must necessarily diminish the progress towards cure. To effect this, the double-inclined plane-bed, invented by Mr. Earle, will be found of the greatest service, as when the patient is placed on it there will be no necessity for him to be moved, either to perform the natural evacuations, or to have those means employed which are necessary to the restoration of his health.

In concussion of the spine, the muscles of the rectum are usually either so paralysed that they have no power to act, or that the fæces escape without

their being able to control them: in the former case injections must be used. The bladder likewise is unable to expel its contents. A catheter in most cases must be passed at least twice in the day, or as often as a sufficient quantity of urine is secreted.

It often happens that patients who have had bad concussions of the spine recover to a certain point, and yet do not get quite well; that is to say, they have either an imperfect power of motion, or an imperfect sensation. It is difficult to say exactly from what this arises, but it is most probable owing to chronic inflammation, or to some alteration of structure of the medulla, in consequence of the injury. It should be treated, however, according to the symptoms. If pain still exists in the injured part, the means employed should be the same as in diseases of the spine. The patient should constantly lie upon his back, counter-irritants should be used, by repeated blisters, the moxa or issues, and the general health should be attended to. If, however, there is no pain, and there is reason to believe that the defective power arises rather from weakness than from any other circumstance, then stimulating the part will be the most likely means of restoring the lost powers, and the

best means for this purpose will be friction on the spine and limbs, stimulating liniments, shampooing, electricity, and galvanism, and if the power of movement alone be defective, then the limbs affected should be made to undergo certain exercises calculated to restore them.

As examples of the treatment of concussion of the spine, I shall relate the two following cases :—

### CASE I.

#### CONCUSSION OF THE SPINE, WITH PARTIAL PARALYSIS OF THE LOWER LIMBS, BLADDER, AND SPHINCTER ANI.

JAMES LIDDY, æt. 30, Henry's Ward, St. Bartholomew's.—Feb. 5th, 1830. About the middle of January, 1830, he was engaged with some fellow-labourers in pulling down a wall about twelve feet high, from which he threw himself, under the impression it was giving way : on reaching the ground he experienced a sensation of chilliness and partial inability to move the right leg, with a sensation of pricking ; in addition to which he was unable to make water, or retain his fæces. He immediately obtained a letter for the Surrey Dispensary, the surgeon of which, from the patient's account, passed



the catheter, and gave him some pills, from which he derived but little benefit. On the above date he came to St. Bartholomew's Hospital, and on being questioned as to his complaints, stated that he had considerable pain in the lumbar region, much increased by tapping the vertebræ with the extremities of the fingers, with pain also extending along the anterior and upper part of the thigh, in the inguinal and hypogastric regions, with some swelling in the groin.

He was immediately cupped to twelve ounces, which afforded him considerable relief, after which a blister was applied: the symptoms of paralysis were much diminished by the above treatment.

On the 13th, another blister was applied to the loins as before, and the patient became so well as to be able to leave the hospital; on the 20th of the same month he returned to the hospital, complaining of considerable uneasiness in his leg, thigh, and hip, with a disposition to sickness and thirst, upon which he was bled from the arm to the amount of 16 ounces, and took 20 drops of tincture of opium in an effervescing draught, to relieve the sickness. On the 21st, another blister was applied; and on



the 1st of March he was again cupped to sixteen ounces. By these means he was relieved, and there remained but slight uneasiness in the right thigh and knee, with an inability to rest the heel on the ground. On the 9th a moxa was made over the original seat of the disease. At this time he left the hospital by his own wish.

The following is the continuation of the case :—

The patient has been in this hospital twice before for the same complaints, and left it about the middle of September last, contrary to the wish of his surgeon; the action of the bladder at that time, although much improved, was still imperfect, and he had a slight pain in his thighs; he then pursued his occupation, that of a corn-porter, when he very soon became worse, and continued getting so until the incontinence was complete, which was the case on his admission; he had also some difficulty in retaining his motions, pain on pressure in the lumbar region, and complained of pain along the inner side of the thighs, and great tenderness on pressure. His general health very good, but he does not sleep well.

He was put on milk diet; was ordered to keep in the horizontal position; had two moxas applied to the lumbar region, and took some house physic.

Although the dribbling of urine was constant, he always felt as if there were some in the bladder, and in consequence of this, a few days after his admission, the catheter was passed, and about a pint of healthy urine withdrawn; there was a slight stricture about three inches from the orifice of the urethra. After withdrawing the catheter he retained the urine for four hours, when it again flowed. He was ordered to wear an elastic gum catheter, plugged, and to have the water drawn off every four hours.

Dec. 6th.—He retains the urine rather longer than before, but has no power to expel it: two more moxas were applied to the spine a little above the former, which were then allowed to heal.

10th.—He complains of very great increase of pain in the thighs, extending also to the calves of the legs, which prevents him from sleeping: eighteen leeches were applied to the thigh with considerable benefit.

18th.—The pain in the legs is very severe ; eighteen leeches were applied to them, which gave some relief.

January 1st.—The pain in the left leg was very great, for which a blister was applied to the calf, since which he has been quite at ease. He continues improving ; he can bear pressure on the spine without feeling pain, but complains of cold and shivering ; the moxas discharge very freely.

February 1st.—He is in good health, but does not sleep well ; he passes his urine three or four times a day, but can only do so at the water-closet, and always feels a want to pass more ; he introduces the elastic catheter every evening, and draws off nearly half-a-pint of healthy urine ; the moxas are not yet healed ; there is no difficulty in retaining the fæces. He left the hospital in this state.

## CASE II.

PARALYSIS, NEARLY COMPLETE, OF THE LOWER EXTREMITIES, FROM A FALL ON THE FEET.

GEORGE MADDUX, *æt.* 32.—St. Bartholomew's Hospital, October 16th. Seventeen days before his admission, this man, being frightened, jumped out of a window about twelve feet high. He says that he pitched on his feet, and then fell forwards; he was unable to move, and was carried to bed: he was insensible for the first few hours, during which time he was bled. On becoming sensible, he recollects having great pain in his back and legs; he had not the slightest power over the lower extremities, and he had a partial loss of sensation: the urine and fæces were discharged voluntarily, and without difficulty. The pain during the first week was very severe, particularly when he coughed or sneezed, and extended from the back down the thighs to the feet. After this time it gradually subsided, and he is now, when lying quietly in bed, perfectly easy; but on moving, or when pressure is much on the left side of the lumbar vertebræ, he complains of a dull pain, though not very severe. The sensation is almost restored, but

there is a sense of numbness remaining. He cannot reach or draw up his legs in the slightest degree, but if they are drawn up by any person, he can by his own efforts again straighten them.

When some time had elapsed without any restoration of power in the limbs, the lower part of the spine was carefully examined, the patient being supported in a sitting position. A little uneasiness was felt in the lumbar region; some pain was experienced on pressing the part, and the patient was sensible of weakness in the same situation. A moxa was applied on each side of the spine, and the application was followed by a considerable return of power in the limbs. As they still remained feeble, two other moxas were placed lower down, and a further great improvement was derived from them. As he was able to walk very well with a stick, he was discharged on the 13th of December.

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The following morbid appearances may more or less be observed in those who die from concussion of the spine :

The parts exterior to the osseous canal are much



contused, and sometimes blood is found extravasated in the cellular membrane. The membranes of the medulla spinalis are in a high state of vascularity, opposite to the point where the blow took place, and occasionally one or more of them are ruptured. There is also more or less blood, either coagulated or not, between the dura mater and osseous canal, the dura mater and arachnoid membrane, the arachnoid membrane and pia mater, and sometimes between all at the same time. When the patient dies immediately after the accident, the medulla spinalis is generally of its natural colour and texture, but now and then it is rather redder, and if minutely examined through a magnifying-glass, the capillaries ramifying upon it may be seen injected with blood. When the death of the patient has been delayed, it is not uncommon to find it of a yellowish red colour, and of a softer consistence, and in some cases where there has been much inflammation, it is rendered into a more fluid state at the part where the concussion took place. Occasionally it is observed that the inflammation of the injured portion has extended itself along its own substance to the brain, as well as along its membranes, to those of that organ, and in this case there is a quantity of fluid found in the vertebral canal.



## CHAPTER III.

### ON FRACTURES AND DISLOCATIONS OF THE SPINE.

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*The Varieties of Fracture—The Injury done to the Medulla—Symptoms and Prognosis—Fracture of Spinous Process—Reparation of Fracture—Reparation of the Medulla—Treatment—Cases—Morbid Appearances.*

So various are the forces received on the spine, and their modes of application, that the vertebræ are liable to be broken in all their parts ; in their spinous processes—their transverse processes—their rings—their articulating surfaces—and their bodies.

Fractures of the spine may occur at any part of the column, from the atlas to the sacrum, and are frequently very complicated. Sometimes the vertebræ may be fractured without any displacement of bone ; sometimes they may be fractured with depression, and sometimes there is a fracture with dislocation of the bodies from one another ; in fact, there is hardly any complication of injury that may not happen at the same time in them. This may be seen by taking a cursory view in our museums\* of the preparations from those who have died from such

\* Vide Museum, St. Bartholomew's Hospital.

injuries. In some we see a dislocation of the cervical vertebræ, with fracture of one or both articulating surfaces : in others, a greater or less number of the arches broken, with or without compression. In some, again, the bodies of the vertebræ are the seat of the fracture, combined or not combined with other injuries ; and in others also, one or more of the spinous processes are the only parts that suffer. Many other varieties could be adduced, but it is useless to relate them ; for wherever force is applied in different degrees and by different methods upon any frangible body, so will that frangible body suffer varieties of fracture.

In general it is not very easy in simple fractures of the spine to discover, during life, where the solution of continuity has taken place, or even to decide whether the accident is concussion alone, or a complicated injury, as from there being no displacement of bone, the fractured parts remain in their natural situation. This may be observed when only one side of the arch or bodies are severed without displacement, and when either of the transverse processes are broken, or the articulating surfaces fractured without dislocation. When, however, any of the spinous processes are broken, it can

easily be detected, as their points in the back are not regular, and sometimes there is depression with crepitus. If also a ring of a vertebra was completely severed on both sides, with depression at the same time, this would cause an irregularity in the spinous processes of the back. Fracture, with dislocation of the bone, would also be very perceptible.

When there is only simple fracture of the spine, without displacement, then the injury to the medulla amounts to little more than concussion; but if the fractured portions are beat inwards, then a blood-vessel may be ruptured, the membranes torn, the medulla spinalis compressed or contused, and sometimes a piece of bone may be driven into its substance, and remain there. If also there is fracture with dislocation, the ligaments and the intervertebral substance binding the vertebræ together are torn asunder, one or both the articulating surfaces broken, and the vertebræ above are pressed forwards, leaving the lower ones protruding. The mischief done in this case may be compression or contusion, but most generally the medulla is lacerated as well as its membranes.

The extent of injury done to the medulla and its

membranes must depend upon the kind of fracture, and the manner in which the foreign body is depressed. Should the ring of one bone only be beat inwards, the sharp point of the fractured extremity may cause a prick merely, which may extend nearly through the dura mater, or through the whole of the membranes into the cord itself. It generally happens, however, that the wound is much more extensive, and that all the membranes are torn, as well as the spinalcord lacerated.

It has been observed by M. Ollivier\*, in his excellent work on the Injuries of the Spinal Marrow, that wounds of the dura mater are attended by the most serious consequences, on account of their giving rise to inflammation of all the membranes. He has also remarked that if there be a lesion of the pia mater, that hernia of the medulla is produced; that is to say, the medullary substance opposite protrudes through it, and forms a sort of button excrescence, flattened on the top, and projecting at each side, and resembling a mushroom. This excrescence, for the first few days, is of a reddish colour, caused by the capillaries of the nervous mass being injected with blood. The

\* *Traité de la Moelle Epinière.*

vessels of the pia mater round about are also much distended ; and sometimes there is found below this nervous mushroom a small clot of coagulated blood from a ruptured vein. He remarks also, that if an animal that has received such a wound is killed a long time afterwards, it is found to be cicatrized, and adhering to the nervous protrusion, which is diminished in size, and hardened. When this occurs, it generally happens that the lost power of motion or sensibility has been entirely recovered.

Fractures of the spine are attended by the same symptoms as those of concussion, excepting that they are usually much more severe, and remain so until death. The prognosis, likewise, is still more unfavourable than in concussion, as it usually happens that some irreparable mischief is done to the medulla or its membranes. There is no reason, however, why in some cases of simple fracture the patients should not ultimately recover ; as, when there is no displacement of the bone, the injury amounts to very little more than concussion.

Fractures of the spinous processes frequently get well, as may be seen by the two following cases.



## CASE I.

In the month of December, 1820, a soldier, belonging to the North Gloucester Militia, was at work in an excavated stone pit, when the roof gave way, and fell upon his back. He was immediately dragged by his fellow-workmen from the stones and mould which were upon him, and was carried home. He was examined, and it was found that the spinous point of the first lumbar vertebra was not in a regular line with the others; it was depressed, and fractured. The man had complete paraplegia below the injury, and the bladder and the rectum were also paralysed. When reaction was established he was bled largely, and powerful doses of purgative medicines were administered, in every form and dose, together with the employment of purgative clysters, but with no effect, until the eighth day, when the torpor of the bowels was overcome. He was now unable to retain the fæces, and they made their escape involuntarily. His bladder also still remained paralysed, and it was necessary to relieve it constantly by the catheter. He continued in this state for three months; at about which time sensation began to return, with pricking and shooting pains in the limbs, and shortly afterwards



he perceived he could move his legs slightly backwards and forwards. In six months both these powers had so increased that he could walk with crutches, and in twelve he could go about without any support, and all that he suffered from was weakness in the limbs. The bladder and rectum gained their power also, in the same ratio as the other paralysed limbs. When I last saw him, the parts over the injury were much thickened and consolidated. It is probable that there was more injury in this case than fracture of the spinous process; but this can only be proved by the examination of the parts after death.

## CASE II.

A man was admitted into St. Bartholomew's Hospital for an injury of the back, but he had no symptoms whatever of concussion of the spine. There was, however, an irregularity of the lower spinous processes of the dorsal vertebræ, and it was found that the tenth was flattened and depressed. The part was cupped and fomented, and aperients administered. In a month he went away quite well.

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The last of these cases shews that fracture of a spinous process may occur without concussion.

Although it seldom happens, when the person recovers, that we have an opportunity of finding out, in injuries of the spine, what mischief has occurred to the vertebral column, in consequence of the difficulty of obtaining an examination of the parts after death, yet there are two preparations in existence—one in the College of Surgeons, and the other which belonged to Mr. Brookes's late Museum—which undoubtedly prove that the vertebræ will unite after fracture. As Sir Astley Cooper\* has given an account of them in his work on Dislocations, I shall take the liberty of quoting it. The history of the first of these cases, which occurred in the practice of Mr Harrold, is as follows :—

### CASE.

“ A man, 28 years of age, was knocked down by a quantity of chalk falling on him ; by which his spine was broken at the lower part of the dorsal, or beginning of the lumbar vertebræ.

“ The principle upon which Mr. Harrold pro-

\* Treatise on Dislocations and on Fractures of the Joints.

ceeded, was, to produce union of the bones by preserving the spine at perfect rest, and to effect this object the patient was placed in a fracture-bed, which permitted him to evacuate his bowels without disturbance. The urine was drawn off daily by a catheter, for several weeks; after which time he was able to retain from a pint to a pint and a half, and to discharge it when he pleased. A wound was produced on the sacrum, from the constant pressure of his body upon the bed, and, although he was insensible of it, gradually healed.

“ At the end of six months his state was as follows:—His back was straight, flexible, and apparently as strong as ever: he retained, and passed his urine; but probably he discharged more by the action of the abdominal muscles than by any contractions of the bladder. He had a stool once in three or four days. His health and spirits were good; but he had neither sensation or motion in the lower extremities, or volition. He dressed himself entirely: he let himself down stairs step by step. He died in twelve months, wanting nine days, from the accident, owing to a sore on the tuberosity of the ischium, and disease of the bone.”

In speaking of the preparation, he says, “the bodies of the first and second lumbar vertebræ had been fractured: the first had advanced, and the second had been forced backwards. The fracture had united by ossific matter, which had been spread over the fore part of both vertebræ, to a considerable extent, and a little had been deposited on the dorsal vertebræ. The spinal canal had been much diminished, by a portion of bone being forced into it, from the first vertebra of the loins. This portion of bone had split the theca vertebralis into two, and divided the spinal marrow almost entirely. A bulbous projection of the spinal marrow, appearing above and below the bone, formed by its divided extremities, which were separated nearly an inch from each other.”

In speaking of Mr. Brookes's preparation he says: —“Mr. Brookes has also a preparation in his excellent Anatomical Collection, of fracture of the spine at the seventh and eighth dorsal vertebræ. The person had lived sufficiently long, for a great deposit of ossific matter to have formed upon the anterior, and lateral part of the fractured vertebræ. The spinal cord was nearly entirely torn through, but the spinal sheath remained. Mr. Brookes could

not learn how long the person had survived the accident.”

If in these two cases the union of the fractured extremities took place, and in one of them there was displacement of the bone, how many are there that may occur which unite where there is no change of the situation of the parts? No doubt, in many cases where patients recover, as we think from concussion alone, there is simple fracture of the vertebræ also; for at the time of the injury, it is impossible for us to ascertain whether the bone is broken or not, and the opportunity of examining the parts after death of a patient who recovers, and who may live perhaps for many years afterwards, so seldom occurs, that it is difficult to determine this point.

The first of these two cases is particularly interesting, not only as relates to the fracture uniting, but also as relates to some of the symptoms. The regaining the power of the bladder and rectum is what I am alluding to. The urine was drawn off by a catheter for six weeks, and after this time, although the medulla spinalis was nearly severed through, and the lacerated extremities were almost



an inch asunder, yet the patient could retain a pint or a pint and a half of urine, and in six months he could expel it of its own accord without the aid of the instrument. The same phenomenon takes place in the rectum: he is enabled to retain the fæces, and expel them of his own accord every three or four days. These facts are very extraordinary. Sir A. Cooper thinks it probable that he discharged his urine, more by the action of the abdominal than by any other contraction of the bladder. This may have been the case; yet when we consider how the abdominal muscles are supplied by nerves, they themselves must also have suffered paralysis, more or less, from the injury, and therefore their action must have been incomplete, and more particularly at the lower part of the abdomen. A question may be asked, how far the junction of the anterior spinal nerves with the sympathetic, which jointly supplies the bladder and rectum, might have influenced the return of their functions: all the anterior spinal nerves, which are those of motion, form a ganglion with the sympathetic. Now, although it is not possible that any nervous influence could be conveyed to the bladder, from the lower part of the medulla below the injury, yet by the channel of the sympathetic, which commu-



nicates by the anterior branches of the upper portion, such might have been the case. It appears to me very probable that the muscular coat of the intestines, and partly that of the bladder, receive their power of motion from the junction of the sympathetic with the anterior spinal nerves, and if so, the return of this function, in the case just related, might be easily accounted for ; for if when the trunk of an artery is obliterated, the circulation can be carried on by its ramifications, why should not the nervous circulation (if I may use such a term) be carried on by the communication of nerves with the healthy portion of the medulla spinalis? It remains, however, for the experimental physiologist to prove the truth of this suggestion.

Whether any reparation of laceration of the medulla ever takes place or not, seems very doubtful. I have not met with any cases recorded of it, nor have I seen any preparations in any of our museums that would prove that it would. Wounds of the medulla, however, with sharp pointed instruments, have been known to get well. M. Ollivier has related several cases where the spinal cord has been wounded by the point of a sword, and the patients have either wholly or

partially recovered. In one instance, a young man was wounded by a quadrangular poniard on the left side of the neck, just below the ear, and at the origin of the spinal cord. He immediately lost all power of motion and sensation in all the parts below the head ; in fact, he was perfectly paralysed. At the eighteenth day he began to recover a little feeling in the left side of the body. On the twentieth day he could move slightly the fingers and toes of the arm and leg of the same side, and he continued improving until the thirtieth day, when sensation began to return in the right side, being gradually followed by the return of the power of movement. He received the injury on the 31st of January, and could walk, though slowly and feebly like a child, on the 26th of May following. M. Ollivier also records other cases, where the patients either wholly or partially recovered after the medulla had received a wound from a clean cutting instrument. It appears, therefore, that if the medulla be only cut or pricked, the wound will heal most probably by the first intention ; but, if it be lacerated, there is as yet no fact to prove that such an injury to it will be repaired.

The general treatment of fracture of the spine

is exactly the same in every respect as in concussion ; but it is more imperatively necessary that the parts should be kept quiet. On this account, indeed, if bleeding be required, it would be better to take it from the arm than by cupping, unless, during the latter operation, the spine can be kept in such a position as not to be moved. The necessity of perfect quietude is of such extreme importance, that it has often happened, from the neglect of it, that sudden death has been caused, as will be seen by the two following cases.

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#### CASE I.

July 25th.—A man having received a kick from a horse, upon the back of his neck, became instantly paralysed in all parts of the body below the injury. He was immediately carried to St. Bartholomew's Hospital, and in about twelve hours after the accident delirium came on. The surgeon desired that the head might be shaved, in order that the proper remedies might be employed. In doing this the barber turned the head a little on one side : the patient instantly fell from under his hand, and expired. Upon examination it was

found he had fractured the third cervical vertebra, and that the sharp point of the fracture had pressed upon and wounded the medulla.

## CASE II.

A man fell from a great height, and broke his neck. An officious nurse, in moving him up, as she thought to relieve him, let his head fall backward. He instantly expired. He had fractured the second cervical vertebra.

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Both of these cases occurred to my own knowledge, and from them it may be seen how necessary it is to keep the spine quite motionless, and more particularly when the accident happens in the neck. As soon as the patient receives the injury he ought to be placed on one of the double-inclined plane beds, upon his back, and he should never, if possible, be moved, until there is sufficient reason to believe the fracture is united.

In fractures of the spine it often happens that the ring of one or more of the vertebræ is beat

inwards in such a manner as to compress the medulla and its membranes. A question arises how such a fracture ought to be treated : whether, under these circumstances, the bony column of the spine ought to be trepanned, and the depressed portion of bone removed, as in fracture of the cranium, or not? The experiments that have been performed on animals certainly favour the opinion that such an operation might be performed. Baglivi and Pallisio have frequently trepanned the spine of dogs, and they have found in many instances that it did not appear to give rise to much suffering, or to affect the functions of the medulla, unless the dura mater was pricked, when convulsions were produced. Experience as yet, however, on the human subject, is rather against than for the operation. The spine, when a piece of fractured bone has been depressed upon the medulla, has been trepanned five times, and in all these cases the patients have died. In one case, where the operation was performed by Mr. Tyrrell, sensation immediately partially returned, but the patient died of inflammation of the bladder.

The two following cases will illustrate the general treatment of fractures of the spine :—



## CASE I.

FRACTURE OF THE SPINE, WITH PARALYSIS AND LOSS OF  
SENSATION BELOW THE INJURY.

John Ryder, æt. 40.—This patient, who is a stout muscular man, was brought to St. Bartholomew's Hospital at two o'clock, P.M. The persons who conveyed him stated that about an hour before he fell from the roof of a house about twenty feet high. He was found lying upon his back, quite insensible. Ten minutes after the accident he was bled, and immediately afterwards brought to the hospital. When admitted he was perfectly sensible: he complained of great pain between his shoulders, which was increased on moving them; pain also was felt at the back of the head, which had been struck in the fall. His pulse was very weak; respiration very slow, and performed by the diaphragm. There was priapism, with total loss of sensation and motion in the lower extremities, the insensibility extending as high as the clavicles. He could slightly move the arms, but had no power over the fore-arms and hands, the sensibility of which was considerably impaired: this was more



particularly the case with the left. He has, however, a feeling of numbness. The legs and arms are much below the natural temperature. Pressure on the lower and back part of the neck caused pain, but no irregularity of the spine could be discovered. He was carefully placed on his back, ordered to be kept perfectly quiet, and to take four grains of calomel and twelve of jalap.

Ten o'clock, p. m.—Priapism has subsided; pulse more perceptible, beating fifty in a minute; the bowels have been moved: repeat the calomel and jalap. He had discharged no water since twelve o'clock this morning: about six ounces of high coloured urine were drawn off.

14th.—Has slept very little during the night; complains of pain between the shoulders: pulse sixty and apparently natural, with the exception of being too slow; heat of the trunk and extremities somewhat increased. The elbow, as well as the wrist and fingers, are bent, and the hand is drawn in contact with the corresponding axilla. The only power he possesses of moving the upper extremity is, that of raising the arm slightly by the deltoid. Has taken another dose of calomel and

jalap, but the bowels are not relieved. A cathartic clyster was administered. A large quantity of dark and offensive matter was discharged immediately after the use of the injection, and some urine escaped involuntarily: in the afternoon about two pints of highly-coloured foetid urine were drawn off by means of the catheter.

