CASE
OF
DISTORTION OF THE SPINE,
WITH
OBSERVATIONS ON ROTATION OF THE VERTEBRÆ AS A
COMPLICATION OF LATERAL CURVATURE.

BY
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THE late Gideon Mantell was born at Lewes, in the county of Sussex. He applied himself at an early age to the exploration of the fossils of the upper chalk formation, and on coming to London to attend the medical school of Bartholomew's Hospital, he took with him a collection of considerable extent.

On his return to Lewes to engage in practice, he still continued his investigations, and it will easily be believed that his labours were great, inasmuch as his most remarkable and successful researches were carried into the Galt and Wealden rag,—in the hard and untractile masses of the latter he discovered the remains of those lost gigantic reptiles, the *Megalosaurus* and *Iguanodon*.

Impaired health and other causes induced him to transfer his practice from Lewes to Brighton, and some time after he again moved, and settled at Clapham, where his personal labours as to his favorite pursuits were restricted to the collection and examination of the few fossils to be met with in the gravely alluvium.

It appears that in 1842, being 52 years of age, he suffered from excessive pain in the back, inducing him to apply an opiate liniment and leeches. Then he was thrown from his

carriage upon the back ; and the symptoms are reported to be aggravated, and numbness came on in the left foot.

After this it is stated that he attended a case of concussion of the brain, and walked home in an intensely cold night, when the lower limbs became paralysed, the bladder required the catheter. The rectum was also affected, and enemata were used.

After many weeks the power of voluntary motion slowly returned ; sensation followed with intense neuralgia. The tumour in the back rapidly increased, with supposed fluctuation. During the period of nine months, Liston, Brodie, Bright, Lawrence, Stanley, Coulson, &c., were consulted. The tumour became slowly harder, and almost disappeared. Sensation continuing to return, the tumour again became larger and harder, and the abdominal aorta was pushed forward.

The cachectic appearance of the patient led to the suspicion of the formation of a malignant tumour in connexion with the bodies of the vertebræ, an idea which was subsequently abandoned.

By degrees the neuralgia became less frequent, but Gideon Mantell notes his health as broken up.

To relieve intense suffering, he sometimes resorted to anodynes, but it does not appear that he ever prescribed large doses for himself. On the last occasion a dose of this kind, which is believed to have been taken on an empty stomach, produced the symptoms of narcotic poisoning, which proved fatal.

Report of the Post-mortem Examination of Dr. Mantell.

By MR. WM. ADAMS.

Died 10th November, 1852. Examination of the body 13th November.

A tall, well-developed, muscular man. As the region of the spine was the chief seat of interest, from there being a history of a tumour or swelling having existed in the left lumbar region, supposed to be dependent upon, or connected with disease of the spine, the body was first placed in

the prone-position, and the dissection commenced from behind.

There was a slight fulness in the left lumbar region near to the spine, but certainly nothing amounting to a tumour. On pressure, three or four hard and prominent nodules could be felt, one above the other, situated from 2 to 3 inches to the left of the spinous processes, and on a level with them.

No lateral deviation of the spinous processes could be detected in any portion of the column. Both sides of the chest were fully and symmetrically developed. No tilting of the pelvis was apparent, though some deviation might have existed, as exact measurements were not taken, nor were the pelvic bones thoroughly exposed by dissection. It may therefore be said that the body did not present any remarkable external appearance. No obvious deformity existed. In pursuing the dissection from behind towards the abdominal cavity, it soon became apparent that the prominent nodules felt in the left lumbar region were the apices of the transverse processes of the lumbar vertebræ projecting backwards, and rising to the level of the spinous processes. The bodies of the lumbar vertebræ could also be felt projecting in an arched form, with the convexity outwards to the left side, and at first suggesting the idea of a hard tumour connected with the vertebral column. No morbid appearance presented itself in the soft tissues in this region. The subcutaneous cellular tissue and fat were everywhere perfectly healthy; the muscles were apparently quite healthy. There was no trace of any morbid growth, cyst of abscess, or of any other inflammatory process having existed in the neighbourhood; no thickening, adhesion, or other alteration in any of the soft tissues.

The body was now placed on the back, and the abdominal cavity was laid open in the usual way. A very severe lateral curvature of the spine to the left side in the lumbar region was now seen. The curved portion of the spine presented also a remarkably twisted appearance, from lateral rotation of the vertebræ, so that the transverse processes of the left

side projected backwards, as above described, whilst those on the right side projected inwards towards the abdominal cavity. The anterior common ligaments of the spine, and the cellular tissue on the anterior and lateral aspects of the vertebræ, and also the *psoæ* muscles and other tissues, were in a perfectly healthy condition.

No traces of abscess or of any old inflammatory process could be found, and it being impossible that a lumbar abscess could have formed and disappeared without leaving some structural changes in the soft tissues surrounding the spine, it may confidently be asserted that no abscess ever existed.

A portion of the vertebral column, consisting of the three lower dorsal and all the lumbar vertebræ, with a portion of the sacrum, was removed for separate examination. Viewed from its posterior aspect, the apices of the spinous processes of this portion of the spinal column are seen to present a lateral deviation to the left side, the most prominent part of which, viz., between the spinous processes of the second and third lumbar vertebræ, measures rather more than half an inch from a vertical line drawn from the spinous process of the tenth dorsal vertebræ to that of the first sacral bone. This distance is easily diminished to a quarter of an inch by a slight effort at straightening, and this, as above stated, was not apparent previous to its removal, though as measurement was not then adopted, it might have existed.

The bodies of the spinous processes, however, instead of passing directly backwards, incline towards the left side, so that in this aspect, the sides of the spinous processes are brought into view. This deviation exists in the spinous processes of the first, second, third, and fourth lumbar vertebræ, but to a much greater extent in the second and third than in the others, the angle of lateral inclination in these being nearly 45° . The spinous process of the fifth lumbar vertebræ retains its normal direction.

The transverse processes of the first, second, and third lumbar vertebræ on the left side project backwards towards

the skin at about an angle of 45° , and rise exactly to the level of the apices of the spinous processes. The transverse process of the fourth lumbar vertebra is very remarkably altered both in direction and form; instead of passing directly outwards, it curves upwards as a horn-like process, and approaches the transverse process of the third vertebra within three eighths of an inch; and instead of being flattened in its antero-posterior aspects, it is compressed from above downwards, and expanded horizontally towards its free extremity. This expanded portion measures three quarters of an inch in its transverse diameter, and its under surface presents a shallow cup-like depression, coated with a thin layer of fibro-cartilaginous substance, giving to it a well-marked character of an articular surface.—There can be but little doubt that this transverse process rested upon the crest of the ilium, articulating with it, as it were, by its expanded extremity, the form of which, together with its altered direction, being the result of long-continued pressure from the superincumbent weight. The oblique section made through the sacrum, in removing the parts, has unfortunately not included the corresponding portion of the crest of the ilium, but the above supposition is rendered exceedingly probable by the general aspect of the parts, and is also supported by the existence of a similar condition in the specimen closely resembling the present from Mr. Cæsar Hawkins's collection at St. George's Hospital. In this preparation the pelvis is attached, the corresponding transverse process presents a precisely similar appearance, and has only been slightly separated from the crest of the ilium, upon which it obviously rested, in the process of drying. The transverse process of the fifth vertebra has been sawn through in removing the parts, but from the portion still remaining, it must have been either absorbed to a great extent, or remarkably altered in form and position.

The transverse processes on the left side are widely separated from each other, whilst those on the right side are proportionably approximated. The distance between the transverse processes of the first and second lumbar vertebræ

on the left side measures rather more than an inch, and between those of the second and third vertebræ one and a quarter inches. The transverse processes of the third and fourth vertebræ on the same side are remarkably approximated, in consequence of the altered form and direction of the latter above described; they are only three eighths of an inch apart. The transverse process of the fifth vertebra has been sawn through in detaching this specimen. The distance between the transverse processes of the first and second lumbar vertebræ on the right side is only half an inch; and between those of the second and third vertebræ, and also of the third and fourth vertebræ, rather less than half an inch. The transverse processes of the fourth and fifth vertebræ on this side appear to be abnormally separated from each other, to some extent, the distance between them measuring fully an inch.