15th.—The pulse is feeble; the fæces, which are dark-coloured, are very offensive, and discharged involuntarily; the abdomen is swollen and tense; the tongue white and coated; the urine high coloured and very foetid, and drawn off by the catheter. When he attempts to strain, in order to expel the urine, no change in the abdominal muscles is felt: when requested to take a deep inspiration, the abdomen is enlarged and rendered tense, the chest is raised, and the sterno-cleido mastoideus is distinctly felt to contract; the same thing was observed during the act of coughing, which he could only perform very feebly; on holding his nose and desiring him to blow it, the inability of calling into action the respiratory muscles is evident.

16th March.—The same as yesterday; pulse rather quicker; heat of the body increased; tongue

white and coated; abdomen swollen and somewhat tense; complains of soreness of the mouth and throat; passes his motions involuntarily; two pints of dark-coloured fœtid urine drawn off by the catheter; paralysis and loss of sensation continue the same; pulse more quick, 84; countenance flushed; tongue coated; very thirsty; small ulcerations of an aphthous appearance are observed in the mucus membrane lining the cheeks.

19th.—In all respects the same as yesterday, excepting that there is a loss of power in the pulse, and it is less frequent. No observable alteration took place until the 22d, in the afternoon of which day his countenance had undergone a marked change, and he lay in a state approaching to that of stupor; his pulse was more weak; his abdomen very large and swollen; his bowels were in the same state as for some days past; he voided his urine involuntarily, which has been the case for these last three days, so that it has not been required to use the catheter.

23d.—He died at two o'clock this morning.

On dissection, the body of the sixth cervical ver-

tebra was found pushed forwards over that of the seventh. The left articular process of the fifth cervical vertebra was fractured, together with the transverse and articular processes of the sixth, with a portion of the arch of this last vertebra: neither the spinal cord nor the membranes were lacerated, but the former was somewhat softened, and blood was effused into its substance opposite to the seat of the injury. Nothing particular was observed in the brain, excepting an increased quantity of fluid in the ventricles. The contents of the abdomen and thorax were healthy.

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This is an excellent case, as it illustrates almost all the symptoms of importance which are related in the preceding pages. In the first place, we see complete paralysis of the lower extremities and all the muscles below the scapulæ, and only partial paralysis of the arms, although the blow seems to have been received opposite that part of the spine where the nerves which form the axillary plexus are given off. He could slightly move his arms, but had no power over the fore arm. It also shews the different degrees of paralysis in the different limbs.

The motion and sensation of the left arm was more difficult than in the right. The legs and arms also were much below their natural temperature. We here also may remark that there was fœtid urine, inflation of the intestines, almost constant priapism, and that his pulse did not rise as usual above the natural standard, and was even as low sometimes as fifty. The morbid changes also are as important as the symptoms. The medulla is much softened opposite to where the injury was received, and blood is effused in its substance, and its colour of a dirty reddish yellow. The membranes also are much increased in vascularity.

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## CASE II.

GEORGE JONES, ætat. 32, a large muscular man, was admitted into Rahere's Ward, St. Bartholomew's Hospital, on the night of the 13th of June, 1830, with complete paralysis, and loss of sensation of his lower limbs and trunk, as high as the middle of his sternum; his pulse was seventy-six and soft, countenance calm, intellects perfect, temperature of the lower extremities natu-



ral, partial priapism, respiration performed wholly by the diaphragm, but without difficulty. The previous afternoon, whilst driving rapidly a light cart with two men in it, and endeavouring to restrain the horse, the reins broke, and he fell towards the ground, the wheel passing over the back part of his neck; he was stunned, and on recovering found the lower part of his body paralysed. The surgeon who saw him immediately after the accident, finding him in a state of collapse, gave him stimulants.

14th.—He has passed a quiet but sleepless night; purgative has procured slight evacuations; his urine was drawn off by the catheter; he did not feel the introduction of the instrument, and the bladder required external pressure to evacuate its contents: he feels occasionally a pricking sensation in his legs, and is disturbed by a frequent cough, with inability to throw up the mucus.

15th.—He has had no sleep during the night, but frequent vomiting; pulse seventy-six, soft; skin cool; slight difficulty in respiration, with cough; he feels the introduction of the catheter; sensation has partially returned in his feet and ankles; he has no power of motion over his toes; he can feel pres-



sure made on his chest an inch nearer his abdomen than when admitted : vomiting occasionally during the day ; bowels sluggish.

16th.—He feels considerable pressure made on his legs and abdomen ; pulse seventy-six, soft and full ; cough ; vomiting at intervals ; abdomen tense, from the accumulation of wind, which he passed in large quantities ; bowels but slightly opened. To be bled fourteen ounces ; blood slightly buffed. Nine in the evening, pulse eighty-two, full, soft, and weak ; his breathing is rather more free, although still performed by the diaphragm ; no recurrence of vomiting.

17th.—He expresses himself as better ; pulse seventy-six, and soft ; bowels very torpid, requiring active purgatives, and injections.

18th.—Abdomen less tense ; pulse seventy-six, full and soft ; the collection of mucus in the bronchial tubes, which he is unable to expectorate, prevents his getting much rest ; to be bled to twelve ounces : this produced faintness and considerable relief ; it was followed by evacuations of the bowels ; sensation is partially restored over the whole para-

lysed part of his body, but his feelings are not accurate; the blood was neither buffed nor cupped.

21st.—He has some power over his abdominal muscles and those of his back; his intercostals do not act; the pricking pains in his limbs have daily increased; the cough and accumulation of mucus almost prevent his sleeping; bowels freely opened without purgatives; evacuations dark coloured, and fœtid; pulse very little disturbed: in the evening he complained of a giddy sensation in his head.

22d.—During the night he has been very delirious, but this morning seems quite sensible; pulse one hundred, sharp; head-ache; very white tongue; considerable difficulty in respiration.

23d.—He expressed some relief; pulse slower and softer: about eight o'clock in the evening he complained of increased difficulty in respiration, and about an hour afterwards died. The catheter was introduced daily during his illness; the urine was more highly-coloured than natural, but had no fœtid or ammoniacal smell; the partial priapism continued.

*Examination of the Body twenty-three Hours after Death.*—Fracture of the arch of the sixth cervical vertebra without depression; slight separation of the intervertebral substance between the seventh and eighth vertebra; the external appearance of the spinal cord was natural, no fluid in the theca; on passing the finger over the surface of the cord, that part, about half an inch in length, corresponding to the injured vertebræ felt softer than the parts above and below it, and on making a section, the medullary matter was there found soft, pulpy, and of a slight reddish colour; the brain was healthy; slight effusion beneath the arachnoid membrane; the viscera of the thorax and abdomen were natural; there was a considerable quantity of mucus in the bronchial tubes.

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MORBID APPEARANCES.

When only simple fracture of the spine takes place, the morbid appearances are generally the same as in concussion; but if there is a complication of injuries, such as depression of the bone, &c. or there is dislocation of the vertebræ from one another, then it is found that compression, contusion, or either total or partial laceration of the medulla spinalis, may be produced. When the medulla is com-

pressed, it does not always follow that there should be any difference from concussion in the morbid appearances, although most generally it is found that either some of the membranes are torn, or there is an extravasation of blood in the canal, and the medulla itself is much redder than usual. When the medulla spinalis is contused, it is usually found to be soft and disorganised; being occasionally streaked in its external substance with coagulated blood, and in one instance, mentioned by Sir E. Home, a clot of blood was found in its centre.

The membranes may be ecchymosed, ruptured, or have coagulated blood between them. If long after the injury, the medulla may be changed both in colour and structure, being in the one of a yellowish, red, or grey, and in the other much softened. Laceration of the medulla almost always occurs when there is fracture with dislocation, or when there is dislocation alone, and it may happen even under any circumstances, when there is displacement: the medulla, in these cases, may either be partially or wholly lacerated, and generally its membranes are torn, and blood is effused in the vertebral canal.

## CHAPTER IV.

### ON DISLOCATIONS OF THE SPINE.

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*The various Dislocations which may occur.—Cases.*

DISLOCATION of the vertebræ from one another, without fracture of the articulating surfaces, is an accident of very rare occurrence, and by some it has been considered impossible to happen. This difficulty of a proper dislocation of the vertebræ is owing to the peculiar manner in which they are articulated. In the dorsal part of the column the articular surfaces of the superior vertebræ hang so completely vertical over those of the inferior, and are so locked into one another, that it is impossible the bones can be moved from their situation without their fracture; and in the lumbar also, the articular surfaces of the inferior vertebræ so overlap those of the superior, that a proper dislocation of them cannot well take place. In the cervical vertebræ, however, the articular surfaces are more



horizontal, and having more motion, will admit of a proper dislocation, although it is an accident of very uncommon occurrence, so much so, that Sir Astley Cooper acknowledges, in his work on Dislocations, that during the whole of his professional career and great experience, he never saw an instance of it; he does not, however, deny its possibility. Boyer considers that all the cervical vertebræ can be dislocated, but that it most frequently happens between the first and second. J. L. Petit relates a case, which is also quoted by Boyer, where the only son of a tradesman went into his neighbour's shop, and playing with his infant son, lifted him from the ground, by putting one hand under his chin and the other on the back part of the head, by which he dislocated his neck, and the child instantly died. The father in his passion pursued the unfortunate homicide, and threw at him a saddler's hammer, the sharp point of which penetrated between the first and second vertebræ, and divided the medulla spinalis, and killed him upon the spot also; and thus, as he remarks, they both perished from nearly the same accident. M. Louis observed, that it was necessary in this dislocation that a rotatory motion be given to the body; and he found in those who were hung, and

the neck of the culprit was dislocated, that a twist was given to the body by the executioner.

The cause of the more frequent occurrence of this accident is owing to the principal rotatory motion of the head being between the first and second vertebræ; the rotatory motion being carried too far, the ligaments of the processus dentatus are broken, and the vertebræ dislocated. This is not, however, the only mode by which the first vertebra can be dislocated from the second. There is a possibility of this accident being produced by the head being bent forwards. Whether the following case, which occurred during the time I was House-Surgeon at St. Bartholomew's Hospital, happened from this cause, is uncertain, although it seems not unlikely.

#### CASE I.

A bricklayer ascending a ladder at a great height, lost his hold, and fell upon his head. He was taken up dead, and conveyed to St. Bartholomew's Hospital. His spine was examined, and it was found that he had dislocated the first vertebra from the

second, the ligaments of the processus dentatus being torn.

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Boyer mentions another species of dislocation of the vertebræ, in which only one of the articulating proceses was thrown out of its articulation. He relates one or two facts of this description, and it is owing to the overstretching of the rotatory motion on either side—thus a person suddenly turns his head round beyond the natural point, and dislocates one of the articular processes.

The five other vertebræ may suffer a proper dislocation from one another; and when it does occur, it appears usually to happen, at least from the cases I have seen of it, between the fifth and sixth vertebræ; and even this may be observed also, when there is a dislocation with fracture of the articulating processes.

The three following cases, all of which happened but a few years ago, prove that a proper dislocation of the cervical vertebræ can take place. The preparations taken from the individuals upon whom the

accident occurred, are preserved in the Museum of St. Bartholomew's Hospital.

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### CASE I.

A man was working upon the roof of a house, and, having lost his balance, fell upon the pavement with his head foremost, and bent his neck forward to an extreme angle. He was taken to the hospital. Some displacement was observed between the fifth and sixth vertebræ; and the upper part of the column was protruded a little more forward than the lower. He had paralysis of all the parts below the injury. The usual remedies were employed, but he died in a fortnight. It was found that there was a proper dislocation of the fifth vertebra from the sixth; but that neither the articulating processes, nor the rim of the body of the vertebræ were fractured.

### CASE II.

A man also fell from a height, and bent his neck

forward to an extreme angle. He died, and it was discovered that he had dislocated the fifth vertebra from the sixth, without fracture of any part of either of them.

### CASE III.

Charles Butcher, æt. 22, Jan. 8th, 1827, (Rahere, Tuesday).—Injury of the cervical region of the spine, with paralysis of the parts below.

The patient, a stout muscular man, while descending a step about two feet in height, with a barrel (1 cwt.) upon his shoulder, slipped and fell upon his buttocks, the barrel resting upon the back of the head and upper part of the neck. He was lifted up and brought to the hospital about five o'clock, P.M. He was perfectly sensible; there is a total loss of sensation and voluntary motion below the neck; respiration is performed solely by the diaphragm; the chest is motionless, and the abdominal muscles do not contract in respiration; The abdomen rises in consequence of the descent of the diaphragm, and the parts thus pushed downwards and forwards restore themselves by their elasticity. Pulse weak and slow; body cold;



priapism. To be placed carefully upon his back in bed. 10 P.M.—His pulse is full and hard; heat of the body increased considerably beyond the natural temperature; respiration rather hurried. To be bled to sixteen ounces, and to take four grains of calomel and ten of jalap immediately. About four ounces of urine were drawn off by the catheter.

Jan. 9th.—Has dosed, but not slept during the night; complains of pain in the lower part of the neck; respiration slower; pulse full; heat of the body diminished; can move the arms very slightly; and has a little feeling in the front of the chest. Fæces dark and offensive; have been passed involuntarily: a catheter was introduced, but only about a table-spoonful of urine evacuated. To take the saline medicine every six hours. In the evening about six ounces of high coloured urine were drawn off.

10th.—Has slept three or four times during the night, for about an hour each time, and expresses himself better this morning. Pulse and temperature of the body remain the same; he has a tingling sensation in the hands this morning, and is sensible to impressions on the upper parts of the arms and

thighs. Fæces have been discharged involuntarily, and complains of distention of the bladder; about eighteen ounces of high coloured urine were drawn off, which upon standing deposited a small quantity of dark brown sediment. Priapism continues to a greater or less extent at different periods. Nine P.M.—Much the same; four ounces of urine drawn off.

11th.—Worse this morning. Sensation in the arms and legs continues in a slight degree. Has not slept during the night; thinks he could walk home, and asks for his clothes to dress himself; countenance looks unfavourable; tongue light brown, and dry in the middle, but moist at its edges. Fæces have passed involuntarily; six ounces of urine drawn off, of a lighter colour than that drawn yesterday. 10 P.M.—Is rapidly sinking; countenance exceedingly anxious; respiration performed very laboriously; little action of the diaphragm; priapism; pulse weak and slow; surface of the body cold: three ounces of thick urine were drawn off. In this state he continued until one o'clock on the morning of the 12th, when he expired.

*Examination.*—Complete dislocation of the fourth vertebra of the neck ; its inferior oblique processes have passed in front of the superior oblique processes of the fifth vertebra ; its body, separated at the fibro-cartilage, stands over that of the fifth by its whole depth.

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The manner in which dislocation is accomplished is by the neck being bent forward to an extreme angle, so that the articulating surfaces are dislocated, and the ligaments broken. A blow upon the neck could hardly produce the accident without breaking them, from their hanging so obliquely over one another ; but the neck being bent forward, the inferior articulating processes of the superior vertebra are lifted up from those of the inferior over their extreme points, and are thus thrown out of their situation.

To attempt to reduce a dislocation of this description, could be of little avail. The treatment must be the same as in fracture and concussion ; but there is little or no chance of recovery.

# ON DISEASES OF THE VERTEBRÆ AND INTERVERTEBRAL SUBSTANCES.

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## CHAPTER V.

### *PATHOLOGICAL REMARKS ON THE VERTEBRÆ AND INTER- VERTEBRAL SUBSTANCES.*

As I have reason to believe that the diseases of the bones of the spine and intervertebral substances are greatly connected with the peculiarity of their internal structure, I shall first make a few pathological remarks on this subject.

It may be observed, that upon breaking the substance of the body of a vertebra in a fresh subject, the cancelli are found to be composed of thin transparent plates, and of round pillars of bone, both of which arise from the internal surface of the external plate surrounding the body, and are irregularly disposed and connected one with the other, throughout its whole substance. These plates are slightly transparent, and between their interstices is deposited an oily unorganized matter, which answers to the

marrow in the long bones. When the phosphate of lime is dissolved by diluted nitric or muriatic acid, the bone is rendered soft, and the cancelli become quite transparent: they still retain their reticulated appearance, but their substance is so pliable that it resembles sponge, and can be compressed into a very small compass. Upon a closer examination of the cancelli in this state, they are found to be of a membranous structure, having a smooth, shining surface, on each side of them, with rounded edges, and being of a dense, tough consistence. Hence it would appear, from the common character of membranes being smooth on one side and rough on the other, that they are composed in their natural state of a duplicature of membrane, with phosphate of lime either deposited in their texture or on their surfaces.

Having so far shown by this description that the cancelli are of a membranous structure, I shall now endeavour to prove that they resemble other membranes in their functions as well as in their diseases. They possess the power of secretion as other membranes; for instance, they secrete phosphate of lime, and the oily matter deposited between their interstices. That the phosphate of lime is a mere secretion, is proved from the fact, that its quantity is increased or



diminished according to the healthy or unhealthy state of the membrane; as may be seen from its deficiency in rickets and scrofula. In rickets the earthy matter is almost entirely absorbed, and the cancellous membranes are left uncovered by it. The same takes place in scrofula; the bone becomes softened, that is to say, the action of these membranes is changed; they do not secrete phosphate of lime, but an albuminous cheesy matter. In rheumatism the contrary takes place: there is more earthy matter secreted than ought to be, and the bone is rendered hard. These facts are illustrated by many preparations preserved in museums. The membranes of the cancelli also secrete an oily matter, which is lodged between the interstices. This oily matter is frequently entirely wanting in affections of the spongy texture of bones, and in scrofula its place is supplied by an albuminous or caseous matter, (a secretion peculiar to this disease,) which proves that the action of this membrane is altered, and that the natural secretion must have been previously absorbed.

Although the membranes of the cancelli no doubt are of a character *sui generis*, yet from the diseases

which affect them they appear more to resemble the serous and synovial membranes than any. Both of these are liable to scrofula; so is the cancellous structure, and the matter secreted is the same in all. They are also affected by rheumatism, by the action of mercury, and by the venereal disease: so are the membranes of bone. A greater proof, however, of their resemblance is, that serous membranes sometimes secrete phosphate of lime. As a proof of this, I have frequently inspected bodies where I have seen bony matter deposited on the dura mater of the brain, the arachnoid membrane of the spinal marrow, on the pleura, pericardium, peritoneum, &c.

Now if it be granted that the cancelli of bone have the action of a membrane, how greatly must the spinal column, which is composed almost entirely of this structure, be affected by it! If, from any peculiar state of health, the function of this membrane should be weakened, in the same degree would the whole spinal column be weakened. This we see in rickets: from a deficiency of phosphate of lime, the vertebral column becomes contorted into all kind of forms. The same is the case

in a general softening of the bone,—in consequence of the phosphate of lime being absorbed, the vertebral column yields, and becomes deformed.

The structure of the intervertebral cartilages also is of great importance as relates to their diseases. These bodies are firmly united to the surfaces of the superior and inferior vertebræ, and are of a highly elastic character. On severing them it is found that their external part is of a cartilaginous nature, and that the internal substance is composed of a fibrous structure, intermingled with a pulpy membranous matter. This fibrous structure is formed in layers, which intersect each other at right angles, and in their interstices is found this elastic pulpy matter. In the centre the fibrous structure is wholly wanting, and is completely occupied by the pulpy tissue, which is so highly elastic as immediately to rise up above the surface when one of these bodies is severed.

When we consider the variety of movements the spinal column has to undergo, how beautifully arranged is this structure! it is at once a combination of strength and flexibility. We find that the fibrous structure is firmly united to the upper and under surface of the vertebræ, all around its external part,

whilst in its centre is a soft elastic cushion. Hence the vertebræ are as it were resting upon a kind of pivot, or centre ; so that whatever movement we may make, whether forward or laterally, this elastic cushion rises up in the middle between each of them, and supports us. The pulpy mass also between each of the vertebræ prevents sudden shocks to the whole frame ; for instance, the jar which would be given in jumping, running, and even in walking, is thus obviated. The elasticity of the intervertebral substances, also, is so great, that instances have been known of people having been taller in the morning than in the evening, in consequence of lying in the horizontal position during the night. The weight of the trunk upon the intervertebral substances being taken off, they gradually expand, and the body becomes elongated.

When we reflect upon all the above phenomena, and that the intervertebral cartilages occupy at least from one-third to one-fourth of the spinal column ; that they are much more highly organized than common cartilage ; that they sustain the whole weight of the head and trunk ; that they are the centre upon which each movement of the body is performed ; and that from this cause, and from their elasticity, these sub-

stances must be constantly changing their position, we cannot be surprised at their liability to disease. Should one or more of these bodies, for instance, become inflamed, the constant motion must necessarily increase it, and, as it too often happens, from the insensibility of their structure, the disease is not discovered until considerable mischief has taken place.



## CHAPTER VI.

*Diseases of the Vertebrae from Rickets—General Softening—Mollities Ossium—Hardening of their Structure—Tumors formed in and pressing upon them—Fungus Hæmatodes—Abscess formed in the Substance of the Bone—Secondary Symptoms of the Venereal Disease—Gout—Rheumatism—Inflammation—Ulceration—Scrofula—Disease of the Intervertebral Substances, and of the Articular Joints and Ligaments.*

IN the present chapter it is my intention to treat briefly upon the diseases of the vertebrae, the intervertebral substances, and their ligaments; and as the affections of these bones and their appendages are very varied and different in their characters, I shall speak of them according to the following arrangement:—1st, where they undergo a change of structure without a destruction of their substance,—such as their becoming soft from rickets, &c;—2d, where they become harder than natural;—3d, where their bodies are absorbed by tumors pressing upon them, or forming in their substance;—4th, where their substance becomes destroyed from inflammation, suppuration, ulceration, and from scrofula.

## RICKETS.

One of the most frequent diseases which affect the vertebræ is rachitis or rickets, which arises from the membranes of the cancelli being defective in their power of secreting bony matter, and the bones being thus rendered soft and yielding, are unable to support the weight of the head and trunk: hence the spine becomes contorted into a variety of forms.

Rickets is a disease of childhood, and although it has been known to occur in the fœtus, yet it usually shows itself about the sixth or seventh month after birth. The cause of this affection of the bones is involved in much obscurity: some have ascribed it to a defect of nourishment; some to scurvy; some to scrofula; and others to a long continuance of acidity, which children are particularly liable to in the alimentary canal, &c. All these reasons may be very good, but it appears to me not improbable that it is owing to some faulty or imperfect organization of the membrane of bone; that is to say, from some defect of nourishment of the part during its development while in utero: its texture is so constructed, by being either too weak or otherwise, as

not to possess that degree of vitality which would enable it to perform its natural function—the secretion of bony matter. It is impossible in so minute a structure to say in what manner this defect of organization takes place. It may be from a want of denseness of texture, by which its natural power of secretion would be weakened, and considering that it usually recovers in after life, this most likely is the case; for if the cause of this disease was inflammation or over action, it would be followed, at least in some instances, by ulceration or suppuration, which does not ensue. In scrofula almost the same phenomena occur as in rickets; the earthy matter is absorbed, and the bone is rendered soft. In this latter disease, however, pus of a peculiar character is secreted, and the bone ulcerates; whilst in rickets neither the one nor the other occurs, which appears to be one of the chief distinctions between them.

I have only been able to obtain a sight of one preparation of a ricketty bone, in its softened state, and as Mr. Stanley has given an account of it in the *Medico-Chirurgical Transactions*, I shall quote his own words. He says, “Very few observations have been made respecting ricketty bones during the continuance of their soft state, or state of disease, and

none at all (as far as I am informed) respecting the process by which they resume their solid and healthy condition. Lèveillé has given an account of the structure of a soft ricketty bone, with a representation of its curved figure. It is described as having been exceedingly light, yielding with facility to the scalpel, and presenting throughout a cellular and spongy texture. Bichat thus remarks concerning the condition of bones in rickets. ‘In this disease the solid structure forming the walls of long bones entirely disappears; the whole interior of the bone presents a homogeneous appearance, and cellular texture throughout; the periosteum is also thickened.’—The several bones which I have examined exhibited the same structure as that here described by Lèveillé and Bichat, excepting that the periosteum was not thickened, as is mentioned by the latter. ‘The consistence of the bones (alluding to this preparation) was nearly that of common cartilage; they presented throughout an areolated texture, and the cells were in some part large, and contained a brownish gelatinous substance.’” It seems, then, from this account, and from various other authorities, that the bones in rickets are lighter than natural, and that they have so little earthy matter deposited in their structure that they can be bent to almost any form; that

their walls are thin, and penetrated by enlarged blood-vessels; that their colour is red or brown; their texture soft, spongy, and compressible; and that their interstices contain a kind of gelatinous matter.

## TREATMENT.

The treatment of distortions of the spine from rickets, is obvious: 1st, to relieve the column of the weight it has to sustain; and, 2ndly, to endeavour to restore the bones to their healthy condition. To effect the former of these objects, the horizontal position can alone be depended upon. The more, therefore, the patient lies down, the better; and the position in which he should be placed is on the back. It is of the greatest consequence, however, that every means should be taken to improve the health. For this reason, the individual affected with the disease should not always be confined in the house, but should be allowed to be in the open air as much as possible. When in the house, he should lie on the sofa, or upon the outside of the bed; and when out of doors, he should be drawn, lying at full length, in a carriage constructed for that purpose. The food should be of the most nourishing description, such as plain roast and boiled meats, jellies, &c.; but



pastry, and all indigestible substances, should be avoided. The medical treatment consists in the exhibition of tonics, steel, quinine, the bitter infusions, &c. It is of the utmost consequence, also, to attend to the state of the bowels, and alteratives may be given with great advantage. A residence by the sea-side also might materially facilitate the restoration of the health of the patient.

In some cases the distortion of the spine from rickets becomes so great, that the horizontal position will not alone be sufficient to prevent the deformity from increasing. In such, machinery must be worn, to steady the vertebral column. In other cases also, the health of the patient suffers so greatly, from the constant lying down, that it is absolutely necessary he should occasionally be relieved from this position, and take exercise in the ordinary manner. When this happens, machinery also must be employed, according to the circumstances of the case.

As the deformity I am now treating of arises from the softening of the bones, an inquiry may be instituted whether stretching the vertebral column on one of those beds made for such a purpose, might

be attended with any advantage? In many cases I am inclined to think that this process, very cautiously performed, might be of great service. The daily use of a machine of this description, producing a gradual extension of the spine, might certainly assist in bringing it back to its normal form, and at least it might prevent the deformity from getting worse. When these means, however, are employed, the patient should afterwards wear machinery, to keep, if there be any, the ground which has been gained.

It is of importance also that the patient should lie on a particular description of bed. It should not be too soft, as then the vertebral column might yield from its inequalities, and thus the distortion would be rather increased than diminished. A firm elastic woollen mattress is the best kind of bed—one which, although it is not too hard, yet would be of such a consistence as to support the back without distressing the patient.

## GENERAL SOFTENING OF THE VERTEBRÆ.

A general softening of the bones of the vertebræ, occurring a little before or about the period of puberty, is not an uncommon affection of the spine. In these cases, as in rickets, the vertebral column becomes contorted into a variety of forms, and the bone, proving that the phosphate of lime has been absorbed, and not reproduced, is much lighter than natural. This I have observed in several dried specimens, in which there was great distortion without ulceration. It is doubtful from what cause exactly this affection proceeds; but it has been observed to take place in those persons who have what is termed a scrofulous and scorbutic habit of body. It appears to be brought on from a weakened state of health, and it seems to me to arise more from a want of vitality in the osseous membranes than from their increased action; thus, as fat is absorbed by the cellular membrane, owing to an ill state of health, and not reproduced, so is the earthy matter in this affection in bones. It is not improbable that it may be that state of bone which precedes scrofulous action; that is to say,

the phosphate of lime may be partially absorbed from the cancelli without ulceration, or even a deposition of caseous matter having taken place between their interstices. This I am inclined to think, from having observed that if the bones of a dried vertebral column having this character be severed, the cancelli still retain their reticulated appearance, although the bone is much lighter than natural. In several preparations also of this description of disease, I have observed that the membranes of the cancelli remain quite transparent, without any appearance of inflammation or enlargement of the vessels.

The disease usually occurs in weakly girls, about or before the period of menstruation, without being attended with pain. At the time of and previous to the affection, they become pallid and emaciated, are languid and almost unequal to support themselves, having hardly strength to move about. At length the spine gradually gives way, and becomes bent in the lumbar region, and in course of time is answered by the consecutive curve. I have seen two or three cases of this description, in which the patients were females, and from twelve to sixteen years of age. In all of them, as

the health improved, the bones, though the contortion remained, became firmly set. One of them, who was most deformed, told me that she was very tall, and had a remarkable fine figure when she was fifteen or sixteen years of age. At that time, however, she became unhealthy, and the spine crooked. She afterwards improved in health, when for a few years the curvature remained stationary; her health again declined, and the distortion increased: sometimes, however, it remained stationary, and sometimes increased; until the vertebral column at length nearly rested upon the crest of the ilium, and the deformity of the body was so great, that it was only surprising how the functions of the viscera could be carried on. Notwithstanding this, she lived to the good old age of seventy-seven.—The following case will illustrate the opinion I have just offered.

#### CASE.

A young lady between fourteen and fifteen years of age, very tall and of a slender make, fell into bad health. Her appetite failed, and she was extremely weak and languid. She became emaci-



ated ; she was pallid, and the least exertion almost exhausted her. Her mother attributed these symptoms to the particular period of her life. At length, however, she perceived that her spine was becoming crooked : she was advised to take her to the sea-side, and to let her lie constantly in an horizontal position, which she did. This plan was pursued for nearly two years, when upon getting no worse, she was sent to Boulogne, with the view of completing her education, and at the same time giving her the advantage of a sea residence. At this place, although every caution had been given, the disease was neglected, and she became much worse. On her return home, about fifteen months afterwards, to the astonishment of her mother and friends, (who, from the accounts they had had from her, believed she was going on well,) she was so deformed that they hardly knew her. Her spine was curved laterally to such a degree that its inferior convexity almost rested on the crest of the ilium, and the convexity of the superior portion corresponded to it, causing of course great distortion of the trunk of the body. Shocked at such deformity, they immediately consulted an eminent surgeon, who advised that she should wear machinery, to relieve the spine of the weight, and

that she should take tonics, live well, and do every thing that would tend to improve the health. At that time she was greatly debilitated, and therefore it was thought better that she should not lie too much in the horizontal position. Henceforward her health began gradually to improve, and in proportion to this improvement the spine became stronger, and now, although the contortion remains, the bones appear to be firmly set, and the vertebral column is equal to support the weight it has to sustain.

In this case it would seem that as the health improved, the spine became stronger.

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#### TREATMENT.

The treatment of a general softening of the vertebræ from the causes mentioned in the preceding pages, is much the same as in rickets. In the first stage of the disease, the horizontal position is indispensable: great care should be taken to prevent the curvature from increasing, and for this reason the patient should not be allowed to lie on a

feather or on a very soft bed : a woollen mattress, of an equal surface, and made firm and elastic, is the best description of bed, as it yields to the natural incurvations of the spine, and yet it is not so hard as to be disagreeable. Nothing can be more absurd than placing patients on very hard or very soft beds in diseases of the spine, for, in the former, from the natural inflections of the vertebral column, only a part of the spine can rest upon it; for instance, the back of the head, the spinous points of the dorsal vertebræ and the sacrum—the cervical and lumbar vertebræ therefore receive no support at all, and in the latter there being no firm support whatever, and the bed yielding wherever there is most pressure, the distortion cannot be prevented from increasing.

In this disease, perhaps, more than in any other affection of the spine, the health of the individual should be carefully looked after. It most probably arises from a scrofulous diathesis. It would therefore be advisable that the patient should reside by the sea-side, and the more he is drawn out in the horizontal position in the air, providing it be fine weather, the better. If also the patient is equal to bear it, he might bathe, or at least have his body

daily sponged over with sea-water. The food should be of the most nourishing description, consisting of plain boiled or roast meats, with a proper quantity of bread and vegetables. Porter may be allowed in moderation, and one or two glasses of port wine taken daily, at or after dinner, will materially assist in the improvement of the health. The medical treatment consists in the exhibition of tonics, and a proper regulation of the bowels and biliary secretions. In some cases of softening of the vertebræ, as in rickets, machinery must be had recourse to. If the health suffers from the lying down, then the spine must be supported in this manner.

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## MOLLITIES OSSIUM.

Mollities ossium, a disease implying the same as the preceding, but being of a very different nature, sometimes attacks the bones of the vertebræ. This affection is one of very rare occurrence, and from the accounts that have been given of it, is of an acute nature.

As I have not myself seen an instance of the real

disease, I shall quote the well-known case of Madame Supiot, which will point out the difference between it and the preceding—the softening of bone :—

In the year 1747 she had a fall, which occasioned her to keep her bed for some time, and left great pain and weakness in her loins and lower extremities. In about a year and a half afterwards, she began to perceive her left leg particularly affected. Along with this weakness, she had violent pains over her whole body, which increased after a miscarriage, and still more after a natural delivery, in the year 1751. She was now seized with startings, great inquietude, and such violent heats, that she was almost continually in a sweat, and could not bear the least covering even in the coldest weather ; and while her pains continually increased, she took notice that her urine precipitated a white sediment. Her pains abated on the appearance of the sediment, but she now observed that her limbs began to bend, and from this time the softness of them gradually increased till her death. In the month of April, 1752, the trunk of the body did not exceed twenty-three inches in length, the thorax was exceeding ill formed, and the bones of the



upper part were very much distorted ; those of the lower part were considerably bent. At length, the thigh bones became so pliable that her feet could easily be laid on each side of her head. The right side did not, till after some time, become so deformed as the left ; but it was surprising to observe the alterations which daily took place, and the different figures assumed by the limbs, in consequence of the increased softness of the bones ; so that when the sediment in the urine was considerable, the disease of the bones seemed to be at a stand, increasing considerably when it was suppressed. Besides this, she had violent pains, startings, difficulty of breathing, spitting of blood, and, lastly, a fever, with convulsions. She died in the beginning of November, 1752 ; and on dissecting her body, the following appearances were observed : 1st. the muscles in general were of a very soft and pale consistence ; the vastus externus, fascialis, quadriceps, biceps, and external parts of the gracilis, were much shorter than in their natural state, and more firm and tense ; while those on the opposite side were much elongated, thin, and very tender ; in short, the whole muscular system had suffered more or less, according to the action of the muscles in her life-time. 2nd. The bones were entirely dissolved, the perios-

teum remaining unhurt, so that they exhibited only the form of a cylinder. 3rd. The heart and principal blood-vessels, both veins and arteries, contained large black polypi, of a viscid consistence, and very unlike those usually found in dead bodies.

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#### HARDENING OF THE VERTEBRÆ.

The bones of the vertebræ may also become hardened in their structure, the result most probably of chronic inflammation, by which more earthy matter is secreted than natural. There is a preparation in the museum of St. Bartholomew's Hospital, which illustrates this fact. In this specimen two of the bodies are destroyed with the intervening cartilages, as well as those above and below. The bodies of the bones adjoining are reddened, and are much harder and more dense in their structure than natural.

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#### TUMORS PRESSING UPON THE VERTEBRÆ.

It is not uncommon to find part or the whole of the bodies of the vertebræ absorbed by tumors

pressing upon them, and sometimes they have been so completely destroyed that the medulla spinalis has been compressed. Aneurisms of the aorta, and tumors from the enlargement of the glands, are generally the cause of their destruction : of the former there are plenty of specimens to be seen in the museums. I have occasionally observed both in examining bodies after death. In one instance, I recollect a tumor of immense size, which was situated in the posterior mediastinum, and which from pressing upon the vertebral column, caused the absorption of nearly the whole of several of the bodies of the dorsal vertebræ ; and in another case, four bodies of the vertebræ were almost consumed, from an aneurism of the aorta pressing upon them, but the cartilages were left nearly entire. There is a case related in the *Revue Médicale*, where an aneurism was connected with and burst into the vertebral canal. It is related as follows :—

“ L’aneurysme de l’aorte était situé vers le milieu de la portion pectorale descendante de cette artère. Le malade éprouvait dans l’espace interscapulaire gauche une douleur fixe, qui, de temps en temps, devenait très vive, et s’étendait dans tout le côté, en suivant la direction des nerfs intercostaux. Toute

la partie du dos comprise entre les quatrième et huitième côtes donnait par la percussion un son mat. Cependant le bruit respiratoire s'entendait bien et purement dans cette partie ; mais il était plus foible qu'ailleurs, et se faisait si évidemment dans un point profond, que M. Laennec ne balançâ pas à affirmer, dès le premier examen, qu'un corps étranger, et meilleur conducteur du son que le poumon lui même, était interposé entre sa racine et les côtes. Au bout de quelques jours il ne hésita plus qu'entre un aneurysme de l'aorte, et une carie vertebrale avec collection purulente derrière la plèvre. Le malade fut frappé tout-à-coup d'une paraplégie incomplète, qui fit penser que le sac aneurysmal s'était ouvert dans le canal vertebrale. Il succomba quelques heures après. A l'ouverture du corps, on trouva effectivement une communication de près de six lignes de diametre entre le fond du sac aneurysmal, et le canal vertebrale : communication qui repondait au corps de la huitième vertèbre dorsale. Le sang qui avait pénétré par ce point avait decollé la dure-mere dans une etendue de huit à dix lignes, et formait un petit caillot oblong, bien suffisant pour comprimer la moelle, et produire la paraplégie. Ce n'était pas cependant la cause unique de la mort. Le sac aneurysmal s'était ouvert plus en dehors dans

la plèvre gauche, qui était remplie de sang coagulé. La face interne des côtes était corrodée jusqu'à la hauteur de leur angle; les corps des vertèbres l'étaient également. On put remarquer ici, comme dans presque tous les aneurysmes de l'aorte descendante, que l'usure des corps des vertèbres était beaucoup plus profonde que celle des cartilages intervertébraux. Cependant l'un de ces derniers, celui qui separe les septième et huitième vertèbres était presque entièrement détruit, quoique ces deux vertèbres fussent peu altérées."—Tableau des maladies observées à la Charité dans les salles de M. le Professeur Laennec, pendant le premier semestre de l'année scolaire de 1825.—*Revue Médicale*, 1825, tome ii. p. 359.

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## SCIRRHOUS TUMORS.

Scirrhus tumors have also been found in the bodies of the vertebræ. There are preparations of this description in the museum of St. Thomas's Hospital—the tumors are embodied in the substance of the bone. A softening of these bones likewise has occurred from a cancerous disposition in the constitution. Such cases are very rare, and there are but few specimens of them to be seen.



## FUNGOID TUMORS.

Fungoid tumors may arise from the periosteum of the spinal bones.

A poor boy in St. Bartholomew's, a patient of Mr. Abernethy's, had a tumor of this description growing from the periosteum of the sacrum. It was of such an extent as to press upon the rectum, and close up its sides, by which the fæces were prevented from passing: even the bladder was pushed on one side by it, for it could be felt immediately above the pubes. The poor fellow died in extreme agony, and on the post-mortem examination the tumor was found to be of a fungoid character, and occupying nearly the whole cavity of the pelvis.

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FUNGUS HÆMATODES OF THE SPINE.

This disease is liable to affect the vertebral column, just in the same manner as it attacks the articular extremities of other bones. It is just the same in both instances, and seems to begin indiscriminately in all structures, tendon and nerve

being less prone to it than any other parts. There is a beautiful specimen of this disease affecting the vertebræ, in Mr. Langstaff's museum.

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#### ABSCESSSES.

Abscesses have occasionally been formed in the substance of the bone of the sacrum. There is a preparation of this description in the museum of St. Bartholomew's. The history of the case is unknown.

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#### SECONDARY SYMPTOMS OF THE VENEREAL DISEASE.

The spine has been known also to have been attacked by the secondary symptoms of the venereal disease. I have never seen an instance of it; but the late Mr. Wilson related a case in his lectures, where he traced the disease from this cause. Portal also mentions cases of the same description.

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#### GOUT—RHEUMATISM.

Gout or rheumatism also may affect the bones of the spine and its periosteum, which is proved by an

earthy deposit being frequently found upon the vertebræ of those who have been martyrs to this complaint, and who have also had the same deposit on other bones. Such a state of the bones I have frequently observed.

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#### INFLAMMATION OF THE BONES.

The vertebræ, like other bones, are liable to common inflammation. When in an active state, the vascularity of their substance is greatly increased. They become enlarged by tumefaction and by deposition of coagulable lymph within their substance: they are highly reddened, suppuration takes place, and pure pus is secreted. The parts around participate in the mischief, and ulceration at length commencing, they are rapidly destroyed.

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#### ULCERATION OF THE BONES.

Ulceration commencing in the bodies of the vertebræ, is one of the most frequent affections to which the spinal column is subject. In many

cases the anterior vertebral ligament covering the bodies, is the first part affected; it becomes absorbed, and the ulceration extends to the vertebræ, which it covers. In other cases the disease commences in the centre of the intervertebral cartilage, and soon extends to the bodies of the contiguous vertebræ; but in the greater number of cases, the ulceration decidedly originates in the substance of the bodies of the vertebræ themselves. When ulceration begins in the centre of the fibrocartilages, it often extends so rapidly to the neighbouring vertebræ, as to destroy one or more of the bodies before the whole of the intervertebral substance has been absorbed. This is mentioned to show that in the advanced stage of the disease we are very liable to be mistaken as to the structure wherein it commenced.

The first appearance of approaching ulceration in the bodies are, an unusual vascularity, with, in most cases, a loosening of the anterior vertebral fascia, and subsequently of the intervertebral substances from the vertebræ. Small specks of ulceration soon follow; the absorption now proceeds with the greatest rapidity; pus is abundantly secreted, and may appear in the usual situations of

lumbar and psoas abscesses, and one or more of the bodies is ultimately removed. During the progress of ulceration, the bodies of the vertebræ become preternaturally hard, and they assume a yellowish red colour when a section of them is made. This appears to be the result of the highly-inflamed vessels, pouring out osseous matter into the cancellous structure in the place of the usual medullary secretion. The hardening is indeed precisely analogous to what occurs in ulceration of other bones.

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ULCERATION OF THE RINGS OF THE VERTEBRÆ.

Although it does not commonly happen, yet in some cases ulceration of the rings of the vertebræ takes place. There is a preparation of this species of the disease in the spine in the museum of St. Bartholomew's Hospital. Here the ulceration began in the back part of the rings of the dorsal vertebræ, and a portion of the bone is separated, and pressing upon the medulla, while the bodies are perfectly sound.

In the museum of Guy's Hospital also, there is



a preparation where an abscess is connected with the vertebral canal. It appears in this case that the rings of one of the dorsal vertebræ is ulcerated, from which there is a fistulous passage leading from the vertebral canal to a large abscess in the back. This narrow passage is partly filled up by caseous matter, which proves it to have been a scrofulous abscess, arising in consequence of diseased bone, and connected, owing to the ulceration of the ring, with the vertebral canal.

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SCROFULA OF THE BONES.

The most common disease of the vertebræ is scrofula. From observation of morbid specimens, it may be seen that in this disease the vascularity of the bones is at first somewhat increased; the earthy matter is absorbed; the medullary secretion in the cancellous structure is deficient, and, instead of it, there is a deposition of a caseous matter, or of a yellow albuminous fluid. The deposition of this caseous matter varies in quantity, and sometimes it amounts to so large a bulk as to replace the vertebræ, as they become

absorbed, or to form a tumor which either elevates the pleura costalis, (at least when the disease occurs at the dorsal vertebræ,) or presses upon the medulla spinalis. This may be observed in two of the preparations in the museum of Bartholomew's Hospital: in the one, the absorbed vertebræ are replaced by it, and the pleura costalis is so thrust or pushed forwards that there is a large projection into the cavity of the chest; and in the other, this matter so protrudes upon the membranes and the medulla that it presses upon the substance of the latter.

Although it is usual in scrofula of the bone that this caseous matter is deposited between the cancelli, yet it is not always the case: sometimes there is neither medullary matter nor this secretion, but the cancellous structure is totally deprived of earthy matter, when it becomes beautifully transparent and reticulated. This may be observed in the spongy heads of the long bones, as well as of the vertebræ, and there are several instances of it in the museum before mentioned.

Scrofula of the spine usually commences exclusively in the cancellous structure of the bone; the intervertebral substance, the joints of the articu-

lating processes, and the articulation of the ribs with the vertebræ becoming secondarily affected; and this is precisely analogous to what usually takes place in articulating extremities of other bones: the cancellous structure of bone is first affected, and then the cartilage and synovial membrane of the joint.

Scrofulous action, in the first instance, increases the vascularity of the parts affected by it, and this vascularity continues in those surrounding it, during the progress of the disease, till the bone in many cases is deprived of vitality altogether. If the bone, as may be seen in some preparations in St. Bartholomew's museum, be injected with subtle injection in the early stage of the disease, before caseous matter has began to accumulate, the vessels are seen to ramify freely through the cancelli; but if the injection be made when the cancellous structure is become loaded with this matter, there is still to be seen a degree of vascularity at the line of demarcation between the disease and the sound parts, though the injection has failed to enter the newly-formed matter: from this we may infer, that this deposition is, like pus, a mere unorganized secretion.

When the vertebræ are arrived at such a state of disease as to become softened, from the absorption of the earthy matter from the membranes of the cancelli, and there is this deposition of caseous matter, ulceration commences, and the bodies of the vertebræ, together with the cartilages, are gradually destroyed. The ulceration may begin either in the internal or external part of a vertebra, which it may attack in one or more points, spreading with a greater or less degree of rapidity. Sometimes the anterior ligament, which is absorbed, is first affected by it, then it gradually spreads on to the bone; sometimes it commences on the body, immediately under the anterior ligament, separating it from its attachments with the bone, and thus leaving it bagging or jutting forwards, and at other times, which is most frequently the case, the interior of the body is the first part affected by it. When the interior of the body is first affected, the cancelli are frequently broken down as it were in one spot, which becomes filled with caseous matter. This, most probably, arises from the cancellous membranes being inflamed in one part more than another, and thus the earthy matter becomes absorbed, and the death of that portion of the bone is the result.

## DISEASE OF THE CARTILAGE.

The fibro-cartilage or intervertebral substance is also liable to disease, and it may be attacked in the same manner as the bone, by simple or strumous inflammation, and by their consequences, suppuration and ulceration. . When simple inflammation affects the cartilage, it becomes more vascular, and its substance swells ; it is often rendered soft and pulpy ; ulceration at length commences, which may either give rise to the secretion of pus or not, and the part is rapidly destroyed.

When scrofulous inflammation occurs in the intervertebral cartilages, they are more vascular than usual, and present a dirty yellow appearance : they are not so firm as natural, and often become of a blackish hue, which may be observed mostly in their centre, and this seems chiefly to occur immediately before ulceration commences.

When the intervertebral cartilages are attacked by inflammation and ulceration, it would appear that they are much more quickly destroyed than the bones. This may be seen from many specimens



we have of this disease: they are frequently entirely absorbed while ulceration is progressively and slowly going on in the bone. The most probable cause of this is, the intervertebral substances are much more vascular than the bone, and thus the destructive effects of inflammation is more rapid.

Although it has been before stated that inflammation, ulceration, and scrofulous disease, generally begin in the bones, yet in some instances they have appeared to commence in the cartilage. There are some cases in the museum of St. Bartholomew's, which will prove that it first began in this structure. In one preparation particularly, every one of the intervertebral substances throughout the whole column are entirely destroyed by ulceration, whilst most of the bones are only slightly affected by ulceration on their anterior surfaces. Thus the bodies of the vertebræ rest upon one another without having the intervertebral substances between them.

Mr. Brodie, in his valuable work on the joints, has related two cases, which would lead us also to draw such an inference. In the one, "The bodies of the lowest dorsal and three superior lumbar ver-

tebræ, were found at the posterior part of the abscess, nearly consumed by caries. There were no remains of intervertebral cartilages between the tenth and eleventh dorsal, nor between the third and fourth lumbar vertebræ. These intervertebral spaces were filled with pus, and the opposite surfaces of the vertebræ were carious, but only to a small extent. The central part of the intervertebral cartilage, between the ninth and tenth dorsal vertebræ, had been completely absorbed, and pus was found in its place. Externally to this, the concentric layers of elastic cartilage were entire, though somewhat altered from their natural appearance." And in the other, "There were no remains of the intervertebral cartilage between the fourth and fifth dorsal vertebræ; and the opposite surfaces of these two vertebræ were consumed by caries to some extent; and hence arose the curvature of the spine forward; and they were consumed to a greater extent towards the left side than towards the right; and hence arose the lateral curvature. The intervertebral cartilage between the eleventh and twelfth dorsal vertebræ had also entirely disappeared, and the opposite surfaces of these bones were in a state of caries; but this had not extended itself sufficiently to occasion any sensible loss of

bony substance. The intervertebral cartilages, between the third, fourth, fifth, and sixth, seventh and eighth, tenth and eleventh dorsal vertebræ, and also that between the twelfth and first lumbar vertebræ, were all found in a perfectly natural state towards the circumference; but in the centre they were of a dark colour: and on the surfaces, towards the bones, they, as well as the bones themselves, were in a state of incipient ulceration, but without any appearance of pus having been secreted: and the other intervertebral cartilages were throughout their whole substance in a natural condition; and the bones of the vertebræ everywhere had their natural texture and hardness."