The articular processes have evidently been subject to a very severe amount of irregular pressure and strain, tending towards displacement, but they have at the same time become gradually altered in form, and considerably enlarged by the growth of bone, principally at the margins of the articular surfaces, which have thus been retained in contact. These appearances are well seen in a transverse section which has been made of one of these joints. The process by which the enlargement has taken place appears to be similar to that by which the enlargement of the articular extremities of bones (in the hip and knee-joints for example) has been shown by Mr. Wm. Adams to take place in the affection called chronic rheumatic arthritis. (See 'Trans. Path. Soc.,' vol. 3, paper by Mr. Wm. Adams.)

Viewed from its anterior aspect, the specimen exhibits a very severe degree of lateral curvature to the left side, involving the bodies of the two lower dorsal and the three upper lumbar vertebræ, with a remarkable degree of rotation of the vertebræ in the same direction, and also a very perceptible lateral curvature to the right side, involving the bodies of the two lower lumbar vertebræ and the sacrum; so that a distinct double curvature exists. The most pro-

minent point of the upper and larger curve is the intervertebral substance between the second and third lumbar vertebræ. If a vertical line be drawn from the centre of the tenth dorsal vertebra, and carried downwards through the centre of the sacro-lumbar articulation, it will be found, that the distance between this vertical line, and the most prominent part of the lateral curve, viz., the outer border of the intervertebral substance between the second and third lumbar vertebræ, measures three and a half inches.

The deformity of the spine cannot, however, be correctly described as a direct lateral curvature, for the bodies of the first, second, third, and fourth lumbar vertebræ are also rotated in a horizontal or transverse plane towards the left side, so that the anterior surfaces of the bodies of the second and third vertebræ have a lateral, rather than an anterior aspect. The rotation in these vertebræ, extends to very nearly 45° from the median plane. The eleventh and twelfth dorsal, and the first and the fourth lumbar vertebræ, are also implicated in this lateral rotation. In this anterior aspect of the specimen, it is also apparent, that absorption of the bodies of the vertebræ in the concavities of the curves, especially of the second and third lumbar vertebræ, and also of the intervening intervertebral substance in the upper curve, and of the intervertebral substance between the fourth and fifth lumbar vertebræ in the lower curve, has taken place to a considerable extent. In these situations, there is not the slightest indication of any inflammatory process having existed.

Viewed in profile, or from its lateral aspect, the natural curve of the spine, in the lumbar region, is seen to be reversed; and instead of presenting a convexity forwards, the three upper lumbar vertebræ, together with the twelfth dorsal, present anteriorly a concave outline. This is not produced by any absorption or destruction of the bodies of the vertebræ anteriorly, but is evidently caused by the very remarkable degree of rotation above described; by which the natural anterior convexity in this region, is made to

assume a lateral position, as if the spinal column had been laterally twisted on its vertical axis, the centre of motion being fixed at the apices of the spinous processes.

A vertical section, from side to side, through the bodies of the vertebræ, exhibits the following appearances. There are no indications of any destructive disease, such as caries or necrosis, having existed in any of the vertebræ. The cancellous structure appears to be healthy in all parts. The chief alteration in the bones, is a diminution in thickness of the bodies of the vertebræ in the concavity of the larger curve, the result of absorption from unequal pressure; this chiefly affects the bodies of the second and third lumbar vertebræ, each of which is diminished a quarter of an inch on the right or concave side: these vertebræ each measure one and a quarter inch in thickness on the convex, and one on the concave side of the curve. The wedge-shaped form thus given, to a certain extent, is less than might have been expected from the severity of the curve externally.

The intervertebral substances between the bodies of the first and second, and of the second and third lumbar vertebræ, have been, to a considerable extent, absorbed in the concavity of the curve; these cartilages each measure five eighths of an inch on the convex, and less than a quarter of an inch on the concave side of the curve; this, also, is evidently the result of unequal pressure; there are no indications of ulceration having existed.