The cases here alluded to, as well as the preparations in the museum of St. Bartholomew's, certainly seem to show that the ulceration first commenced in the cartilages. At the same time, however, it may be observed, that in all of them there was disease of the bones as well.

It therefore seems doubtful whether there is not a predisposition to scrofula in both at the same time; and this I am more inclined to believe, from

having observed that although the cartilage may be destroyed, yet there is also a softening or an incipient ulceration in the bones.

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## DISEASES OF ARTICULAR JOINTS AND LIGAMENTS.

The articular joints and their ligaments sometimes suffer from disease, which arises either from a primary or secondary cause. The symptoms of these affections during life are very obscure. That, however, they are attacked by inflammation, ulceration, and its consequences, is shown by morbid specimens : we find suppuration to have taken place in them ; that their ligaments have been destroyed ; that they are sometimes ankylosed ; and that they can be even dislocated by disease. There are several specimens of ankylosis of the vertebræ (particularly those of the neck) in the museum of St. Bartholomew's Hospital, and the following curious and interesting case, an account of which was given to me by my friend Mr. Lawrence, proves that they can suffer a spontaneous dislocation from disease.

## CASE.

A boy, seven years of age, had an affection of the head, considered to be hydrocephalus, but attended with two circumstances, which could not be referred to that cause. He could not move the head on the spine, but carefully held and fixed it with his own hands, so as to prevent any motion between the occiput and the first and second cervical vertebræ, whenever it was necessary to alter his position. A large fluctuating tumor formed in the side of the neck, and increased to such a size that it was estimated to contain a pint of fluid; pressure on this tumor affected the sensorium, and, when carried to a certain extent, caused complete coma. The professional attendants, who regarded the disease as hydrocephalus, judged that this tumor must have communication with the verticles of the brain. No paralysis, no impaired motion, and no loss of sensibility existed, either at this or any other period of the disease. After lasting a very long time, the symptoms of affection of the head slowly gave way, and ultimately disappeared entirely, together with the tumor in the neck. The patient recovered completely, and was sent to the sea-side, where he



was able to take the exercise, and join in the active sports suitable to his age. Very little peculiarity was observed, either in the position of the head, or in its motions. At the end of some months, the health again declined, and the lumbar region of the spine became affected; the column gradually gave way, and bent forward in the loins. Soon after a lumbar abscess appeared at the bend of the thigh, and increased to an enormous magnitude: the matter was evacuated by a puncture. The health now rapidly declined; swelling of the lower limbs and great emaciation, ensued; and the patient sunk, at the age of 12. The body was examined in the hottest part of last summer, and the brain was so soft that a satisfactory dissection of it could not be made. When the basis of the encephalon had been removed from the cranium, a considerable prominence was seen, rising from the point of the foramen magnum, and the surgeon endeavoured to detach the skull from the spine, that he might ascertain the origin and nature of the projection. He cut through the soft parts, and then endeavoured to thrust off the skull by main force; it gave way, and separated, as he supposed, from the spine; but it was found, on further examination, that the occiput, atlas, axis, and third cervical ver-

tebræ, had come away together, the connexion between the latter and the fourth vertebræ having been forcibly dissolved. When the soft parts had been removed by maceration, dislocation was found to have occurred between the occiput and the atlas; a greater displacement of the two latter bones upon the axis had taken place, and their several bones had become firmly ankylosed in their unnatural situation. The atlas had been partially dislocated towards the left, so that the right side of the bony ring which it forms, corresponded nearly to the middle of the foramen magnum. At the same time the right articular portion of the bone, which is articulated to the occiput above, and to the axis below, and to the neighbouring portion of the ring, had been absorbed, so that the right occipital condyle rested on the axis.

The occiput, together with the atlas, had been extensively dislocated towards the left, so that the entire odontoid process of the axis stood up, as an unnatural bony projection, in the basis of the skull, at the anterior and right part of the foramen magnum. The bodies of the axis and third vertebra, instead of being perpendicular under the basilar process of the occiput, are towards the right, and

a line drawn along their middle passes on the right edge of the basilar process.

The basis of the odontoid process is firmly ankylosed to the occiput. The latter bone and the atlas are ankylosed. On the left side, the atlas and axis, and on the right, the occipital condyle, the remains of the right side of the atlas and the axis are connected by the firmest bony union. The axis and the third vertebra are ankylosed. The diseased processes which caused these singular luxations and anchyloses, must have been completely at an end long before death; for the bones in question exhibited their natural firmness and healthy surface, and the anchyloses are perfect, presenting all the solidity of the natural bone. These displacements have reduced the dimensions of the vertebral canal, at its entrance, to less than one-third of its natural measurement. The reaction, no doubt, occurred very gradually, and affords a singular example of what the spinal cord will bear, without its functions being impaired, when the change takes place slowly. The standing up of the entire odontoid process against the medulla oblongata, without any symptom of pressure having existed during life, or any evidence having occurred

of impaired cerebral action, affords a very striking example of an analogous description.

A comparison of this patient's history, with the appearance on dissection, shows that the case was a disease of the articulations and bones with chronic abscess, and that the latter disappeared by absorption when the former began to recover.

## CHAPTER VII.

*Consequences of Disease of the Vertebrae and their Cartilages—  
Angular Curvature and its Effects—Lumbar Abscess.*

THE consequence of caries and ulceration of the spine, is the destruction of the bodies of the vertebrae, as well as of the intervertebral cartilages, whereby the superior portion of the sound part of the vertebral column falls forward upon the inferior portion, and so produces an angular curvature, by which the medulla is more or less bent and compressed. The acuteness of the angle depends upon the number of the bodies and cartilages destroyed; if only one or two of them have been destroyed by ulceration, then the projection of the spinous points is very sharp, but if more of them have been absorbed, the curvature is more round. If a greater number of the bones of the vertebrae are only partially diseased and ulcerated, or several of the intervertebral cartilages are wholly or partially absorbed, then this state of the spine is de-



noted by a bowing forward of the diseased portion. In the former of these cases, the bending of the medulla is more acute, and consequently the paraplegia more confirmed, whilst in the latter no compression whatever may exist.

The extent of the angle of the curve likewise depends in some measure upon the manner in which the two extremities of the diseased bones may be ankylosed; for instance, if the two surfaces fall upon one another, it will be regulated by the number of the bodies of the vertebræ, which are deficient; but if, on the other hand, the anterior surface of the bodies should rest upon one another, which occasionally is the case, and some specimens of which are to be seen in the museum of St. Bartholomew's Hospital, the curvature will be immense. It is this description of case which accounts for the acute hump back usually seen in the streets.

Angular curvature may occur in any part of the vertebral column—in the cervical, the dorsal, and the lumbar vertebræ. It, however, most frequently takes place in the dorsal vertebræ, as they (from the manner in which they are impacted together, with their cartilages, which are much thinner in

front than behind, and from their natural inclination bend forward,) are more favourable to it than any other part of the spine; hence disease of the cervical and lumbar vertebræ, may go on to a considerable extent before curvature forwards will take place, the reverse arrangement of the cartilages occurring, and these parts of the column naturally bending backwards, whilst disease in the dorsal vertebræ, from the weight of the trunk being more particularly upon them, and the curve being forwards naturally, would proceed more rapidly.

The effect of angular curvature is the bending of the medulla and its membranes, which, as I have before stated, causes a greater or less degree of paralysis of the parts below, which, however, does not always depend upon pressure of the bones upon it, but from the bending of its own substance, producing pressure upon itself; for instance, the anterior portion of the medulla would be compressed, whilst the posterior portion, or back of it, would be stretched. It is not probable that an organ of such delicate structure can undergo so great a change of direction, without some injury to it, and this injury will be in proportion to the kind of distortion. When angular curvature has occurred,

the nerves, also, which, have their origin from that part of the medulla that is bent, sometimes are pressed upon by the bones, and thus their functions are partially or wholly interrupted. In this manner many of the symptoms which frequently remain after the bones have ankylosed, may be accounted for.

With regard to the curvature of the spine, it may be considered as a general law, that the medulla takes its course along the greater angle; that is to say, it follows the curve of the rings of the vertebræ rather than that of the bodies. It may be observed also, in most of the morbid specimens of this disease, that the vertebral canal, where the curvature takes place, is even larger than natural, and that the projecting points of the broken-down vertebræ are absorbed, and rounded off. In some cases, no doubt, where only one or two bodies are rapidly destroyed, and the angle is very acute, the bones may press upon the spinal cord, but in the majority they do not, and even in those where they do, if the patient lives long enough, there is but little doubt they are in general gradually smoothed down by absorption.

The state of the medulla itself, if examined after death at the part where the curve takes place, varies; sometimes it does not in any way deviate from health: the structure, both of the medulla and its membranes, are natural, while at other times a considerable degree of disease may have gone on. The membranes may be thickened, matter may be formed pressing upon them, or between them, and the medulla itself may be reddened, or partially softened, or softened in such a manner as to be almost in a fluid state. In these cases the paralysis below is usually complete.

Besides the consequences just related, which happen to the vertebral column itself, angular curvature also produces changes of form upon the body—the trunk is shortened; the shape of the chest is altered, by which the viscera are thrown out of their relative situations; and the aorta (some beautiful specimens of which are to be seen in the Museum of St. Bartholomew's Hospital) usually follows the curvature of the spine. The particular manner in which these deviations from the normal form takes place, depends upon where the disease of the spine is situated: if it occurs in the cervical vertebræ, then only the neck and head

suffer, being made either to incline forwards or laterally ; if high up in the dorsal region, the head and neck sink between the shoulders, the sternum projects forwards, the ribs are compressed and flattened on each side, and opposite the diseased part they are thrown out of their articulations, and become closer together than natural ; and if it occurs in the same vertebræ lower down, the same deformities of the chest arise, but the upper part of the trunk is bent more forward, and the viscera are more completely altered in their relative situations. These are the general characters of the effect of angular curvature on the body, but the exact deformity which occurs depends upon the numbers of the bodies of the vertebræ destroyed.

When the diseased action of the vertebræ has ceased, and the curvature has formed, then the process of ankylosis takes place, and the manner by which this is accomplished, is by the two remaining surfaces of the diseased part of their bodies coming more or less into contact. When this has happened, the diseased surfaces are absorbed, and ossific matter is thrown out from the two extremities of the bones, and the surfaces of the two anterior parts of the bodies are joined to-



gether by ligamentous matter ; and thus, in progress of time, the parts are firmly united.

Sometimes when ulceration of the bodies of the part has not carried on its destructive effects to a great extent, and its progress has been arrested by the improved state of the health, ossific matter has been thrown out on the anterior surface of the bodies, and thus the part which had suffered from disease is strengthened. There is a preparation of this nature in the Museum of St Bartholomew's Hospital. Here there are four or five dorsal vertebræ covered in this manner by ossific matter.

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#### LUMBAR OR PSOAS ABSCESS.

When disease of the vertebræ and of the intervertebral substances has gone on to some extent, it frequently happens that abscesses are formed in consequence of it. These collections of matter are denominated lumbar or psoas abscesses, (the more proper term for them perhaps would be spinal abscesses,) and they arise either from a secretion of pus from the bones themselves, or from irritation of the surrounding parts, which has been caused

by the disease. They most commonly point at the groin, or beneath Poupart's ligament in the thigh, immediately above the insertion of the psoas and iliacus internus muscles. Abscesses connected with diseased vertebræ have also been known to show themselves in the loins, and I have even seen, in one or two instances, an outlet of pus occur in the nates.

In another case, which occurred in the St. Mary-le-Bone Infirmary, I saw the pus make its escape between the eighth and ninth ribs. A man was admitted into this institution with an opening between the eighth and ninth ribs, from whence issued a profuse discharge. It was thought that the ribs might be diseased, or that this opening might be connected with the cavity of the pleura. He at length died, and it was found that three or four of the bodies of the dorsal vertebræ were diseased, and that matter had formed, which had found its way by a fistulous passage situated between the pleura costalis and the edge of the lower rib, through the external opening.

Sometimes an abscess is formed on the loins, or back, which may be connected with the disease of

the bones, or which may arise from the irritation produced by the disease. I have seen three cases of this description, one of which I shall relate.

### CASE.

April 19th, 1826.—W. V. ætat. four years, has a large tumor upon the back, beginning at the first of the lumbar vertebræ, and extending obliquely upwards, and reaching to the arch of the ribs on the right side: it is about eight inches in length from the spine to its extremity, and three and a half in breadth over the part which covers the spine, and five inches at its other extremity. It feels extremely tense, and evidently contains a fluid, for when pressed upon it fluctuates. The skin is smooth and shining, and its surface is streaked with distended veins. Immediately above the tumor there is a curvature of the spine, of about three or four of the last dorsal vertebræ. The child has had complete paraplegia, but has now nearly regained the use of the lower limbs. His health to all appearance is good, having an appetite for food, and his excretions are regular and natural.

The account the mother gives is as follows:—  
When the child was born, he was perfectly well-formed; he had nothing the matter with his spine, and possessed a free use of his limbs. When he was about eleven months old he began to walk, and continued getting stronger until he was two years of age: at this time she perceived he began to get very weak in his lower limbs, and that his health began materially to suffer. She therefore consulted an eminent surgeon on his case, who decided that he had a disease of the spine, and recommended the reclining position, employed issues, &c. &c. When he was about three years and three months of age, he had so far recovered that he only suffered from weakness in the lower limbs: at this time, however, the mother discovered a small tumor, about the size of a walnut, immediately under the curvature of the spine, which gradually increased, until it arrived at the size described in the foregoing part of the case. I punctured the tumor with a needle, but as no fluid escaped, I made a small valvular opening with a lancet, and let out about fourteen ounces of a thin glairy watery fluid, mingled with a curdy matter. The wound was dressed with adhesive plaister, and slight pressure with a roller was made upon it. In three days it had again filled, and I made a second

puncture, and eight ounces of fluid of the same character escaped. The wound was dressed as before. In three days more, the tumor became so distended that the scar, where the first incision was made, ulcerated, and a large quantity of matter passed through the opening. The adhesive dressing was now taken off every morning, and the contents of the tumor evacuated. In six weeks the child perfectly recovered, and is now in good health.

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Lumbar, psoas, or spinal abscesses, should be treated according to the plan recommended by Mr. Abernethy, which consists in making a valvular opening with an abscess lancet in the tumor, and evacuating its contents, and then closing up the aperture with adhesive plaister; this should be repeated as often as it fills, and great care should be taken to prevent the entrance of air; for should this occur, it would cause the matter remaining in the abscess to become putrid, the absorption of which into the system would be attended by the most dreadful consequences.

Mr. A. therefore directs that the wound be closed



as neatly as that made in bleeding, so that it may heal cleverly; and he advises that a compress of lint be laid over it, and strapped down with adhesive plaister, but on no account the application of a bandage, as that would prevent our knowing whether the dressing is in its proper situation, or that the wound remains closed. After having once opened the abscess, we should be careful not to let it distend beyond a certain point, for by so doing, the cicatrix of the punctures which have been previously made, is in danger of ulcerating, and thus we should be allowing the entrance of air.

## CHAPTER VIII.

### SYMPTOMS.

THE symptoms of the diseases of the bones and cartilages of the spine, may be divided into three stages :—

1st. Those which occur before curvature.

2nd. Those which are present while curvature is taking place.

3rd. Those which happen during the progress of recovery.

In the first stage, the patients generally feel great lassitude, look pale, and become emaciated without being able to assign any particular cause. They complain of weakness ; of a dull heavy pain in the back at the point where the disease is present, and of a numbness and coldness in the lower extremities ; their legs totter under them, and when they walk they frequently trip, and are incapable of

placing the feet exactly where they wish to tread. They usually also express relief from being in the horizontal position, and complain that, when they rise next morning, the symptoms increase. They sometimes suffer extreme pain in the hip-joint, the knee, and the ankle, so much so that the malady is often mistook for a disease of one of these joints. They have cramps in the muscles of the lower limbs, and are often seized with convulsive twitchings, the result of the irritation caused by the diseased parts. A sense of tightness is often present at the stomach; pain is sometimes felt in the side, and exercise is fatiguing. They constantly feel chilly; the appetite fails them; the pulse becomes quickened, irritable, feeble, and occasionally irregular; in short, the health is generally deranged.

As the symptoms advance into the second stage, and the curvature is forming, they become more or less paralysed below the diseased part: they gradually lose the power of the rectum, and of the bladder; the function of the intestines is diminished, by which costiveness ensues, and the urine cannot be expelled; the muscles of the legs and thighs become flaccid and wasted, and by degrees lose both the power of sensation and motion: in

this state they remain powerless, unless some favourable change in the disease takes place, until they die.

The symptoms I have here related, are those which generally occur in a greater or less degree, but of course they vary according to the situation of the disease. If it be present in the neck, or in the upper dorsal vertebræ, then a greater part of the body is involved in the mischief; the respiration is affected, being rendered difficult and irregular, and the sense of tightness at the stomach and of the abdominal muscles is greater. If, however, it be situated lower down, the parts which receive their supply of nerves from the medulla beneath the disease, alone suffer a loss of power. It does not always follow, however, when the disease is seated high up—in the neck, for instance, or on the superior dorsal vertebræ, that the muscles of respiration shall be affected. There is a case, under my care, at this present time, in St. Mary-le-Bone Infirmary, where all the cervical vertebræ are diseased (except the atlas and dentatus), and there is an angular curvature, yet the respiration is in no way affected. The power of motion is perfect in the arms, but in the legs it is

entirely lost, and the sphincter muscle of the rectum also is paralysed: a perfect sense of feeling remains throughout the whole body. The only way to account for such symptoms is, that the medulla is only partially compressed.

During the progress of the disease, various symptoms occur, apparently unconnected with the spine, and this may be observed more particularly in the female. It frequently happens that a girl with a disease of the spine, is attacked by all the symptoms of hysteria. One day she will be found apparently in perfect health and spirits, and the next to all appearance dying: she will be attacked by syncope, dyspnœa, &c. Sometimes from the violent pain felt in different organs of the viscera, and from the constitutional symptoms accompanying them, it would seem that one of them was attacked by inflammation. Acute pain is frequently felt in the region of the liver, the stomach, and the intestines, and bearing all the characters of hepatitis, enteritis, peritonitis, &c. Sometimes there will be an attack of fever, resembling what is termed a continued fever. All these variety of symptoms I have witnessed. During the time I was house-surgeon to St. Bartholomew's Hospital, I recollect several in-



stances of it. Out of half a dozen patients, one or other of them, perhaps, would be suffering from some of these symptoms, and it always appeared to me that they were greatly influenced by the state of the atmosphere.

To account for the symptoms just described, would be difficult; they most probably are occasioned by the intimate connexion of the spinal nerves with the sympathetic. Every one of the anterior spinal nerves forms a ganglion with the sympathetic. If, therefore, any portion of the spine be diseased, is it not natural to suppose that the functions of this nerve would in some measure be influenced by it? Certainly; and I have but little doubt that it is; and this inference I draw from the symptoms, leaving alone those of the injuries of the spine. Costiveness is induced by a disease of the spine, by which is shown that the coats of the intestines have a diminished function, and that the peristaltic motion is imperfect. From what can this arise, unless it is that the disease of the spine has affected the power of the sympathetic? Again, the patients continually complain of an uneasiness and sense of tightness at the pit of the stomach. Mr. Pott remarks this: he says, "the adult also finds

all the offices of his digestive and respiratory organs much affected, and he complains constantly of a pain and tightness at his stomach.' Now, although some have ascribed this to paralysis of the abdominal muscles, yet I cannot help differing with them in opinion. Mr. Pott appears to me to be right. I am inclined to think that the digestive powers are really diminished, and that this tightness at the stomach is felt from a diminished influence of the sympathetic nerve, that is to say, whatever power this nerve derives from the spine, is impaired or lost; from which cause these symptoms arise.

In very severe injuries of the spine, we find that the intestines become instantly inflated with air, and that their functions are more or less paralysed. They are supplied by no nerve from the spine, but from the sympathetic alone. How can we explain so instant an effect, unless it is from the connexion of the spinal nerves with the sympathetic? If, then, it be allowed that the junction of the spinal nerves with the sympathetic has an influence over the functions of the intestines, why should it not have the same influence over other organs which are supplied by the same nerve? Should an increase of inflammation occur at the diseased

part of the spine, is it not natural to suppose that it would more or less affect the nerves connected with it, and that secondarily, through its connexions with the sympathetic, the various organs supplied by this latter nerve may suffer? It appears to me that when we take a comprehensive view of the nervous communications of the medulla spinalis, with the sympathetic and other nerves, we cannot be surprised at any symptom that may be present. I am inclined to think, also, that the connexions just alluded to may account for some of the functions of the viscera, which at present are but imperfectly understood.

Children, who are incapable of describing their sensations, are very liable to disease of the spine. As it is impossible to give a better explanation of the symptoms observed in them than Mr. Pott's, I shall quote his words: "When the disease attacks an infant of only a year or two old, or under, the true cause of it is seldom discovered until sometime after the effect has taken place, at least not by mothers and nurses, who know not where to look for it. The child is said to be uncommonly backward in the use of his legs, or it is thought to have received some hurt in his back.

When it affects a child who is old enough to have already walked, and who has been able to walk, the loss of the use of his legs is gradual, though in general not very slow. He at first complains of being very soon tired, is languid, restless, and unable to move much, or at all briskly, for no great length of time. After this, he may be observed to trip and stumble, although there is no impediment in his way; and whenever he attempts to move, he finds that his legs involuntarily cross each other, by which he is frequently thrown down, and that without stumbling; upon endeavouring to stand still and erect, without support, even for a few minutes, his knees give way, and bend forward. When the disease is a little farther advanced, it will be found that he cannot, without much difficulty and deliberation, direct either of his feet precisely to any exact spot, and very soon after this, both thighs and legs lose a good deal of their natural sensibility, and become perfectly useless for all the purposes of locomotion."

The symptoms by which we can more particularly recognize the presence of disease of the spine are, pain in the affected part, accompanied by soreness on pressure, or arising from striking

the part affected sharply with the knuckles: the patient also feels a numbness in his lower extremities, which is very commonly relieved by lying in an horizontal position; if desired to extend the thigh, or to bend it towards the trunk, he finds he has in a greater or less degree lost that power. In walking he limps, and is incapable of directing his steps, and he is unable to stand upon one leg without the limbs trembling under him, and causing him to fall. In the bent position, he usually feels pain in the parts, and should any portion of the bones or cartilages be destroyed, the spinous processes widen from one another, and stretch the skin covering them.

Mr. Copeland, in his valuable treatise, has remarked that an increased degree of heat will cause a sense of burning where the disease is situated; hence if a sponge, wrung out of hot water, be drawn along the course of the spine, it will sometimes give a very acute degree of pain while passing over the part affected.

Notwithstanding, however, all the symptoms here enumerated, so insidious is this disease that I have sometimes known angular curvature to occur with-



out a single indication of it, as far as the health was concerned. A child, for instance, shall play about as usual, without its parents remarking any change in it; it shall have a good appetite, sleep well, &c. and yet ulceration of the bones shall be going on, which shall not be discovered until ankylosis of the part has taken place. I recollect a case of this description happening in a little boy of my own acquaintance. He had always been from his birth more lively and active than usual, and never had any illness to speak of. By mere accident his father discovered that he had an angular curvature of about two or three of the vertebræ, which had firmly ankylosed.

The completeness and incompleteness also of the symptoms, very much depends upon the rapidity with which the curvature takes place. If the destruction of the bodies of the vertebræ has been very quickly effected, the paraplegia is usually more complete; but if it has been slow in its progress, the paralysis below is frequently very imperfect. It is only astonishing in some cases how much mischief may occur to the vertebræ, both as to the extent of the curve and the acuteness of it, without the symptoms of pressure upon the medulla

being produced. I have frequently seen six or eight of the bodies of the vertebræ destroyed without a single symptom as to the loss of the power of motion or feeling to denote it. I have at this present time a case of a child under my care, in St. Mary-le-Bone Infirmary, where at least six of the bodies of the dorsal vertebræ have been destroyed by caries, and the angle of the curve is very acute, and yet no paralysis has ever occurred. Such a phenomenon can only be explained by the very progressive and slow manner in which the alteration of form takes place.

The symptoms which happen during the progress of recovery are these:—the patient first begins to feel an indistinct consciousness of returning sensation at least, when there has been complete paralysis in the lower extremities, and this is usually accompanied by a tingling and pricking, shortly followed by pains in the parts. By degrees the power of feeling increases, until at length the power of motion also returns. This latter symptom is first perceived by the patient being enabled to bring into action the flexor and extensor muscles of the leg (by the movement of the feet). He now becomes enabled gradually to bend the legs

and thighs to a certain position, but he cannot at first return them to the situation from whence he moved them. In a short time, however, he can move them at pleasure, and he progressively recovers their complete use.

## CHAPTER IX.

### *Treatment of Diseases of the Bones and Intervertebral Substances.*

THE treatment of the diseases of the bones of the spine, is of the utmost consequence, and there are certain means necessary to be adopted which are indispensable.

1st. The recumbent position.

2nd. Local remedies.

3rd. Attention to the general health.

The necessity of the recumbent position cannot admit of a doubt. The spine, like an architectural column, which has to support weight, must necessarily give way if any of its parts are defective or decayed. If, therefore, the bodies of any of the bones become carious, they can no longer support

the weight they have to sustain, and the pressure upon them will evidently tend to increase the disease. The most natural idea, therefore, which would suggest itself to our minds, would be, to relieve the diseased part of its burthen, until it is restored to health, and this can only be effectually done by placing the body in the horizontal position.

For this reason the patient should constantly lie down, and as it is of the greatest consequence to keep the diseased part as quiescent as possible, (for each movement of the body from one side to the other must necessarily affect it,) he ought to be placed on his back, on the bed invented by Mr. Earle. By doing this, these objects are fully attained, for it is so admirably constructed, that the parts of which it is composed can be made to move to any angle, so that it is never necessary for the patient to move, not even to perform the natural evacuations.

The patient being placed on this bed, the next point to be attended to is, the local remedies, and these must be employed according to the state of the diseased part.



If there be much pain, with a quick pulse, and fever, we may conclude that considerable inflammation is present. In this case, blood should be abstracted from the part, either by cupping or by leeches, and an evaporating lotion or poultice should be applied externally, with the view of soothing it and diminishing heat, and these means should be employed, until all inflammatory symptoms have subsided.

After having reduced, or rather moderated the inflammation, and when the disease has assumed a chronic form, counter-irritants will usually be found of the greatest service. The employment of these remedies requires some attention and care. At first, until the inflammation is certainly subdued, blisters only, or the tartar emetic ointment, should be applied; but when the disease has assumed a chronic form, and the ulceration and suppuration of the bones and cartilages are going on, then issues or the moxa may be employed, nor should these be made too near the diseased part. It would be advisable to place them, perhaps about the space of two or three vertebræ above or below the disease, for by their too near approach to it, from the close connexion of the vessels of the internal and

external parts, they would rather tend to increase than diminish the malady. When it is necessary to make two issues also, one should be made above the affected part on one side of the spine, and the other below it on the opposite side, by which the counter-irritation will affect the disease equally and more effectually. Two issues thus applied are generally most effectual; but at first it would be better perhaps to make only one, to ascertain how the patient can bear them, as I have sometimes observed in irritable habits that they have produced considerable constitutional disturbance.

It often happens that during the long progress of a disease of the spine, the issues become indolent, and will not discharge; in fact, their counter-irritant effect is lost. In this case they should be healed up, and re-applied, and placed not exactly in the same situation as before, but either above or below it, perhaps now a little nearer to the suffering part. Sometimes the disease also appears to remain stationary, without making the least progress towards recovery. In many of these cases I have reason to believe, that this is owing to the affected part becoming so accustomed to the coun-

ter-irritation that it no longer acts as such upon it. Under these circumstances the moxa should be employed instead of the issue, and be repeated as often as the sores made by it have healed. I have observed that this species of counter-irritant is more effectual than the issue, and that when the latter has failed in its operation, the former has succeeded.

Although counter-irritants are generally of the greatest advantage, yet in some cases they will not succeed. They cause so much pain and irritation, attended with fever, that the patient cannot bear them; when this is the case, their employment must be discontinued, and we must trust to the horizontal position, and the attempt to improve the general health.

Some patients can only bear counter-irritants in a moderate degree. Under such circumstances blisters and tartar emetic ointment may be employed: the former of these may be applied on each side of the spine, from an inch to two inches wide and several inches in length; and the latter rubbed along its course. In some cases, no doubt, at least judging from preparations we see, there is a tendency to dis-

ease in a considerable number of the vertebræ and intervertebral substances, besides the disease of the particular part. When there is reason to suspect this to be the case, we must endeavour, if the patient can bear it, to make our counter-irritation on as extensive a surface as possible. In conjunction with the issues, the other parts of the spine may be rubbed occasionally with antimonial ointment, or with a liniment composed of nitro-muriatic acid, ol. olivæ, and ol. Terebinth.; this perhaps will answer the purpose better than the ointment, as it may be employed without producing pustules. This liniment will in three or four minutes produce a determination of blood to the surface, and if continued long, which can hardly be desirable, even small pustules and peeling of the cuticle. It appears reasonable, from the sympathy there exists between the internal and external parts, to suppose that a sudden and frequent determination of blood to the skin would be of great benefit in extensive diseases of the spine, on which account I should strongly recommend its application. My reason for this idea arises from my having observed the effect produced by it when rubbed upon the surface opposite the diseased viscera. Reason-

ing from analogy, I should conceive the same effect would be produced upon the spine. I should advise its daily application, therefore, but taking care never to produce pustules, or to rub off the cuticle.

It has been doubted by some whether counter-irritants are of any service in diseases of the spine. The common principles of surgery, however, independent of all the facts that have been recorded, and which daily illustrate their great utility, at once refute such an opinion. It is true that in some instances they are not attended with advantage, but these may be considered as exceptions to a general rule.

As diseases of the vertebræ and cartilages arise from constitutional causes, such as scrofula, &c. the state of the general health materially influences their favourable or unfavourable termination. During the progress of the disease various symptoms may arise, such as fever, increase of inflammation, lumbar abscess, &c. &c. which must be treated according to the circumstances arising out of them. In the chronic stage, however, when the disease is going on progressively without any



very active symptoms showing themselves, is the time when our endeavours should be employed to improve the general health.

The bowels should be regulated by aperients and alteratives. The patient should eat food of the most mild and nourishing description, taking care never to overload the stomach, so that it may be properly digested. With a view of giving power to this organ also, stomachics and tonics may be administered—such as quinine, columba, bark, &c. and even steel, if the patient is able to bear it.

In the first stages of diseases of the spine, the patients cannot bear being exposed to the open air; they must therefore remain in bed as quiet as possible; but when there is a disposition in the disease to improve, when there is no fever, the pulse is quiet, and the spirits are not depressed, then it may be attended with the greatest advantage to carry them out of doors, in fine weather, in the middle of the day, but upon the same bed or couch, (I should presume the double-inclined plane-bed,) on which they constantly lie, great care being taken that they be wrapped up warm. By some this may be doubted, but my own experience,

both in a near relation, and in others, has proved to me its advantage. In these cases the patients gained strength daily, their appetite increased, and their general health became much improved.

It appears to me that the benefit which might be derived from occasionally breathing the open air, in almost all chronic diseases, is too often overlooked. The cases I am more particularly alluding to, are the diseases of the joints and of the bones. It frequently happens that patients thus affected are doomed to lie in bed, or at least to keep their room, month after month, without the least change of atmosphere. I have very little hesitation in saying, that in many cases, if the patients were carried out daily, when the weather would permit, that they would much sooner recover. It is unnatural to suppose that the general health can be good when the patient is kept closely confined.

As soon as the disease is in a state sufficiently quiescent to admit of the patients' removal, it is advisable that they should be taken to the sea-side, but more particularly if they are of a scrofulous habit. The benefit derived in some cases from breathing a saline atmosphere has been extraor-

dinary. Many persons who could hardly have expected to get well, have recovered by a residence at the sea-side, and more particularly those who have lived in London or large towns. I have witnessed several instances of this, and I am rather inclined to recommend the coast of Sussex, as being one of the warmest.

During the patients' residence at the sea-side, they should be kept as much in the open air, near the sea, as the state of the disease will admit of, care being taken, however, not to expose them to cold winds or to a damp atmosphere ; nor must they go out too early in the morning, or remain too late in the evening. With regard to bathing, I own I do not think it advisable, unless the patient is convalescent, and even then it should not be done without great caution : the body, however, and more particularly the spine, may be sponged over with sea-water, provided it be immediately dried.

As I have said before, symptoms, such as increase of inflammation, fever, violent pain in some one or other organ of the viscera, &c. show themselves occasionally. These must be palliated according to circumstances, and the judgment of the medical

attendant; but however violent they may be, we must bear in mind the cause from which they arise—irritation of the spine, and in females, most probably, hysteria. We must therefore be careful not to deplete too much. When the bladder is paralysed, the urine must be drawn off as often as it is distended, which is generally night and morning. In the female also, the uterine functions are very often considerably deranged: these must be attended to, and those medicines administered which are customary in such cases; for unless the general health improve, the disease, depending chiefly upon it, cannot be expected to amend.

It frequently happens in diseases of the spine that the patients are seized with a difficulty of breathing, a sense of tightness across the stomach, and severe indigestion. These affections are sometimes so distressing that life is rendered beyond any thing miserable; indeed the sufferings of the patients are so great that they are in the constant apprehension of death. In such cases galvanism has been recommended. During the period I was House-Surgeon at St. Bartholomew's, one or two cases came under my observation, where Mr. Earle employed this remedy with the greatest advantage.

Of these, and of one more particularly, a history is given by Mr. Earle in Dr. W. Philip's work on Digestion, which I shall take the liberty to transcribe :—" She complained of very severe cramps at the pit of the stomach, and acute pain in the course of the costal nerves, which was much increased by pressure on the ribs or any attempt at deep inspiration. Her general health was much deranged; her pulse was very rapid, with occasional severe palpitation of the heart, and constant dyspnœa; her digestive powers were greatly impaired; she had no appetite, and could only digest a small portion of stale bread and some milk and water—even this meal was always followed by uneasy sensations at her stomach, and an increase of head-ache, from which she was hardly ever free; her bowels were obstinately costive, and the urine was scanty, and deposited a large quantity of lithate of ammonia." Galvanism was employed in the following manner: " A trough, containing plates of about three inches, were employed. The positive wire was applied to the nape of the neck, the negative a little below the pit of the stomach. No sensation was at first produced by twenty plates; but after the sensation was excited, she could not endure more than twelve. The first sensation she experienced caused her to



take involuntarily a sudden and deep inspiration. The galvanism was applied for about a quarter of an hour, at the end of which time her breathing became much freer than it had been for many months : of this she repeatedly expressed herself perfectly certain, at the same time she felt considerable uneasiness at the stomach : she was slightly hysterical, in consequence of the agitation she had experienced, but her breathing was tranquil during the whole of the evening.”

During the long and tedious progress of a disease of the spine, the unfortunate patient cannot but become wearied by pain, by long confinement, and by the necessity of remaining in one position. The relations and friends should therefore contrive, by every means possible, to amuse the unhappy individual, for much depends upon tranquillity of mind. The bed I have recommended will admit of various pieces of furniture to be attached to it—such as a table, a writing-desk, &c., so that although the patient lies down, yet the arms can be employed. When, therefore, the disease is in a tranquil state, the sufferer may be allowed to work in moderation, to read, to write, to play the guitar, or to pursue any other amusement compatible with the

horizontal position ; and it is astonishing to think how happily the time in this manner may be passed.

When a patient who has had a disease of the spine has become convalescent, great care is still necessary to prevent a relapse. The spine is yet very weak, and the diseased part is generally unable to bear the weight of the body long together without a return of the diseased action. I have seen much mischief occur in several instances, where too much exertion was taken before the parts were sufficiently recovered. A patient as soon as he can walk, is so delighted to escape from the previous confinement he has been subjected to, that he forgets the mischief that has been going on at the spine : he therefore sits up, and goes about in the same manner as he did before the disease occurred. In a short time, however, the pain in the back returns, and the old symptoms begin to shew themselves, till at length he is obliged to take to his bed, and undergo the same treatment as before. I have seen this happen in many instances ; and for these reasons, it is of the utmost importance that he should continue to lie down for at least six or eight hours every day, for some months, after he can walk, and even for a year or two, to relieve

the spine as much as possible by occasional rest\*. The general health also must not be neglected; the bowels must be regulated; the diet attended to, and moderate exercise enjoined.

As the curative process by which the destruction of the bodies of the vertebræ, and that of the intervertebral substances, can only be effected by the ankylosis of the superior with the inferior portion of the spinal column, it may be advisable, perhaps, to assist the diseased parts in anchylosing. Instances have been known, one of which is shown in a preparation in the Museum of St. Bartholomew's, where several bodies of the vertebræ have been destroyed, and where the two diseased extremities have not come in contact with one another, so that a large gap has been left between them unoccupied. This has been attributed by some (and it certainly is a very rational conjecture), to the patient having lain too long in the horizontal position: thus it has been impossible to approximate the two extremities. Whether this really is the cause, or whether it arises from the rings of the vertebræ and their articulations having sufficient strength to bear the

\* There is an admirably constructed chair, invented by Dawes, which would be found of the greatest service to recline upon.

weight they have to sustain, is uncertain. From whatever cause, however, it may arise, it appears to point out the necessity of our assisting the ankylosis of the two separate parts, which can only be effected by gradually allowing the upper part by its own weight to fall upon the lower part of the vertebral column. The best method to accomplish this is, to raise the superior part upon which the body or trunk lies, of the double-inclined plane bed, to rather beyond that angle which would be equidistant between the perpendicular and horizontal line. By this plan the diseased surfaces will be approximated, and at the same time will be kept in a perfect state of quietude ; thus the process will be going on without disturbance ; by which the disease is cured.

After ankylosis has taken place, every means should be resorted to which will assist in restoring the actions of those muscles which have been paralysed ; friction, therefore, both on the spine itself and the paralysed limbs, will be attended by the greatest benefit : this should be actively employed from half an hour to an hour together at least once every day, and it should be continued as long as

the parts remain in any degree paralysed. The exercises of those parts, likewise, is of great importance. At first, the patient is so helpless that he resembles a child that cannot walk ; when he attempts to stand, he finds that he would fall without support, and he is totally incapable of advancing the legs forward as in walking : gradually, however, being supported on crutches, he will gain both confidence and power : he will at first be able to make, with great uncertainty and want of precision, a tremulous and imperfect step forward with one limb, and then with the other, and progressively he will recover their entire use. At this period exercise is of the greatest consequence : the patient should be set tasks to perform ; for instance, he should first stand on one spot, and extend his foot to a particular mark on the floor, with one leg, and then the other, and the distance of this mark should be from the spot where he stands occasionally increased until he can make a proper step. Being able to accomplish a step with both feet, he must next endeavour to make two, and so on.

In some cases the patients are very slow in recovering the lost powers, and sometimes they do not



even quite regain them— either sensation is more or less deficient, or the power of motion is imperfect. In such, galvanism and electricity may be tried, both at the spine and in the affected limbs. I have known great benefit derived from the employment of each of these remedies in cases of this description.

ON THE  
DISTORTIONS OF THE SPINE.

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CHAPTER X.

*Distortions of the Cervical Vertebrae—Cause—Treatment.—The Stoop or Semicircular Curve forwards—Cause—Treatment.—Lateral Curvature—Cause—Its effect on the Trunk and Viscera—Treatment.*

DISTORTIONS of the spine arise from various causes. It is therefore of the utmost importance, as relates to their treatment, that we should form an accurate diagnosis of their origin. Should they be produced from disease of the bones or intervertebral substances, the treatment employed for other deformities of the vertebral column would be highly injurious; and *vice versâ*, should they be the result of rickets, or irregular actions of the muscles, the methods pursued for the relief of diseases of the bones, would also be equally inefficacious. My reason for thus prefacing this chapter is, that much mischief has arisen from their having been classed (not by the medical practitioner, but by the charlatan, who unfortunately has been too much entrusted with these cases, and who must necessarily be ignorant of their nature, from being unac-

quainted with the anatomy of the part,) under one general head, and treated accordingly.

Distortions of the spine are very rarely congenital; there is one specimen, however, in the Museum of St. Thomas's Hospital, where it is bent forwards in an infant who had Spina Bifida.

In all cases of contortion of the spine it may be considered as a general law, that a portion, more or less considerable, of the vertebræ on the concave side of the curvature, is destroyed, either by ulceration, or by absorption from compression. It may also be observed that the curvature takes place more readily in the directions of the natural inflections of the spine. Thus the curvature behind is seen most frequently in the dorsal region, the curvature before in the lumbar region, and the lateral curvature usually inclines to the right side, in consequence, it is said, of the action of the aorta. It does not, however, always happen that they incline to the right side, as there are some cases where the convexity of the curve is to the left; and a few of such specimens are to be seen in the Museum of St. Bartholomew's Hospital.

There are three distinct species of curvature : forwards, or where the convexity is behind ; backwards, or where the convexity is before ; and laterally, or where the convexity is to either side. These are the distinct species of curvature ; but there are others arising from rickets, and the softening and diseases of the bone, which cannot be classed in any regular order.

As I have already spoken of the cause of angular curvature, that is, from caries of the bodies of the vertebræ and intervertebral substances, I shall not for the present make any further observations on that subject. The cause also of contortions of the spine from rickets, and from a general softening of the vertebral column, has already been discussed : for the same reason also I shall now pass over these. The distortions which I have at present to treat of, are those arising from a general weakness of the spine and its appendages, and from bad habits. I shall take them in their regular order—first speaking of distortion of the cervical part ; then the semicircular curve forwards without ulceration of the bones, or hump back ; and, lastly, the lateral curvature.

## DISTORTIONS OF THE CERVICAL VERTEBRÆ.

Distortions of the cervical vertebræ arise from various causes. 1st. From total or partial paralysis of the muscles on one side of the neck, while the opposite muscles remain healthy.

2nd. From the constant habit of holding the head on one side.

3rd. From disorder of the digestive organs; and

4th. From inflammation of the muscles on one side of the neck, by which they become contracted.

Total or partial paralysis of the muscles on one side of the neck is not an infrequent affection, and it usually may be found to have taken place in infancy, after, perhaps, a fit of convulsions. It does not, however, always appear suddenly; it sometimes comes on very gradually, without any apparent cause, when from some reason or other, (most probably from disorder of the digestive organs,) the nervous influence, and with it the strength of the muscles, is lost, by which the balance



of power on one side is destroyed, and the head is pulled to the other by the action of the healthy muscles. Hence the side to which the head inclines is not the one affected, but that opposite.

The total or partial paralysis of the muscles accounts for the various affections of the neck we daily meet with, such as incapability of keeping the head in the erect position, so that it lolls to one or the other side ; involuntary convulsive twitching, &c. &c.

The first of these affections, which usually has its origin in infancy, and it appears probable from the birth, is owing to a complete paralysis of the muscles of the atlas and dentatus, and weakness of the muscles which maintain the head in the erect position ; and thus the head falls upon the shoulder.

The other affections of the cervical vertebræ may be produced from a variety of causes, and one of the chief among them, I have reason to believe, originates from a disordered state of the digestive organs. During infancy it often happens that the stomach and bowels are extremely deranged, at which time both the brain and spine sympa-

thize with them. As an instance of this, we frequently see convulsions produced from irritation of the stomach. Strabismus or squinting also continually originates from a derangement of the alimentary canal, which, when removed, the irregular action of the muscles ceases. If, then, convulsions can be produced, and the powers of the muscles of the eye be affected by a disordered state of the digestive organs, why should not those of the cervical region also? The irritation produced from teething also may be considered to be one of the chief causes of these maladies. Children are continually thrown into convulsions from the pain they suffer from cutting the teeth, when they are seized with one or other of these affections, from which they seldom recover. I have seen several cases of this description, all of which can be traced from childhood. In one instance the individual has lost all power over the motion of the head, which falls on one or other of the shoulders; in another, the muscles which rotate the head are partially paralysed on one side, so that, although the sufferer can bring the head to a fixed point, it is immediately drawn on one side by the opposite muscles, and thus it is kept in constant motion; in a third, there is a constant convulsive

twitching on one side ; and in a fourth, the cervical vertebræ are contorted, as in wry neck.

Independently, however, of paralysis of the muscles, the habit of leaning the head on one side, no doubt tends to throw the cervical vertebræ out of their equilibrium. This habit, like many others, of course brings the muscles of one side more into action than those of the other, by which the neck is gradually contorted.

Sudden inflammation of the muscles on one side of the neck might also cause their contraction, and produce permanent wry neck. Rheumatism would have this effect, and in the advanced periods of life when it shews itself, more particularly so.

Besides these causes, I have reason to believe that the muscles are very often seized with a kind of tetanic affection, by which they become contracted, and remaining so, the cervical vertebræ suffer distortion.

#### TREATMENT.

The treatment of distortions and affections of the neck must depend on the cause. If the muscles are paralysed, so that the head falls upon the shoul-

der, but little good can be done. The only hope is to fix it, if possible, by machinery.

The other affections of the muscles, such as paralysis on one side, and the convulsive twitchings, also will admit of very little relief, and our attempts only torture the patient, as it is impossible to remove the disease.

The distortions, however, of the cervical vertebræ, which arise from contraction of the muscles, may occasionally admit of some relief. Our endeavour should be, as in lateral curvature, to restore the lost power of the muscles, and this will be best effected by bringing them into action. Any exercise, therefore, which will effect this object, should be resorted to. Friction, shampooing, the vapour bath, &c. should be employed on the concave side of the curvature, while, at the same time, every attempt should be made to compel the muscles on the convex side to pull back the displaced vertebræ. To effect the latter object, a very simple plan might be adopted. A weight hanging laterally over the shoulder, on the concave side of the curvature, might be attached by means of a girdle round the head, and made to weigh down that side of the neck, rather beyond even the

distortion, whereby the muscles on the convex side, which naturally act against it, by the endeavour to keep the head in the centre of gravity, and thus in course of time the cervical vertebræ, if not wholly, might be partly brought back into their places. This treatment might be put in force for an hour at a time, or as long as the patient can conveniently bear it, once or twice every day. In some cases, where no other remedy has been of service, the cervical vertebræ might be extended in a particular description of chair made for that purpose, and which has been invented by M. Jalade-Lafond.

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#### THE STOOP, OR SEMICIRCULAR CURVE FORWARDS.

The stoop, or semi-circular curve forwards of the spine, is usually brought on from two causes:—  
1st. From a general weakness of the whole frame, from which reason the muscles which maintain the body in the erect position, lose their power, and thus allow the head and trunk to lean forwards; and, secondly, from bad habits. The first of these two propositions is well illustrated by the growing school-boy. Nothing is more common than to see



a weakly overgrown boy, about fourteen or fifteen years of age, stooping forwards, as if he would fall every step he takes. The poor lad is blamed, both by his parents and school-master, and is laughed at by his companions, for so careless a habit. The fact, however, is, that the muscles of his back are so weak that they have not sufficient strength to support him. In spite, therefore, of all remonstrances, he still stoops, and vexed at constant reproofs, he seeks, by lolling in all directions, to relieve himself, till at length he falls into bad habits, and the deformity becomes confirmed.

The curve of old age is produced much from the same cause as the preceding. From the advanced period of life, the whole frame becomes debilitated : the muscles of the back lose their strength ; they can no longer keep the body in the erect position, and consequently the superincumbent weight overpowers them, and thus the spine is bent forwards. Independently of these causes, however, bad habits often give rise to this deformity. Studious persons, from constantly leaning forward over books, are liable to contract a habit of stooping. Those persons who write much will have, unless they are very careful, the same produced. Ill-made clothes,

particularly those of the female, will induce the wearers to lean their shoulders forwards, by which stooping will be acquired. If, for instance, the shoulder-straps are constantly slipping off, an attempt is continually made to replace them, and thus the shoulders are frequently raised up and brought forward, which, in course of time, will give rise to this deformity. Any employment which requires that the object should be seen closely, will have the same effect; hence the trades of many mechanics can be discovered from this habit; for instance, the watch-maker, the printer, &c. A careless manner of allowing the arms to hang forward often gives rise to this curvature. This may more particularly be observed in girls who are neglected by their parents or governesses. This is the worst description of deformity, for, independently of the bowing forward of the spine, the shoulders are made to project in such a manner that they produce a contraction of the chest. The clavicles become more bent; the acromions project, and their sternal extremities push the sternum inwards, and thus cause what is generally termed a narrow chest, by which the space for the action of the lungs and heart is diminished.