It is therefore obvious, that the lateral curvature is chiefly dependent upon absorption of the intervertebral cartilages. The intervertebral substance between the third and fourth lumbar vertebræ, is uniformly diminished in thickness to a quarter of an inch through its central portion, but expanded at each side, where it has been free from pressure, in consequence of a certain amount of lateral sliding, or displacement of the body of the third vertebra from the fourth; the lower border of the third vertebra projects beyond the upper border of the fourth vertebra, three eighths of an inch towards the left or convex side; and on the opposite side

has receded, as it were, from the edge of the fourth vertebra to a like extent. The body of the fourth lumbar vertebra, by a similar movement of lateral displacement, also projects beyond the body of the fifth vertebra three eighths of an inch to the left side.

The intervertebral substances between the fourth and fifth lumbar vertebræ, and between the fifth vertebra and the sacrum, are diminished in thickness, in an opposite direction, to those between the second and third, and the third and fourth lumbar vertebræ. The cartilage between the fourth and fifth vertebræ measures rather less than a quarter of an inch on the left side, and rather more than three eighths of an inch on the right side; so that it is diminished a quarter of an inch on the left side. The cartilage between the fifth vertebra and the sacrum is diminished in the same direction, but to a somewhat less extent. The bodies of the fourth and fifth vertebræ are not diminished in thickness on either side; they both measure five-eighths of an inch in thickness in all parts. The wedge-like form of the last two intervertebral cartilages described will be seen to produce a curvature to the right side, the arc of which would include the bodies of the fourth and fifth lumbar vertebræ and the first bone of the sacrum.

As minor alterations in the osseous structures, indicating a reparative process, may be mentioned a considerable increase of thickness and density of the compact structure forming the outer surface of the bodies of the vertebræ in the concavity of the curve, and also of the adjacent portion of the cancellous tissue similar to the thickening of the walls of the long bones in the concavities of the curves following rickets in early life, and no doubt answering a similar purpose of buttress-like support. The superior and inferior margins of the bodies of the vertebræ are also enlarged so as to form projecting lip-like processes.

It was not considered advisable to lay open the spinal canal for the purpose of examining the condition of the cord, though such a proceeding might appear to be necessary to the explanation of some of the symptoms in this

case. The section for this purpose could not have been made without totally destroying the specimen as one of deformity, and in this respect it presented so many features of interest and practical importance, that their preservation was considered to outweigh the chances of discovering any morbid changes in the spinal cord.

The fact of the greatest practical importance which this specimen illustrates and clearly proves, is one which I believe has not hitherto been described, viz., that a very severe degree of lateral curvature of the spine with transverse rotation of the bodies of the vertebræ, accompanied with lateral absorption of the bones and intervertebral cartilages to a considerable extent, and attended with all the distressing symptoms of the most aggravated form of this affection, may exist, with only a very slight lateral deviation of the apices of the spinous processes; in short, that the severest degree of deformity of the spine may exist internally, without the usual indications in respect of the deviation of the spinous processes externally.

When it is borne in mind that all surgeons are in the habit of relying upon the relative position of the apices of the spinous processes to the median line, as an index to the existence or non-existence of lateral curvature, the importance of the fact above described cannot be over-estimated in the diagnosis of this affection. In this particular case it does not appear that any of the very eminent physicians and surgeons who examined Dr. Mantell suspected the existence of lateral curvature of the spine; the general opinion seems to have been that destructive disease existed either in the bodies of the vertebræ or intervertebral substances and was accompanied by lumbar abscess, which one surgeon proposed to open. The fact, however, that the supposed lumbar abscess made no progress after the lapse of a considerable time, from one to two years, but on the contrary rather diminished, threw considerable doubt and obscurity over the case; still in the absence of the great diagnostic symptom of lateral curvature of the spine, viz., lateral deviation of the apices of the spinous processes, this

affection was not suspected ; and it does not appear that the hard nodules felt in the lumbar region, and once supposed to be the lobules of a tumour connected with the bodies of the vertebræ, were at any time recognised as the transverse processes of the vertebræ. This can hardly be matter of surprise, when it is remembered that it was the only positive symptom, taken in conjunction with the general aspect and inclination of the body, by which the affection could have been diagnosed, and up to the present time such a condition has not been described as diagnostic by any authority on curvature of the spine. A careful study of the present case will, however, enable us to diagnose a similar condition in alike case, with as much certainty as if the ordinary indications were present.