## TREATMENT.

In the treatment of the stoop, or curve forwards of the spine, two grand points should be attended to: the one, an inquiry into the bodily state of health and strength of the individual; the other, the correction of bad habits, and the proper exercise of the muscles of the whole frame. If the health of an individual who stoops, is impaired, all our attempts to correct bad habits will be useless, without at the same time pursuing those means which will give general strength to the whole frame. If, therefore, the subject of this affection should be, for instance, a weakly overgrown boy or girl, those plans should be adopted which will improve the general health. Tonics should be taken; the diet should be generous; drinking in moderation wine and porter; and good air and exercise should be enjoined. In conjunction with these means, care ought to be taken not to put the patient into such a situation as to acquire awkward habits: he is suffering from debility, and consequently to relieve himself from the aching and weariness of the muscles of the back, which are incapable of maintaining long together the body in the erect position, he

lolls about in all directions: he should never sit long at a time without support to his back, and when tired, should rest himself by lying down. It is too frequently the case at schools that both boys and girls are made to sit for hours together on a narrow form, with nothing to lean against: they get wearied beyond measure, and naturally place themselves in such positions for relief, that would tend to produce deformity of the spine. Even when children are perfectly well formed, it would be better to avoid such a system, for it is perfectly unnatural to sit so long in one attitude without support.

When the stoop or curve forwards does not arise from mere weakness, then the correction of bad habits, and the due and equal exercise of the muscles of the whole frame, more particularly those of the back, is of the greatest importance. Whatever idle habit a child may have contracted, the parent should correct it, taking care, at the same time, to remove the cause which gave origin to it. If it arose from leaning forward in writing, or from sitting or standing too long in one position, the employment which produced it should be left off for a time: the child should be allowed to play

about more, and should not be kept long together at any particular employment.

That the moderate and equal exercise of muscles gives them an increase of power, and that their disuse renders them weak, is a fact so well known that it is unnecessary for me to discuss that point here. As examples of this, we have only to look at those mechanics who more particularly employ their arms; as, for instance, the boatman, who is constantly rowing; the sawyer; the blacksmith, &c. In these it may be observed that the muscles of the chest, shoulder, and arms, have become so increased in bulk from continual use, that they are quite Herculean: the same may be usually observed in the sailor, in all parts of the body. From the constant habit of climbing, the bulk, and consequently the power, of the muscles of the whole frame are increased. From these facts it may be deduced, that in the stoop, or curve forwards of the spine, exercise of the muscles of the back will increase their power, by which they will be enabled to maintain the body more completely in the upright position. Various plans have been adopted to bring them into action. When a case of stooping is confirmed, a regular course of the



gymnastic exercise is perhaps the best treatment that can be pursued. These, however, must be employed with great caution, as by their too violent use, in the first instance, much mischief may arise. In simple cases very simple means may be resorted to. One plan I am inclined to think would be attended by the greatest success, and which is, a weight being suspended from the shoulders, and resting on the abdomen. My reason for thinking this is, from having observed in a regiment of soldiers that the one who carries the great drum is invariably the straightest man. If a question were asked, who would be the most upright? the common answer would be, the drill serjeant. This, however, is not the case. The drummer is the man, and the reason of it is this:—the weight of the drum resting upon the abdomen would entirely pull the trunk of the body out of the centre of gravity, and thus he would fall forwards; he therefore is necessarily obliged to bring the muscles of the back into action, to keep the equilibrium, and consequently they become more powerful, and from constant habit the body is kept perfectly erect.

For the reasons just mentioned, it would be a

good plan to make children play at soldiers, and let the one who is disposed to stoop carry the drum in the same manner as the drummer of a regiment. I have little hesitation in saying that the habit would soon be cured. Another very good exercise also would be, to make the individual play the cymbals: he would be forced to extend his arms in the air and look upwards, by which the head and trunk would be thrown backwards, whilst the muscles of the shoulders would be in constant action. To prove the truth of this assertion, and to show the utility of the exercise, we have only to observe the two Blacks who play this instrument in the Rotunda at Vauxhall. It would be almost impossible to point out two men who carry themselves more upright.

Balancing a weight on the head is another plan that has been recommended in distortions of the spine. This acts much in the same manner as the last mentioned plan. The use of the dumb-bells would be found in some cases of great service; for instance, where the shoulders hang forward, by which the chest is narrowed, and the sternum is forced inwards by the clavicles: by their employment the shoulders would be thrown backwards, and

the chest expanded. Other methods, no doubt, might be advised: as a general rule, however, any exercise which will bring the muscles of the back into action will be of great utility in this description of distortion.

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## LATERAL CURVATURE.

Lateral curvature is produced from three general causes. 1st, From a weakness of the spinal column and its appendages, whereby it is unable to support the weight of the head and trunk; 2nd, from the habit of more frequently making use of any particular member of one side than the other; and, 3rdly, from any position of the body which may constantly tend to lean the trunk out of its perpendicular line, and thus throw the spine out of the centre of gravity.

In cases of lateral curvature the spine commonly assumes a serpentine direction, one part of the curve being primary, and the other part secondary; for instance, if a curve takes place in the lumbar region, thus (, there will be in the dorsal region a

consecutive curve, inclining to the opposite side, thus ), generally occupying the upper part of the dorsal, and nearly the whole of the cervical, region. All this is but an effort of nature to maintain the upright position of the body, the head being thus supported opposite to the centre of gravity.

It may be observed that lateral curvature usually occurs in people of weak health; hence delicate-made children, who are growing, are most frequently the subjects of this affection. In such individuals the muscular power of the whole frame is enfeebled, and it is with difficulty the weight of the head and trunk can be supported. The vertebral column itself also is weakened; the texture both of the bone and intervertebral substances is less firm than in health; hence it is unable to sustain the weight it is destined to support, in consequence of which it gives way and bends. For these reasons they seek, by every means in their power, to relieve themselves. They find it both painful and irksome to sit or stand too long in one position: the muscles ache, and become tired; and therefore, from mere uneasiness, they lean to that side which is strongest, and thus they gradually throw the spine out of the centre of gravity, by

which the lateral and consecutive curve is produced.

The immediate causes of lateral curvature arise from bad habits, such as standing on one leg and resting the other; from the improper use of the muscles of only one shoulder; from leaning forward too much on one side, and in a twisted position, as in writing; from the endeavours children often make to ease themselves from the unpleasant sensations produced by ill-made clothes; from lying upon too soft a bed with a high pillow, &c. These are the chief causes of lateral curvature, and many of them may be ascribed to the mode in which children of the present day are educated. Deformities of this description are most frequently seen in girls. A mother or a governess has a particular anxiety that the child, the direction of whose education is under her management, shall have what is termed a good figure. With the view of accomplishing this object, she considers it necessary that she should constantly be in the erect position, and therefore is perpetually teasing her to sit up. The poor child, who has, perhaps, sat for hours on the same stool or form, without the least support to her back, obeys the command; but to relieve herself



from the weariness and aching of the muscles of the back, she leans on one side. This position is not observed, and it at length becomes a fixed habit, the result of which is a lateral curve of the spine in the lumbar region, which in course of time is answered by the consecutive curve.

Another cause of lateral curvature is, the standing on one leg while children repeat their lessons. Weakly boys or girls thus situated, being unable to lean against any thing to support themselves, usually stand upon that leg, and lean to that side, the muscles of which are strongest, and rest the other foot. By this habit the spine is bent on the same side, and thus is thrown out of the centre of gravity, by which it gradually becomes distorted.

The improper use of the muscles of the shoulder is another reason also for distortion of the spine. A girl shall have ill-made clothes ; for instance, one of the shoulder-straps will be constantly slipping off the shoulder. She of course will endeavour to replace it : by this effort she is obliged to elevate the shoulder, and thus she not only brings into action the muscles of that side, but at the same

time inclines the spine to the one that is opposite. The effect of this position must be obvious, for, on the one hand, she increases the power of the muscles on one side, which assist in pulling the spine out of the perpendicular; and, on the other, the centre of gravity is destroyed.

The leaning forward in a twisted position, from a careless habit, while writing, would also tend to distort the spine. The same occurs in this as in the former position; the right shoulder is elevated, while the left is depressed, and the spine is thrown out to the other side in a twisted form. Lying on a soft feather-bed with a high pillow will also distort the spine; affecting it much in the same manner as the last-mentioned cause. The attitude of playing the harp would also have the same effect.

The causes which I have just enumerated, are those which usually give rise to lateral curvature, and these may be observed chiefly to originate from the muscles on one side of the spine being brought into greater action than those of the other. Although I am willing to acknowledge that this is the primary cause, yet I cannot help thinking too little stress is generally laid upon the spine being

thrown out of the centre of gravity. It is certainly true that, in the first instance, it is by the action of the muscles that the spine is bent on one side; but we must recollect that when once the equilibrium of the column is lost, the weight of the trunk falls upon the edges of the vertebræ of that side, whilst those on the other have little or none to sustain. Hence, instead of the weight resting upon the middle of the bodies of the vertebræ and intervertebral substances, the centre of gravity is thrown on their edges, and thus from its preponderance laterally, the spine naturally becomes bent without the muscles having the least control over it.

The state of the muscles of the spine on the concavity of the curvature, also proves what I have just stated to be fact; for they must necessarily be contracted without having any power of action, and thus the lateral movement of the vertebræ, as in other joints that are ankylosed from the same cause, is completely prevented. It would appear, then, when the curvature is completely formed, that the muscles which were first brought into action to pull the spine out of its centre of gravity, become rigid and contracted, while the opponent muscles on the convex side remain stretched.

The manner in which the consecutive curve takes place is obviously owing to an effort of nature to maintain the head and trunk in the upright position; and the way by which this appears to be performed is, that as soon as the primary curve begins to be formed in the lumbar region, the superior portion of the trunk, together with the head, is necessarily thrown out of the centre of gravity. The opponent muscles, therefore, of the other side, and of the superior part of the body, are brought into action by the endeavour the patient makes to keep it in the erect position, and thus by degrees the spine forms a curve in the opposite direction, by which its course becomes serpentine. If, therefore, a line were now drawn from the atlas to the spinous processes of the sacrum, it would be perfectly straight, and the head and trunk would be found in the centre of gravity.

The observations which I have just been making, are chiefly directed to those distortions which originate from that position of the body which gives rise to the primary curve in the lumbar region, such as standing on one leg, leaning the body on one side, &c. The distortions, however, which arise from improper action of the muscles of the shoulder,

are such as form the primary curve in the dorsal region : here the reverse takes place. The lateral muscles of the opposite side, and of the lower part of the trunk, are now brought into action, and thus maintain, by forming a curve in the lumbar region, the centre of gravity.

One of the causes which dispose girls to have a distorted spine, is the manner in which mothers dress them from early age. It is not unnatural for a mother, who sees that her child is beautifully formed, to endeavour to keep it so. With this view, therefore, she puts stiff stays on her, thinking by so doing she will keep the spine straight, and prevent the body from becoming deformed. Instead, however, of accomplishing the object desired, the reverse is produced. The trunk of the body is so compressed and confined that it has no power of movement ; hence the muscles of the spine, and those which keep the body in the erect position, become weakened, from want of use ; they can no longer act against the overwhelming weight of the head and trunk, or prevent the vertebræ from yielding to it. The vertebral column, therefore, gives way, and contortion is the consequence. It is not only the muscles, however, which suffer



from want of use—the ligaments of the spine also are weakened from the same cause ; they have not their natural strength and firmness ; they are more easily stretched than when in health, and as the muscles do from debility, they yield from not having power sufficient to keep the vertebræ firmly bound together.

A very common question for a mother to ask, is “ What is the best plan I can adopt to keep my child from being deformed? Do you not think putting stays on will prevent the spine from becoming crooked?” The answer to such queries can only be one. That they cannot pursue a more injurious method; for by tightly lacing up the body, they not only prevent the muscles from performing their proper functions, and thus dispose the spine to distortion, but they likewise compress the sternum and ribs in such a manner that the cavity of the thorax is diminished, and consequently there is not sufficient room for the healthy action of the lungs and heart. It ought, therefore, to be a general rule with mothers, never to allow their girls to wear stays until they arrive at the age of fourteen or fifteen, when the muscles and bones are nearly developed.

To conclude these observations on the causes of Distortions, I have only to add, that any constrained position will give rise to it. If, therefore, a child be made to stand or sit long together in one attitude without support to the back; be allowed to contract bad habits, such as standing on one leg, or using one shoulder more than another, &c.; be constantly teased to sit up; to wear stiff stays at an early age; or any other contrivance which will prevent the proper action of the muscles of the trunk—such will cause this deformity. It would be advisable, therefore, that such a system should be relinquished, and children be allowed the freest exercise of the muscles of the whole frame.

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THE EFFECT OF LATERAL CURVATURE ON THE TRUNK  
AND THE VISCERA.

The effect of lateral curvature is to shorten the trunk in proportion to the extent of the distortion. The whole side of the chest where the curve is, acquires a rounded form; on the convex side, the intercostal spaces are enlarged, while on the concave side they are diminished, the ribs being far-

ther apart in the former, and closer together in the latter. The chest is flattened; the right shoulder is raised higher (the convexity of the curve being usually on that side) than the left, and appears larger than the other. The right scapula also is more thrust out than the other, and the breast on that side is protuberant. In the lumbar region the loin sinks inward on the right side, while in the left it is round, and the left hip (although this is not really the case, for it arises from the curve of the spine more nearly approaching it) appears higher than the right. The effect on the spinal column itself is to widen the transverse processes on the convex side from one another; to partially raise up, and throw outwards, the articular processes of the superior from the inferior vertebræ; to extend the intervertebral substances and ligaments; to stretch the muscles beyond their natural tension, and to make the spinous processes, instead of following a straight line, to bow outwards. On the concave side the reverse occurs: the transverse processes approach one another nearer together; the inferior articular processes (at least in the lumbar region) press upon the superior inwards; the intervertebral substances are partially or wholly absorbed; the bodies of the vertebræ on that side

are more or less diminished in bulk, according to the extent of the curve; the muscles and ligaments are contracted, and the spinous processes curve inwards.

It is not the walls of the trunk alone, but the viscera likewise, suffer from distortion of the spine. In very extensive and confirmed cases of lateral curvature, those contained in the chest are altered in their relative positions. If the convexity of the curve be on the right side, the cavity of the pleura will be but little diminished in volume; the only difference will be, that the right lung will be thrown outwards, and the curve of the spine will encroach upon it. The cavity of the pleura, on the concave side, however, will be diminished; the ribs will press in upon the lungs and the heart, whereby in the one, the space for its action will be rendered less; and in the other, its function will be deranged. Cases have been recorded where the ribs pressed in upon the heart, and the spine was so twisted that it protruded it forwards, and their surfaces almost touched its apex. The late Mr. Shaw mentions an instance of this description. Palpitation, and many other symptoms of disease of the heart, are consequently produced.

The viscera of the abdomen also suffer a displacement. The aorta follows the course of the spine. The liver is usually more or less compressed, and its relative situation is altered: the intestines have not the same space to perform their functions in; and sometimes it happens that the curve of the spine itself presses upon one or other of the kidneys.

In very bad cases of lateral curvature, the bodies of the vertebræ are so thrown out of their situations that they are, as it were, rotated on the intervertebral substances, and instead of their anterior surfaces looking forwards, they are turned laterally. In some cases, also, the curvature is so great and acute that paralysis is the result. This, however, does not commonly happen.

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#### TREATMENT OF THE LATERAL CURVATURE.

From the observations I have made on the causes of lateral curvature, and the state of the spine when thus distorted, the treatment must of course be employed accordingly.

The muscles and the ligaments on the concave



side of the curve are necessarily contracted, and consequently are rendered incapable of performing their proper functions, whilst those on the convex side are equally stretched beyond their natural tension, by which they also are in a greater or less degree made useless. This state of the parts is precisely analogous to what occurs in the contraction of other joints; the flexor muscles are preternaturally contracted, and the extensors elongated. The spine, however, consisting of many joints, and of a greater complication of parts, suffers more or less in all of them: for instance, on the concave side of the curvature, the bodies of the bones are usually considerably diminished in thickness, in some cases being not half their natural breadth; the intervertebral substances are so compressed that they are partially or totally absorbed; the transverse processes are brought nearer together; the articular joints are thrown out of their situations; and the straight course of the spinous points in the back are inclined to one side or the other. On the contrary, the reverse takes place on the convexity of the curve. The bodies of the bones remain unimpaired; the intervertebral substances are widened; the transverse processes are farther asunder; and the articular surfaces of the superior vertebræ are lifted upwards,

thrown outwards, and partly disjointed. These are the mechanical changes which occur to the spinal column itself, independent of the effect such alterations would have upon the chest, the ribs, &c. &c.

Having pointed out these alterations of structure of the spine, we are naturally led to inquire how such changes are to be obviated, and whether they will admit in all cases of a remedy? This must depend both upon the extent of the curvature, and the length of time it has existed. If it be but newly formed, and is only slight, then much may be done to bring back the vertebræ into their natural situation; but if it has lasted a long time, and the curvature is great, it is very doubtful, as it is more than probable that ankylosis has taken place, when it would be highly injudicious to tear the adhesion asunder. Besides which, also, so much mischief must necessarily have been already done to the bones, or intervertebral substances, that it would be impossible, and, even if it could be done, imprudent, to restore them. Before, therefore, an attempt be made to treat a distortion of the spine, it will be necessary to institute these inquiries.

In the treatment of distortions of the spine which are unconnected with rickets and the softening of bone, our attention should be directed to the state of the muscles and ligaments. As I have just stated, those on the concave side, immediately connected with the spine, are contracted, whilst those on the convex side are elongated ; and thus both are rendered incapable of a proper action : we ought, therefore, to employ those means which will restore the healthy functions of these parts, and this ONLY can be done by bringing them into action. The late Mr. Shaw, in his valuable work on this subject, has most ably pointed out the necessity of the proper exercise of a part for the due performance of its healthy functions ; and he has shown that by the disuse of the muscles and ligaments, they become wasted and powerless. Daily experience proves this fact to be correct ; for instance, we see in diseases of the hip-joint the muscles of the leg wasted and flaccid from want of use, and in fractures, and various other diseases, the same effect produced.

Before, however, I proceed to treat of the remedies calculated to produce the above effect, I feel it necessary to state that we must bear in mind,

that there are very few cases of distortion which do not arise either from weakness of the vertebral column itself, or from weakness of the muscles destined to maintain it in the erect position ; that is to say, in the former the spine yields under the weight it has to sustain ; and in the latter, from weariness and aching of the muscles, the patient falls into the habit of leaning to one side or the other for relief, and thus throws the spine out of the centre of gravity. Attention, therefore, to the general health of the patient, is of the utmost importance ; for as long as the frame is in a debilitated state, we can expect but little benefit from any auxiliary means we may employ to restore it to its natural form. The food should be of the most nourishing quality, avoiding any thing, such as pastry, &c. which may disorder the stomach ; the meals should be taken, three in a day, at stated periods, equi-distant from one another, and the bowels should be regulated. The patient should be enjoined to be as much in the air as his strength and the state of the disease will admit of, and tonics may in many cases be administered with advantage.

According to the pathology of lateral curvature, the treatment must chiefly consist in restoring the

muscles and ligaments of the spine to their proper functions, which can only be done by bringing them into use. For this purpose various means have been recommended, and the methods which have been employed are certain exercises by which they are immediately brought into action. Before, however, we proceed to adopt these measures, we must inquire into the cause of this distortion. If it arises from weakness of the spine alone, our chief care should be to relieve it of the weight it has to sustain, which can only be done by lying down. In such a case, however, it would be highly injudicious to confine the patient entirely to the horizontal position, as then the health would suffer, and the muscles, from want of use, would become debilitated, and incapable of supporting the body, by which the very thing we wish to avoid would be accomplished. It would be advisable, therefore, that moderate exercise should be taken, as much as the patient is able to bear, but the greatest part of the day should be spent in lying on the inclined plane, or using such exercises as are compatible with the horizontal position, and which would tend to restore the spine to its normal form.

When lateral curvature originates from bad



habits, such as standing upon one leg ; the constant lifting up of one shoulder more than the other, &c., they should be corrected. Before we proceed to the treatment, it is of importance to find out which of these habits gave origin to the deformity, as our means must be directed accordingly ; for upon this depends where the primary curve first occurred.

If a child has been habituated to stand on one leg, the primary curve would of course begin in the lumbar region ; but if, on the contrary, it has used the one shoulder more than the other, for instance, to relieve itself from the shoulder-strap which is constantly slipping off, then, if I mistake not, the primary curve is first established in the dorsal and cervical region. It appears to me, therefore, of consequence to know its origin, as the means we should employ when the primary curve begins in the lumbar region would not be exactly the same as that in the dorsal.

If it is observed that a child stands on one leg, and inclines to one side, while repeating its lesson, it is a clear proof that the muscles which are destined to keep the body erect, are wearied, and that they are too weak to perform their office. Under

these circumstances, it will not be sufficient to correct the child, and make it stand on both feet equally—we must prevent the tendency to such a habit, by not placing it in such a situation as to acquire it. The child should be allowed to sit in a chair with a back to it to lean against, by which it will be supported, or to lie down. If, also, it is observed that a child, who is accustomed to sit upon a stool, falls into the same habit, the same simple means must be employed. We may be assured that it suffers uneasiness or pain, or it would not resort to such means to relieve itself.

It frequently happens that the habits just alluded to become confirmed, and that the spine has already suffered more or less distortion before we discover it. In such a case, the most simple means of remedying the evil is to make the little patient use the limb on the opposite side; for instance, if the mischief has arisen from standing on one leg, the more the other is used the better, and the best method of gaining this, is to introduce such games for the amusement of children as will effect this object. The favourite game called hop-sotch, is one well adapted for this purpose. Should the habit have been standing on the right leg, which

is most frequently the case, then the parent should encourage the child in this game to hop on the left, or *vice versâ*.

Another simple and admirable plan of exercising the spine, from whatever habit the curvature arises, is, that the child should stand laterally on a semi-circular piece of wood made with boards, like the bottom of a rocking-horse, only much higher, so as to allow of a rope being attached on each side to its upper extremity. He should stand with his feet from half a yard to a yard asunder upon this machine, and take hold of the rope with each hand, and thus rock himself backwards and forwards. It will be seen by this movement, that not only the muscles belonging to the lumbar region, but those also of the dorsal, will be brought into action. Hence they will act laterally both on the primary and secondary curve.

The curvature, from the habit of using the muscles of the shoulder on one side more than the other, will be best counteracted by exercising those of the opposite side. If, from the endeavour a child may make to relieve itself by constantly elevating the shoulder, from the irksome sen-

sation of the shoulder-strap slipping off, the right arm has been most raised, then those games should be played which will bring into action the muscles of the left: for example, the game of battledore and shuttlecock may be played with the left hand, and, in short, any exercise that will bring into use the left shoulder. To relate all the exercises that may be taken in this way would be useless. When the principle is once understood, common sense will at once point them out.

The above are some of the plans by which slight distortions of the spine may be relieved; but there are others which it will be necessary to undergo if these fail, or that the curvature is so serious and confirmed that simple means will not accomplish the desired object: these are the gymnastic exercises, which consist of various movements of the body, well adapted to bring into action the muscles of the spine. I shall, however, but briefly notice them, as there are works published expressly on this subject.

The manœuvres which are most calculated to bring into action the muscles of the spine, are the

climbing ropes or poles in various slopes, inclining from the perpendicular to the horizontal lines; the hanging by the hands from a see-saw or balance while in motion; the scaling different sorts of gymnastic ladders in a variety of attitudes, &c. &c. A regular course of these exercises, as the cases demand, and which can only be judged of by the description of distortion, and the peculiarities attending it, will frequently be attended with the greatest benefit, but at the same time they must be employed with the greatest caution and judgment.

Besides the gymnastic exercises, other plans have been recommended for the purpose of making the muscles restore the spine to its normal form. One of these is the carrying a weight on the head; the object of this is to bring into action the muscles of the back and back part of the neck, whereby the body is maintained in the erect position. As Mr. Shaw\* very justly observes, the benefit derived from this treatment arises from the difficulty of balancing the weight, and not from its gravity: it ought, therefore, to be light, as a very ponderous

\* Shaw on Distortions.



substance would make the lumbar vertebræ bend inwards.

The arguments that have been brought forward in favour of this treatment are, that those people who carry weights on their head, particularly milkmaids, are usually more erect than others. This is certainly true ; but we must recollect, even before they pursue such an occupation, they had most probably no distortion of the spine. It appears to me, therefore, that from the muscles which are brought into action, this method might be of the greatest service in an habitual stoop, and may be a preventive against distortion ; but that in lateral curvature, where the spine is contorted from side to side, it would be attended by but little advantage.

With the same view as the above, and at the same time to correct habits which lead to lateral curvature, the late Mr. Shaw invented a machine to which a weight was attached, to be fixed by a riband to the head, while the patient was sitting ; in which case each movement, made either forwards or laterally, would occasion the weight to fall ; on which account the patient is obliged to exert him-

self to keep it up. By these means the muscles of the back are constantly called into action.

It appears to me of great importance in all cases of lateral curvature, that the spine should be exercised laterally. It was from side to side the curve first commenced, and consequently, to bring it back again to its natural state, that set of muscles ought to be more particularly acted upon which would effect this object. The muscles and ligaments on the side of the spine, not on the back alone, are those which have lost their proper functions: to restore these, therefore, should be our chief object. It also appears to me of great consequence that the exercises employed should be performed in the horizontal position, by which two objects would be attained; the weight of the head and trunk will be taken off from the spine, while the functions of the muscles and ligaments will be gradually restored.

For the purpose of exercising the spine laterally, and in the horizontal position, a particular description of bed or couch might be devised. It might be so constructed that it should divide into three parts; one of which should be fixed, while the other two

should be moveable on wheels from side to side. The buttocks being made steady to the fixed part, the other two moveable parts would of course correspond with the trunk ; the one to the lumbar region of the spine, and the other to the dorsal ; and thus both the primary and secondary curve would be acted on laterally. The patient might exercise himself by having a rope fastened on each side of him in the wall or to any fixed point, whereby he would be enabled to pull himself from side to side, and thus first act on the primary, and then on the secondary curve.

The late Mr. Shaw invented an admirable apparatus, for the purpose of exercising the various sets of muscles of the back. It is too complicated for me to give a description of it here, but the principle on which it is founded, is to make the patient, by ropes and pulleys attached to the head, draw up weights in various ways, and thus to exercise the muscles of the back. The plan recommended appears to me highly advantageous in restoring the lost functions of the muscles of the back ; but I am inclined to think it does not bring them into action sufficiently laterally, consequently, although it is a most valuable adjunct in the treatment

of lateral curvature, yet it is not quite calculated to restore the vertebræ to their natural situations, and bring back the spine to its normal form.

In conjunction with the measures already proposed, friction on the spine itself will materially assist in the restoration of the affected muscles and ligaments: rubbing it, therefore, and more particularly on the concave side of the curve, with stimulating liniments, such as *ol. camphoræ*, *linimentum ammoniæ fortius*, *oleum cajeputi*, &c. will be found beneficial. Shampooing the part would tend very much to render the muscles and ligaments more pliant: for this purpose, also, a roller with a handle to it, and with round prominences on its circumference, has been invented. This instrument should be employed along the course, and on each side, of the spine, letting the friction be as sharp as the patient can bear it. Vapour baths would be useful in relaxing the contracted muscles and ligaments, and they might be so contrived as to direct the steam more particularly to the concave side of the body; thus not only the contracted muscles of the spine, but those of the ribs and side also, might be benefited.

In the more advanced stages of lateral curvature, where the bendings or inflexions are so great that the spine is completely thrown out of the centre of gravity, the mere action of the muscles will not be sufficient to restore it to its natural form. The weight, therefore, of the head and trunk must now be entirely taken off the spine, and this can only be accomplished in two ways,—by machinery for that purpose, and the horizontal position.

The first of these remedies, machinery, is very seldom advisable; for although it assists in taking the weight off the spine, yet it totally prevents the action of the muscles: hence patients who have been treated according to Mr. Chesire's plan, become so accustomed to the support that they cannot well do without it, and should the machine be left off, the spine is usually so firmly set that it will hardly admit of any motion, in consequence of which the natural movements of the vertebral column cannot be performed. In some cases, however, where the health suffers from confinement, and the spine is much distorted, machinery must be used, and that which is best adapted to this description of the distortion should be employed.



In addition to the means I have already recommended, and in conjunction with them, I am convinced that cautiously stretching the spine, in some cases, would be found of the greatest advantage. It stands to reason, when the spine is completely thrown out of the centre of gravity, and the curvature is great, that the exercise of the muscles and ligaments will not alone be sufficient to bring it back to its proper form: they are so contracted on one side of the curve, and so elongated and pressed upon by the vertebræ on the other, that their function is almost entirely lost. In this weakened state it is not likely they can be made to act. Stretching the spine, therefore, will effect two objects—the one, the restoring the vertebræ to their places; the other, the bringing back the muscles and ligaments to their natural situations, by which they may be enabled to recover their lost power.

The benefit derived from stretching the spine has been more particularly shown by Delpech, by Jalade-Lafond, and others. In proof of its beneficial effects, they have brought forward several cases, of which drawings have been made, both before and after the treatment, where this plan has been employed. In many instances the distortion has

been immense, and yet if the spine has not been wholly, it has been nearly, restored to the natural form. The methods they have adopted are two,— a particular kind of machine to be used as a chair, and another as a bed. The patients sit in the former of these, being firmly fixed by a belt strapped round the body above the hips to the seat, and being gradually drawn up by pulleys and other machinery attached to the neck and beneath the axillæ on each side ; and in the latter they lie on the back, being fixed much in the same manner, only in the horizontal position, and by ropes and pulleys are thus extended. The last of these two machines is the best, because it has not to act against the weight of the head and trunk.

The plans which have been related in the preceding pages appear to me the best that can be adopted for the cure of lateral curvature. During the treatment, however, when the exercises recommended are not being pursued, it would be better, perhaps, if the patient reclined. The subject of the disease is usually weak, and the spine being once thrown out of the perpendicular line, the distortion would be liable to increase, unless the

weight it has to sustain were taken off. It would be advisable, therefore, that the horizontal position be enjoined as much as possible, without injury to the general health.

It has been customary in schools and school-rooms, that young ladies who are weakly, and disposed to a distortion, should lie down for hours together on an inclined plane, made of hard board. Now, in my opinion, this is about the worst description of machine that could have been invented; for in the first place, it must be perfect torture to the individual who is doomed to recline upon it; and, in the second, it is not at all adapted to the purpose for which it was intended. The pressure of the spinous points and the projecting parts of the back against the hard board, must of course be painful, and, at the same time, the spine itself is not equally supported; for, from the unyielding nature of the board, only a part of it can rest upon it—the back of the head, the most projecting spinous points of the dorsal vertebræ, and the sacrum: hence the cervical vertebræ, both the upper and lower of the dorsal, and the whole of the lumbar, receive no support at all. The couch or

sofa, best adapted for the patient to recline upon, should be perfectly flat, and thus the whole weight of the body will be taken from off the spine: it should have a cushion upon it of an equal surface, made with horse-hair or wool, firm and elastic, yielding to the natural incurvations of the spine, and yet of such a consistence as to support the back.

ON  
THE DISEASES OF THE MEDULLA  
AND ITS MEMBRANES.

CHAPTER XI.

*Arachnitis Spinalis—Symptoms—Treatment—Morbid Appearances—Cases.—Dropsy of the Medulla, or Hydrorachitis—Symptoms—Treatment—Case.—Blood effused between the Membranes—Cartilaginous Specks on the Arachnoid Membrane, and Tumors formed between them.*

It is so very seldom that the Medulla Spinalis and its membranes are examined after death in this country, and so little are the diseases which affect these organs understood, that it is with great difficulty one individual can obtain facts sufficient to describe all their symptoms, and to illustrate the morbid changes these parts undergo, when affected by disease.

The diseases of the contents of the spinal canal may be divided into two classes—those which affect the membranes, and those which affect the medulla itself. I shall first speak of those of the membranes. They are liable to inflammation; to dropsy, or hydrorachitis; to extravasations of blood between



them ; to have cartilaginous depositions formed upon them ; and to the formation of tubercles in their structure.

All the membranes of the spine are liable to inflammation, which may arise idiopathically, or from injury. The arachnoid is the one most frequently attacked by it, and when thus affected, it is called, by some writers,

#### ARACHNITIS SPINALIS.

The cause of Arachnitis is very obscure. Sometimes it comes on very gradually, while at others, suddenly. The symptoms which denote it are the following :—The patient at first commonly finds himself generally unwell, without being able to describe any particular symptom, excepting that he has not the same power over his limbs as usual. At length he has pain in the back, in one particular part, or along the whole course of the spine. Contraction of the muscles of the back ensues, which varies from simple muscular rigidity to violent spasm, affecting one particular part, according as the disease is situated on its whole extent. Accompanied with these symptoms, there may be disury, retention of urine, and complete constipa-

tion. As the disease advances, the pain along the spine increases; the muscles become violently spasmed; there is difficulty of deglutition and respiration; convulsions of the whole frame; trismus; at length opisthotonos, and all the symptoms accompanying tetanus.

The symptoms of arachnitis are not always equally acute. M. Ollivier\* remarks, that sometimes the patients only have pain and rigidity along the course of the spine, and are even enabled to walk or to turn themselves in bed almost until death. Neither are the symptoms in every instance equally violent at all times; like tetanus, there are paroxysms arising spontaneously, without being produced by an attempt to move any of the limbs: at other times also the rigidity remains fixed until dissolution. The circulation at first does not appear to be much affected by the disease; the pulse remains in a natural state: the same may be remarked in some cases of severe injuries of the spine; there is hardly any perceptible change until the last moments of the patient. In arachnitis, however, after a time it increases in the rapidity of its beat; it becomes quick, irritable, and feeble, but

\* Opt. Cit.

irregularity seldom or ever occurs : the tongue at first is slightly furred ; as the disease advances, however, it becomes coated with a dark brown fur ; it then is dry and rough, and lastly aphthous. At this period the patient usually complains of extreme thirst, with a burning sensation in the throat, and difficulty of swallowing.

In true arachnitis, there is never paralysis of any of the limbs, or loss of sensibility in them. It often happens, however, that one or both of these symptoms occurs at the same time : when such is the case, the spinal cord itself is affected, being either inflamed or softened in its structure. It is seldom found also, after the death of a patient suffering from this disease, that the arachnoid membrane is alone inflamed ; the pia mater is frequently affected, as well as the dura mater. The corresponding membranes of the brain also are continually inflamed, giving rise to those symptoms which usually occur in such affections of this organ.

From the symptoms which take place in arachnitis spinalis, it may be observed that they very much resemble those of tetanus. The morbid appearances of the spine, also, are much the same in both, as I shall, when speaking on that subject,

presently show. I am inclined to think, therefore, the disease we term idiopathic, tetanus, and arachnitis, are synonymous. The only difference, if there be any, is, that arachnitis may begin in any portion of the spine, while tetanus usually makes its first appearance in the medulla oblongata; thus producing trismus, then the contraction of the muscles of the neck, and at length, opisthotonos.

#### TREATMENT.

If the patient in arachnitis be plethoric, the pulse full and strong, blood should be taken from the arm until syncope takes place: indeed I am inclined to think venesection should be employed in the first instance, in all cases, until this effect is produced; for if the vessels of so delicate a structure be completely emptied before they have lost their power of contractility, it is possible they may contract, and thus prevent the return of blood into them. In addition to general bleeding, blood should be repeatedly abstracted, by cupping from each side of the spine, along its whole course: counter-irritants also should be applied on each side of the spine in the same manner, and those which will affect this object the quickest, are the best.

It is of the greatest importance in this disease that the bowels be kept freely open. At first it would be advisable, perhaps, to give an active purgative, such as calomel and jalap, croton oil, &c. ; but to produce an equal action, the best plan that can be adopted is that recommended by Mr. Abernethy—small and repeated doses of aperient medicines at stated intervals. I have seen several cases of tetanus, which were under his care, recover from this mode of treatment. He used to prescribe half a grain of calomel and six of jalap, to be taken every three or four hours. This combination usually produced three or four motions every day, with the most beneficial effect. Should not these succeed, then saline medicines might be given in the same manner, and should small doses be found ineffectual, more active means might on this principle be resorted to.

When we consider the intimate connexion of the spinal nerves with the sympathetic, which supplies the intestines, we cannot be surprised that purgative medicines should be beneficial. The carrying away any irritating matter lodged in the alimentary canal, must necessarily, through this channel, relieve the spinal cord.



In proof of the advantage of purgative medicines, I recollect a case of tetanus, where they were employed in the first instance with the greatest benefit, and the patient bid fair to recover. A difference of opinion arose among the medical attendants, as to the treatment: opiates alone were administered, from which period the bowels were confined; the patient became worse, and died.

One of the symptoms of both arachnitis and tetanus is violent paroxysms of spasm; so violent that sometimes it is necessary that the patient should be held by three or four individuals. In such cases I have employed the extract of belladonna, rubbed along the whole course, and on each side, of the spine, with the greatest advantage. The spasm, as soon as the belladonna acts, ceases, and does not return while the patient is kept under its influence—at least, in two cases in which I made use of it, it did not. In the one, the patient was seized with traumatic tetanus, and there was trismus and opisthotonos, accompanied with such severe spasm of the whole trunk and limbs that four persons employed for that purpose could not hold the patient in bed. The extract of belladonna was rubbed along the whole course of the spine on

each side, and in half an hour afterwards the spasm entirely ceased ; the patient could open the mouth, which before was firmly closed, so as to admit the forefinger between the teeth, and the opisthotonos was greatly relieved. The belladonna was washed off, and fresh was re-applied every three or four hours, and for seventeen hours the patient was perfectly tranquil. It unfortunately happened, however, that from the large quantity necessary to be used the supply of it failed about two or three o'clock in the morning, and before any more of it could be procured, five or six hours having elapsed, the patient was seized with another paroxysm, in which she died. In the other case, which was one of hydrophobia, occurring at St. Bartholomew's Hospital, during the time I was House-Surgeon there, where there was violent spasm of the trunk without confirmed opisthotonos, the application of belladonna, in the same manner as in the foregoing case, almost immediately relieved them, and the unfortunate patient died without pain. In speaking of this remedy, I only offer it as an auxiliary to the other means recommended.

In very severe cases, and where the pain and spasm are very great, opiates may be administered,

but it would be better to avoid them if possible, as they confine the bowels : occasionally, however, the sufferings of the patient are so great that we are obliged to resort to them. Ice applied upon the spine, and cold affusions, have been recommended : I am very doubtful, however, as to the utility of such a treatment.

As the prognosis of this disease is so very unfavourable, I am disposed to think, from the morbid appearances presented after death, that a very quick salivation of the patient might be attended with benefit. A coating of lymph is usually found on the arachnoid membrane, and serum effused in the canal. Mercury, as in iritis, might produce the absorption of this matter, and alter the action of so delicate a structure. Three or four grains of calomel might be given every three hours, and the strong mercurial ointment rubbed in night and morning, pursuing at the same time the remedies already recommended.

#### MORBID APPEARANCES.

The morbid appearances which may be observed

in inflammation of the arachnoid membrane of the spine, are that it is unusually reddened and injected with blood : sometimes it is rendered opaque, and thickened, and upon its surface there is deposited a coating of lymph of a whitish yellow colour, and of a tough consistence. There is generally more or less fluid found between it and the pia mater than natural, which is often of a milky colour, having pus floating in it. Blood sometimes is effused between all the membranes, or between it and the pia mater, and the latter is often inflamed. The medulla itself, likewise, is frequently in a state of congestion.

The appearances just described are variable : sometimes the arachnoid membrane may be observed to be inflamed only in portions of it, with these depositions upon it ; while at others, its whole extent, with the corresponding membranes of the brain, may be affected in the same manner.

The resemblance of arachnitis spinalis, and tetanus, may be seen by the symptoms and dissection of the following cases of the latter disease, by a comparison with two cases of true arachnitis, which I shall presently relate.

## CASE I.

Nov. 18, 1822.—Thomas Billings, æt. 25, was admitted into St. Bartholomew's Hospital, with a compound fracture of the second phalanx of the ring-finger, which had been produced by its having been squeezed in a door. The wound was in a sloughing state.

Eight days after the accident he was seized with trismus, his teeth being firmly clenched; he had rigidity and tension of the muscles of the neck and back, with slight curvature of the trunk backwards; the affected muscles were also slightly spasmed; he complained of great difficulty to expectorate, which was the more distressing, as there was a great secretion of mucus from the trachea and lungs; his bowels were very costive, not having had a stool for four days. Pulse 110, full, hard, and incompressible; tongue coated with a brown fur; breath fœtid; urine natural; skin hot and dry: he was bled to sixteen ounces; ordered one grain of calomel and eight of jalap every three hours, and an injection, containing four drachms of oil of turpentine, and half a pint of gruel. On the



following day his bowels had been copiously evacuated, and he appeared to experience some relief. In the evening, however, paroxysms of violent spasm came on, in one of which he died.

*Sectio Cadaveris.*—The theca vertebralis was greatly distended with a greenish fluid. The arachnoid membrane and pia mater were highly reddened, and upon the surface of the former was found, here and there, extensive patches of coagulated lymph. The vessels of the medulla were extremely turgid, and a redness pervaded its substance, not natural to this organ.

#### TETANUS FROM BURN\*.

#### CASE II.

John G——, æt. 14, was burnt on the buttocks, upper part of both thighs, and penis and scrotum, by his clothes taking fire, while attending a brick-kiln, on the 28th April, 1826: the injury was so severe as to produce the death of the integuments, far beneath the skin, over the greater part of that surface. Considerable coldness and col-

\* This case occurred in the practice of my friend, Mr. T. Brayne, of Banbury.

lapse took place immediately after the accident, from the immediately fatal effects of which he was rescued by warmth, brandy, and a large dose of opium : sufficient purgatives were administered as soon as might be ; at first saturnine lotion, warm, and afterwards turpentine liniment, were applied to the wounds. He did not complain of extraordinary pain for some days, nor was there much excitement : a good degree of suppurative action, and some granulations, arose, and the discharge was copious and healthy.

On the evening of the 6th of May he complained of some difficulty of swallowing, and considerable tightness and spasmodic contractions of the muscles of the left side of the neck ; he was able to swallow then nearly as much as usual. Pulse 80 ; bowels open ; tongue foul and rather dry ; pain of wounds kept him from sleeping last night : a large number of leeches were applied to the spine of the neck and upper part of the back ; large doses of calomel, and calomel with opium two grains, at bedtime.

On the 7th, after a tolerable night, the muscular contractions increased, and the head was for-

cibly drawn backwards, and to one side. Pulse 100; tenderness of epigastrium, from contraction of diaphragm.

On the 8th, every thing worse. Pulse 120; more rigidity of muscles; jaws closed; repeated leeches and cupping on the spine, and calomel and opium were persisted in. In the evening, the respiration had become affected. Pulse 160-80, with occasional spasms of the long muscles of the spine, producing a degree of opisthotonos. Died at eleven p. m.

*Sectio Cadaveris, twelve hours after death.*— External veins about the spine, particularly cervical and dorsal portions, excessively loaded with blood, though the body had been for some hours on the face; dura mater of the cord of darker purple hue throughout than natural, with a vivid red blush in patches here and there; arachnoid membrane of cervical and upper dorsal part exceedingly vascular, so much so as to be quite red in places, and between these the vessels were numerous, long, large, and tortuous: no change could be perceived in the pia mater; but there was an effusion of serum between it and the arachnoid membrane.

On dividing the substance of the cord itself, the medullary matter seemed darker than usual, and the transverse sections exhibited numerous bloody points, from the division of the turgid vessels which had pervaded it.

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Besides these cases of tetanus, I have seen others where the morbid appearances were much the same. The resemblance of the two diseases will be exemplified by the two following cases of true arachnitis spinalis.

#### CASE I.

A man was admitted into St. Mary-le-Bone Infirmary, who gave the following history of himself:—Two days previously he had been lying on his back on the damp grass, while the sun at the same time was extremely hot. In the evening of that day he felt himself very unwell, and went to bed early. On the following morning, he found the muscles of the back, and on the posterior part of the neck, very stiff. The symptoms gradually increased until the day he was admitted into the Infirmary, when he was in the following state:—He had pain along the whole course of the spine;

his pulse was about 100, rather full and hard ; the skin hot and dry ; the tongue coated with a brown fur ; he felt great thirst, and his bowels were constive : the muscles of the back and neck were rigid, and the whole spine was fixedly curved backwards. He was bled to syncope, and ordered five grains of calomel and twelve of jalap, to be taken immediately. In the evening trismus came on, and he was seized with paroxysms of spasm : these continued all night, and on the following day he died.

*Sectio Cadaveris.*—On opening the spinal canal, it was found that the arachnoid membrane was in some places reddened, and in others opaque ; there was a deposition of lymph of a tough consistence, and a yellowish colour, on its whole surface, and in the centre of the dorsal region, about three inches in extent, blood, which was dark-coloured and coagulated, was effused ; the whole canal between the arachnoid membrane and pia mater was filled with serum, opaque and of a reddish hue, having been tinged by the extravasated blood : nothing remarkable was observed in the viscera, or any other part of the body.



## CASE II.

November, 1826.—J. D. æt. 33, a middle-sized man, rather disposed to plethora, was admitted into St. Bartholomew's Hospital, with the following symptoms:—He felt extreme pain in the loins; the muscles of the back were extremely stiff and rigid, and there was opisthotonos. At first, he found an incapability of moving with facility his lower limbs, and at length he became perfectly paralysed in both powers in the right leg: he complained of head-ache and drowsiness; his pulse was extremely quick and feeble; the skin hot and dry; the tongue aphthous, and he suffered from extreme thirst. As these symptoms had existed for some days, and as the powers of life appeared to be nearly exhausted, he was merely ordered a mild aperient, and afterwards an opiate. He died on the next day after his admission into the Hospital.

*Sectio Cadaveris.*—The arachnoid membrane of the brain was very vascular, and on parts of it there were considerable-sized spots of coagulable lymph. The arachnoid membrane of the spine presented the same appearance, with here and there

large flakes of lymph deposited on it ; and there was a great quantity of fluid in the theca vertebralis. The mucous surface of the intestinal canal was ulcerated nearly throughout its whole extent, and it contained a considerable quantity of black stuff, the colour and consistence of pitch.

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DROPSY OF THE MEDULLA SPINALIS, OR HYDRORACHITIS.

The term Hydrorachitis has been usually applied to Spina Bifida. The disease I am now going to speak of, although implying the same, and arising from an accumulation of water in the spinal canal, yet from the slow manner in which it is collected, its occurring in the adult, and being unconnected with a congenital malformation, cannot be considered of exactly the same character.

Dropsy of the Medulla Spinalis arises from a secretion of fluid from the arachnoid membrane, which gradually collects until it fills the whole canal. The disease is usually of a very chronic nature, and it may take months, and even years, before there is a sufficient quantity of fluid col-

lected to destroy the patient. From the symptoms it would appear that it gradually accumulates, first being lodged from its gravity in the lower part of the canal, then higher and higher, until it arrives as high as the brain. The cause of this affection is buried in great obscurity; the arachnoid membrane may take on this action spontaneously, or after an illness, such as a rheumatic attack of the joints, &c.

The symptoms which denote dropsy of the spine are, that the patient first finds that the locomotive powers are not as active as natural. This inability to walk increases slowly; months may elapse before there is any perceptible change: at length there is a gradual and partial loss of feeling in the lower limbs, as well as loss of motion. Both the rectum and bladder become enfeebled; the one not being able to retain the fæces, the other being unable to expel its contents. These symptoms increase to perfect paralysis, and by degrees the upper part of the body—the trunk and arms—become affected in the same manner.

In the first part of the disease the general health does not appear to suffer much; as it increases,

however, the whole body is enfeebled. Cramps frequently occur in the lower extremities; respiration becomes difficult; and the diaphragm is spasmed. The arachnoid membrane of the brain takes on the same action; the stomach sympathises with the cerebral irritation, by which it cannot retain the food, and thus sickness is produced. The patient lingers on in this distressing state for some time, and at length dies.

#### TREATMENT.

In a disease coming on so insidiously, so deeply seated, and in so delicate a structure, it is extremely difficult to offer any satisfactory mode of treatment. The remedies employed in dropsy of any other part of the body, will be of little service here, as it is a local affection. All we can trust to, therefore, is, attention to the general health, the regulation of the bowels and digestive functions, and repeated counter-irritants applied on each side of the spine. As our means are limited, and the disease is almost hopeless, it might be as well, perhaps, to give mercury so as slightly to affect the mouth, by which the action of the arachnoid might possibly be altered, and the fluid absorbed. I shall now relate

a case which I saw myself in St. Bartholomew's, and for the notes of which I am indebted to my friend Mr. Wood, the late House-Surgeon of that Hospital.

### CASE.

Rahere, Sept. 30, 1830.—Thomas Cox, light-porter, ætat. 23.—Paraplegia, with retention of urine, and involuntary evacuation of the fæces.

This patient, who is of moderate strength and stature, has usually enjoyed good health, with the exception of occasional head-aches, which have troubled him from childhood. He has been accustomed to indulge pretty freely in liquors; but since his marriage, which took place a twelvemonth back, he has not, on an average, got drunk more than once a week. For three or four weeks previous to admission, he experienced uneasy sensations in the lower part of the belly, and a numbness of the thighs, accompanied with swelling of the right testicle. On Saturday evening, Sept. 25, he walked to the hospital to have his water drawn off, having never found any difficulty in passing it before. He afterwards walked home, a distance of half a



mile, without difficulty, though he did not feel altogether firm upon his legs. He slept that night as well as usual, and found to his surprise, on Sunday morning, that there was complete loss of motion, and partial loss of sensibility of the lower limbs, with inability to make water. The fæces came away involuntarily in the course of the day; and the paralyzed limbs were occasionally affected with spasms, of which he was conscious. He was not feverish, and had neither head-ache nor other pains. On Monday he was cupped on the back by order of a Dispensary-Surgeon, who supplied him with medicines, and drew off his water till Thursday, when he was received into the Hospital, having derived no relief from the treatment.

Sept. 30th —The symptoms present on his admission were the same as on the Sunday previous to it, excepting that the swelling of the testicle had gradually diminished since the first introduction of the catheter.

(Cupping on the back of the neck to ten ounces, a blister to the loins, a warm bath immediately, and a drachm of the Epsom salts in saline medicine every six hours; the urine to be drawn off night

and morning, milk diet, and barley-water for ordinary drink.)

October 2d.—The saline aperient draught discontinued.

4th.—Twelve leeches to the region of the bladder, which is hot and painful.

5th.—The paralytic symptoms remain unaltered. The general condition of the patient is worse: he complains of great weakness, loss of appetite, and restlessness; a brown fur occupies the centre and back of the tongue; the skin is dry, and the pulse feeble. (An additional alkaline calumba draught every six hours.)

6th.—A moxa applied on each side of the lumbar region of the spine.

9th.—The constant pressure and moisture to which the integuments of the sacrum are exposed, have occasioned considerable sloughing at this part: the urine is secreted in small quantity, and is mixed with a quantity of thick ropy mucus, which completely plugs up the eyes of the catheter.

(Ten leeches to the lower part of the belly, where the patient still feels heat, and uneasiness on pressure : eight grains of the extract of hyoscyamus at bed-time.)

11th.—No improvement in any respect. The patient is weaker, and the sloughing process is extending at the back of the sacrum ; a stinking muco-purulent secretion is withdrawn with difficulty on introducing the catheter into the bladder, and offensive urine dribbles constantly from him.

(Broth diet, with six ounces of wine daily.)

25th.—No water has been passed through the penis for the last ten days, a communication having taken place between the bladder and rectum, the formation of which was attended with the discharge of a small portion of sloughy membrane from the anus. No other material change has occurred. The tongue is cleaner, and the patient feels a little stronger. A large portion of the integuments covering the right trochanter and sacrum has separated, and the ulceration of the latter part has a clean granulating surface in many points. He lingered from the end of October, without expe-

riencing at any time the slightest improvement in any respect, until the 20th of January, when after having gradually become extremely feeble and emaciated, and undergone much suffering from restlessness and hectic cough, death released him from his deplorable condition.

*Examination.*—The arachnoid membrane, covering the top of the brain, was raised by thin serous effusion, and the same kind of fluid was discovered under this membrane in the vertebral canal. The legs were much swollen, from anasarca. The mucous membrane of the bladder was discoloured, thickened, and pulpy, and an ulcerated communication existed at the inner orifice of the urethra, between it and the rectum. The kidneys and ureters were healthy.

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#### BLOOD EFFUSED BETWEEN THE MEMBRANES.

Blood effused between the membranes of the spine is not an uncommon occurrence. It may take place between all at the same time, or between any of them, arising spontaneously, or from an injury.

When blood is effused spontaneously, it generally proceeds from a congested state of the arachnoid membrane, or it is owing to a rupture of some of its vessels. There are no decided symptoms by which we can for certain ascertain its presence. Sometimes there is paralysis more or less complete below the extravasation : sometimes it is marked by pain opposite the part where the blood is situated ; and sometimes there are convulsions. These symptoms are usually accompanied by fever and its consequences.

The treatment consists in both general and local blood-letting, spare diet, counter-irritants, and purging. It rarely happens that patients recover from this affection.

As examples of this disease, I shall relate a case which came under my own observation, one which Sir Astley Cooper has published, and others which occurred in Mr. Chevalier's practice.



*Cases of Effusion of Blood in the Spinal Canal.*

## CASE I.

May 23, 1828.—J. Connell, æt. 31, was admitted into St. Mary-le-bone Infirmary, with the secondary symptoms of syphilis. He was ordered a dose of house-physic, and ung. hydr. fort. one drachm, to be rubbed in on the thighs every night. Having on the third night great difficulty of respiration, the ointment was discontinued: a blister was applied on the sternum, and an aperient administered.

26th.—State of breathing nearly relieved: the bowels had been copiously opened. Ordered a saline aperient draught every four hours.

27.—Was seized in the night with an attack of complete paraplegia; complains of severe pain in the dorsal region of the back: pulse 80, sharp and full; bowels costive; retention of urine. Sixteen ounces of blood were abstracted from the back, opposite the painful part: he was ordered a warm bath, and to continue the draughts; the catheter was used, and desired to be passed night and morning.

28th.—Much the same as yesterday: a large blister was applied on the dorsal region.

To take an active purgative.

29th.—Had a bad night: pulse 110, and irritable; no stool. Ordered—

Pulv. Jalap. ℥j. statim sumendus. In the evening, a purgative injection.

30th.—Bad night: pulse 110; skin hot; tongue furred; had had no stool. Ordered—

R Hydr. Subm. gr. v.; pulv. Jalap. gr. x. M.; to be taken every six hours. A purgative injection administered.

31st.—Much the same as yesterday; his bowels had not acted. Ordered—

Ol. Crotoni, gtt. j. micæ panis, gr. iv. M. statim sumend.; to be injected per anum. R Ol. Croton. gtt. j.; Ext. Col. Comp. ℥ij.; Pulv. G. Acaciæ, ℥iv.; Inf. Sennæ, ℥vj. M. ft. Enema.

Three o'clock P. M.—No stool.

Ol. Ric. ℥i. statim sumend.

June 1st.—Bowels had been copiously relieved during the night; felt much better; slight pain in the back; pulse 100; paraplegia still complete.

4th.—Had been going on much the same for three days; but gradually getting weaker. The fæces were now discharged involuntarily, and the catheter was still passed twice daily. A large slough had made its appearance on the nates. In a week after the last date, he died, having fallen into a state of hectic, and the slough having exposed the tuberosity of the ischium.

On examination of the body, all the viscera were found healthy, excepting that the mucous surface of the bladder was inflamed. On opening the spinal canal, it was discovered that a large quantity of blood had been extravasated between the arachnoid membrane and pia mater: it was in a semi-fluid state, and filled nearly the lower part of the canal. The medulla was rather softer in the dorsal part than its natural consistence.

## CASE II.

MASTER —, a fine youth, aged twelve years, in June 1814, was swinging in a heavy wooden swing, and just commencing the moving forward, was caught by a line which had got under his chin,

by which accident his head was violently strained, and the whole of the cervical vertebræ; but as the line slipped immediately off, he thought no more of it. Subsequently to the accident for some months, he was not aware of any pain or inconvenience, but his school-fellows observed he was less active than usual; instead of filling up his time by play, he would be laying on the school forms, or leaning on a stile or gate, when in the fields. They were always teasing him on this account, and at last he was persuaded himself that he must be weaker than he used to be. From this time he continued to decline both in strength and power. About the middle of May following, he came to London. His complaints were, occasional pains in the head, which were more severe and frequent about the back of his neck, (where a blister had been applied without relief,) and down his back. The muscles at the back of the head and neck were stiff, indurated, and very tender to external pressure. He felt pain in moving his head or neck in any direction; added to these symptoms, there was a great deficiency in the voluntary powers of motion, especially in the limbs.

May 18th.—Two setons were made in the neck,

and he was ordered various medicines, without any being useful.

May 29th.—His complaints and the paralytic affection of his limbs were getting much worse, added to which, he felt a most vehement hot burning pain in the small of his back. This, by the next day, was succeeded by a sense of extreme coldness in the same part. Some time after, the same pain occurred higher up in the back, and then left. Pulse, and heat, natural.

June 3d.—A consultation of Dr. Baillie, Dr. Pemberton, Mr. A. Cooper, and Mr. Heaviside, was held, and the application of mercury was determined on. The pil hydr. was taken for a few days, but as it run off by the bowels, mercurial frictions were consequently preferred. He felt his limbs getting every day weaker, but his neck was more free from pain when moved, and he was more capable of moving it by his own natural efforts.

June 7th.—His respiration became laborious, he passed a bad night, on the following day all his symptoms increased, and at five in the afternoon he expired.



*Examination.*—The whole contents of the head were carefully examined, and found perfectly healthy, but upon sawing out the posterior parts of the cervical vertebræ, the theca vertebralis was found overflowed with blood, which was effused between the theca and the enclosing canals of bone. The dissection being further prosecuted, this effusion extended from the first vertebra of the neck to the second vertebra of the back, both included.

The preparation only shews a small porportion of the effused blood which had become coagulated on the theca, as much of it escaped in the act of removal, it being fluid.

## CASE II.

Miss D——, aged 14, for several days felt pain in the head and back, which induced her, on the 26th of February, to apply for medical assistance. Blisters were applied behind the ears, and opening medicines were ordered, which operated the following day, and relieved the pain in the head; but the pain in the back grew much worse, and was aggravated and accompanied with a tendency to sickness on sitting up. On the 3d of

March the pain in the back increased much, and on the following day her mother thought she discovered a little projection of the spinous processes of the lumbar vertebræ, in consequence of which I was desired to see her. I could not discover any thing in the appearance of the back that was not natural, nor was any particular pain excited by pressure. The effort to sit up distressed her much; but her countenance was clear and healthy. The tongue was rather white: she had a moderate, regular pulse, at 120. Under these circumstances the pain did not excite any particular alarm in my mind: I directed some leeches to be applied as nearly as possible to the seat of the pain, and afterwards an opiate lotion: she was also ordered to take three grains of antimonial powder, with a saline draught every six hours, and I left her in full expectation of finding her relieved on the morrow, especially as, on strict inquiry, she could recollect no exertion or other violence by which the symptoms could have been produced.

On the following morning, to my great surprise, I was informed that, on the evening after I had seen her, she complained of a sudden and violent increase of the pain, and immediately went into

convulsions, in which she continued between five and six hours, and then expired. On the 6th of March I examined the body in the presence of Mr. Johnston, of Mortimer-Street, who had attended her from nearly the commencement. There was not the least appearance of disease in the brain or in any of the thoracic or abdominal viscera. The appearance of the spine was also perfectly natural. I therefore proceeded to cut away the bodies of the lumbar vertebræ, in order to expose the cavity of the spinal canal, close to where the seat of pain was. I found it filled with extravasated blood, which from its florid colour must certainly have been arterial, and which covered the whole of the cauda equina. The cavity appeared to be filled much higher up; but I did not prosecute the dissection, as it did not appear to me of much consequence to ascertain the exact limits of the extravasation, and the violence that must have been committed in opening the cavity farther, would have rendered it difficult, if not impossible, to tell precisely from what vessel the blood had issued. The original seat of the pain would naturally lead me to suppose that the rupture must have taken place near the commencement of the cauda equina, and it is probable the effusion of blood stopped within that part of the cavity enclosed

by the dorsal vertebræ, as there was no appearance of it at the foramen magnum occipitale, when the brain was examined.

The blood, though florid, was not all of an equal tint; it was very imperfectly coagulated; it is therefore probable that the vessel first gave way at the commencement of the illness, and again to a much greater extent at the time the convulsions came on.

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A child of 12 months old, who had just recovered from the operation for hare-lip, was carried out by the nurse. On its return home, it seemed in much pain, and appeared to have lost the use of its lower extremities: it died in three days. On opening the body I found the spinal canal full of a bloody serum, which, I have no doubt, was occasioned by slight extravasation from a strain, and subsequent inflammatory effusion. And how destructive such extravasation and inflammation combined, may be to the structure and office of the nerves, was illustrated by the case of a miller, who suddenly lost the use of his lower extremities, by lifting a heavy sack of flour. He died on the 15th day after the acci-

dent. On examining the vertebral canal, some extravasated blood was found mixed with a sanious matter, the theca vertebralis was evidently inflamed, and the nerves of the cauda equina were more completely rotten than I have found them after many weeks' maceration in putrid water, when removed from the dead body.

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#### CARTILAGINOUS SPECKS ON THE ARACHNOID MEMBRANE.

The arachnoid membrane undergoes other changes besides those already mentioned. It is not uncommon to find specks of cartilage and bone, sometimes of great size, deposited in its interstices in different points. In the Museum of St. Thomas's Hospital there are some beautiful specimens of this appearance. Flakes of cartilage and bone are occasionally found, as was the case in these instances, upon it. These patients have died of tetanus; hence some have inferred that those who are the subjects of it are predisposed to this disease. This, however, is doubtful, as these appearances are frequently seen in those who have died of other diseases, and they do not always occur in tetanus.



TUMORS BETWEEN THE MEMBRANES PRESSING ON THE  
MEDULLA.

Tumors are occasionally seen between, and formed in the structure of, the membranes of the spine: M. Ollivier has remarked two or three cases where they were present: they generally occur in scrofulous subjects, where the bones are diseased, and they compress the medulla. There is a preparation in the Museum of St. Thomas's Hospital, where there is a tumor pressing upon the cervical portion. The symptoms which mark this occurrence are those of compression of the spine; partial or total paralysis below the tumor.

# DISEASES OF THE MEDULLA SPINALIS.



## CHAPTER XII.

*Inflammation of the Medulla—Hardening of its Structure—  
Softening—Ulceration—Concluding Observations.*

### INFLAMMATION.

INFLAMMATION of the medulla gives rise to a variety of symptoms and morbid appearances, according to the length of time the disease has existed. In the early stage, it does not undergo any perceptible change. All that can be perceived is, that it is redder than natural, and that when a section of it is made, its vessels are found turgid, presenting bloody points in its substance: it is usually found in this state in injuries of the spine, opposite to where the blow was received; and sometimes this appearance may be observed in tetanus. When it is found in this state, the symptoms which denote it, are deep-seated pains of the spinal cord, attended with convulsions.

When inflammation in the spine has been prolonged, then it undergoes an alteration of structure; it may become much harder in its texture than na-

tural, or much softer, being almost in a fluid state, and in some instances it has been found ulcerated. When it is hardened, the inflammation has most probably been of a very chronic form, and has existed for some time. The history of the following case, related by Portal, will point out its symptoms:—

*Case of Hardening of the Medulla.*

There was at first, he says, pricking of the fingers of the right hand, and foot of the same side: these fingers became less sensible, but preserved, however, their movement. This insensibility by degrees extended from the hand to the foot: these parts fell away and became cold. The evil gradually augmented from the hand to the fore-arm, from the foot to the leg: the patient, however, could walk. The arm and the thigh of this side were affected in the same manner in their turn, and the patient remained more than a year in this state, and walked with a crutch placed under the arm-pit of the affected side. The same parts of the left side presented, by degrees, the same phenomena, and at length the patient was obliged to take to his bed altogether, deprived of all hope of recovering the faculties of the lower part of the body. His respiration and deglutition were easy, and the

other functions appeared for some time unaltered ; but by degrees they became extinguished : he became deaf ; the pulse was slow ; very hard and irregular ; the respiration was free, but by degrees it became weaker ; deglutition ceased ; the pulse was slower, beating only 40-30, and even 10 in a minute. At length the patient died.

On opening the body, all parts of it were found in their natural state, excepting that a portion of the spinal marrow at the cervical vertebræ was extremely hard, having a cartilaginous consistence : the membranes which covered it were very red and inflamed.

The treatment of this disease consists in bleeding at first generally, and then topically ; the application of repeated counter-irritants, more particularly the moxa over the affected part ; spare diet, and the regulation of the bowels, as well as the most perfect quietude, by lying in the horizontal position.

#### SOFTENING OF THE MEDULLA.

Softening of the medulla from inflammation is much more common than hardening, and it is most frequently found in this state in injuries and dis-

eases of the vertebræ. Sometimes, however, it arises spontaneously, and it may affect any part of the medulla. The change of structure it undergoes is very various. Sometimes it is of the consistence of soft cheese; sometimes that of cream, and at other times it is quite fluid. It also may affect the substance of the medulla in different degrees, being in the internal part softer than the external, and *vice versâ*. When it is found in any of these states, its colour also becomes altered, varying from a reddish yellow to a dirty grey.

The symptoms which occur in softening of the medulla, are complete paralysis below the affected part. At first, before the change takes place, it is marked by deep-seated pain and convulsions. The treatment is much the same as in other diseases of this organ; but when once an alteration of structure has been produced, no remedies can avail.

As examples of this disease, I shall relate two cases where it occurred under my own observation.

#### CASE I.

1821.—Mary W——, æt. 25, was admitted into



St. Bartholomew's Hospital, with a disease of the lower dorsal vertebræ. She was kept in the horizontal position, and after the parts had been soothed by the application of leeches, poultices, &c. two issues were applied on each side of the diseased vertebræ. She appeared to be going on well for a month, when she was attacked by the following symptoms :—She felt an extreme burning sensation in the back, and the limbs were occasionally thrown into convulsions ; the pulse was quick ; skin hot and dry, and tongue furred ; in short, she had all the symptoms of fever caused by local irritation. The symptoms continued until paralysis below the disease was complete. In about a fortnight she died, having had during the whole period retention of urine, and involuntary discharge of the fæces.

Upon examination, it was found that the membranes opposite the diseased vertebræ were highly reddened and inflamed, and that the medulla was of the consistence of soft cheese.

## CASE II.

Rebecca Dixon, æt. 16, admitted into St. Bartholomew's Hospital, November 1st, 1827 : said that

she had been struck with the handle of a mangle on the back part of the neck, in February last ; but the injury was so slight that she took no notice of it until the beginning of September, a space of six months, when she applied to some public institution, on account of a severe pain in the upper and back part of her neck, and her face being drawn towards the right side : she took a number of remedies without benefit.

When she was admitted, she complained of severe and continued pain in the upper and back part of her neck ; her face was directed over the right shoulder ; she had not the least power of moving her head from side to side, and the least attempt made by another person to move it in that direction, produced excruciating pain. There was no defect either in motion or sensation of the extremities at this time. No disease of the vertebral column could be detected by an attentive examination. Her pulse was quick and feeble ; her bowels were torpid, and required large and frequently repeated doses of aperient medicines to keep them free. Neither her respiration, nor her voice, were much affected at this time. She had never menstruated ; her countenance was bloated and pale, without be-

ing particularly anxious. Her bowels were cleansed with calomel and jalap; and under the supposition that these symptoms arose from uterine irritation, the preparations of iron were given, with the occasional abstraction of blood from the back of the neck by cupping. This plan was persevered in during three weeks without benefit. About this time she had an attack of pain and tenderness in the abdomen, more particularly towards the right side, attended with vomiting, which continued till her death. The pain and tenderness were relieved in three or four days, by the use of leeches, and the exhibition of calomel and opium, the state of the pulse not justifying the use of the lancet.

Nov. 29th.—About this time she first perceived an inability to hold any thing small in her hands, and a sensation of numbness over the whole body, and an inability to stand or walk. These symptoms gradually increased, till they amounted to a total loss of sensation and voluntary motion: during the last two days of her life she passed her urine and fæces involuntarily: her muscles were rigid, and her limbs could be put in any position without pain. She died on the 11th of December.

*Post-mortem Examination sixteen hours after death.*—In a most careful examination of the brain, nothing deviating from the natural and healthy appearance of that organ could be discovered, except an unusual paleness of the plexus choroides: upon examination of the spinal cord, it was found in a state of ramollissement, about an inch below its commencement: it was soft and pulpy, and stuck to the fingers when touched; at that part it was of a reddish brown colour, and exhibited no traces of its original structure: this change extended about an inch in length down the cord. The change of structure appeared to be more complete, and of a greater extent, in the posterior than in the anterior column. The rest of the cord was healthy. The heart and lungs were healthy, except at the posterior part of the superior lobe of each lung: the pleura costalis and pulmonalis were adherent, and a small portion of each lung in that situation, contained tubercles not in a state of supuration. There were adhesions of the peritoneum covering the convex surface of the liver to that lining the diaphragm and abdominal muscles; they did not appear to be very small. The mucous membrane of the lesser arch of the stomach and of the intestines, was ulcerated in some places. The

liver, and the rest of the abdominal and thoracic viscera, were sound.

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#### ULCERATION OF THE MEDULLA.

Ulceration of the medulla is of very rare occurrence. That it does take place, however, is proved by the following case, related by Sir Astley Cooper.

#### CASE.

A gentleman who resided about eight miles from London, had, by a fall, received a severe blow upon his spine; but as it produced no immediate ill effect, he thought very lightly of it. In going down to his country-house, he was exposed to the inclemencies of the weather, and he was on a sudden seized with pain in his back, and paralysis of the lower extremities, retention of urine, and an involuntary discharge of fæces. I was requested to see him on account of the retention of urine, and went daily for a length of time to Wimbledon Common, where he resided, to make use of the catheter. For several weeks his symptoms remained unchanged, excepting that now and then the integuments of the sacrum



gave way, and required great attention, to prevent a dangerous sore. Towards the close of his existence, he complained of a sense of uneasiness and distention of the upper part of his abdomen. His appetite failed him, and he rejected his food, and had a great deal of fever, with quick pulse and profuse perspiration. He sunk gradually, worn out by irritation.

I removed the spinal marrow, and have it preserved in the collection at St. Thomas's Hospital.

Upon opening the spinal sheath, a milky fluid was found within it just above the cauda equina, and higher than this for the space of three inches, the spinal marrow was ulcerated to a considerable depth, and was in the softened state which the brain assumes when it is rendered semifluid by putrefaction.

All the other parts of the body were healthy, excepting the bladder, which was considerably inflamed and exceedingly extended by the long continued retention of the urine.

In a case similar to this, it will be required to make use of precautions to prevent inflammation,

by cupping or by leeches. Blisters should be applied, and if the fever still continue, a seton should be made, or issues be opened, to prevent the continuance of inflammation, by producing and supporting external irritation.

Besides the alterations of structure I have already enumerated, the Medulla Spinalis may undergo other changes. It may be found both larger and smaller than natural in volume—tumors of various characters may be found in its substance, or pressing upon it, causing the symptoms of compression—hyatids may be lodged between its membranes—and various other changes affecting its substance, may occur.

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In concluding these observations on the Diseases of the Medulla Spinalis and its membranes, I cannot help remarking that it appears to me probable that many affections, the pathology of which we are at present but imperfectly acquainted with, may arise either from a functional derangement, or from some imperceptible alteration of structure of this organ. Among these may perhaps be enumerated Chorea, or St. Vitus's Dance—Hysteria—Tetanus, as I have

before observed—some particular species of Rheumatism, or Sciatica—any inordinate contraction of the voluntary muscles—and several other obscure affections, for which we cannot assign any particular cause. My reason for thinking this is, that in Chorea those muscles are affected with involuntary spasm which are supplied from the spinal cord, without the will having any control over them, and while the functions of the brain are unimpaired. In Hysteria, it often happens that when the spine is pressed upon, pain is felt in one particular part of it, so much so, that it is frequently supposed the vertebræ are diseased, which inclines me to think the medulla sympathises with uterine irritation. In Tetanus, the substance of the medulla and arachnoid membrane are found inflamed. In some particular kinds of rheumatism, the pain is so constant in a certain set of muscles—so unvaried, and so benumbing—that it leads me to conclude its origin is seated in the spinal cord ; in Sciatica, the disease follows the course of the sciatic nerve ; and in inordinate Spasm, the membrane covering the origin of the nerves is always more or less inflamed. To bring facts sufficient to illustrate the precise changes which take place in the spinal cord, or to

point out the nature of the alteration of its function in these diseases, would require the research of many years : I shall therefore take leave of the subject, hoping it may fall into hands more capable of treating upon it than my own.

THE END.











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