The condition of the spine here described as transverse rotation of the vertebræ, the centre of motion corresponding to the apices of the spinous processes, I do not find mentioned by any modern authority on these affections ; but it appears to have been observed by the late Dr. Dods, of Bath, who, so far as I know, was the first to direct the attention of the profession to the subject of rotation of the spine in lateral curvature. In the year 1824, he published a somewhat remarkable work, entitled, 'Pathological Observations on the Rotated or Contorted Spine, commonly called, Lateral Curvature.'

The author endeavoured to show, that the condition generally described as lateral curvature, was really one of transverse rotation of the vertebral column, the natural flexures of which were by this movement brought more or less into view posteriorly instead of laterally ; that, in fact, as an object becomes changed in its appearance from change of position, or by varying the point of sight, so an altered position, the result of rotation of the spinal column, produces the deceptive appearance of lateral curvature. At page 98, he observes, "It does not happen in all cases of contorted spine that the whole column is moved round ; if it were so, we should have invariably the profile of its three flexures brought into view in the manner described, whereas,

it is well known that there are frequently but two of them observed." At page 23, he remarks, "As the spine is rotated spirally, and not as upon a pivot, the profile of its flexures will be imperfect." Dr. Dods appears to have been led to the existence of rotation by observing what was really the most positive symptom in the case now under consideration, viz., the prominence of the transverse processes in the left lumbar region. He states, page 101, "During the course of my operations (alluding to friction, &c.) upon several patients, I was struck in all of them, (for they were all contracted to the right side,) with a considerable bony hardness and projection on the left side of the loins, raised nearly to a level with the spinous processes; and this I found to be the case in the patients whose spine exhibited little or no apparent curvature in the loins, as well as in those in whom the apparent curvature was very great." After the muscles had been relaxed by friction, Dr. Dods was enabled to satisfy himself that the bony prominences were produced by the transverse processes of the lumbar vertebræ, which could be distinctly felt and counted like the spinous processes. In these cases the transverse processes of the same vertebræ on the opposite side could not be felt, and appeared to have sunk inwards completely out of reach. Reasoning upon these facts, and considering that a direct lateral curvature of the column could only affect the transverse processes by separating them on one side, and approximating them on the other, without altering their transversity with respect to the body, Dr. Dods concluded that such a condition could only be produced by a movement of transverse rotation. He also traced a similar condition in the dorsal region, evidenced by the oblique position of the spinous processes, also described in Dr. Mantill's case, and considers the rotation sometimes to extend to the cervical region.

From the above observations, it would appear that Dr. Dods had met with and recognised the precise conditions now described in the specimen under consideration; for he specially mentions the fact, in some cases, of the transverse

processes rising to the level of the spinous processes in the lumbar region, with "little or no apparent curvature in the loins;" and we have thought the evidence of this fact of sufficient importance to justify his views being brought under the notice of this Society. They are evidently the result of careful and original observation, though the explanation of the phenomena observed, their mode of production, and the indications for, and methods of treatment given, are in many respects erroneous, like the great majority of pathological doctrines tested by the experience of thirty years' scientific inquiry; it would, however, be out of place to advert to these points in the present communication.

In the cases alluded to by Dr. Dods, his attention was probably directed to the existence of rotation in the lumbar vertebræ by prominence of one of the shoulders, and other points of defective symmetry which may or may not have existed in Dr. Mantell during life, though not obvious after death. By some it has been remarked, that "he looked as if he suffered from curvature of the spine." There is no account, however, of any examination having been made with special reference to this point. From an observation made by Sir B. Brodie, in a clinical lecture delivered by him in Dec., 1846, and published in the 'London Medical Gazette,' it would appear that M. Guérin was familiar with the appearances described in the specimen exhibited. Sir B. Brodie observes, "At a very early period, and even before the lateral curvature is very distinct posteriorly, the bodies of the vertebræ are actually twisted to one side. This curious circumstance was pointed out to me by M. Guérin, who has some preparations, in which the fact is very perceptible." In M. Guérin's first memoir, 'On the Treatment of the Deviations of the Spine by Section of the Muscles of the Back,' published in 1843, page 18, he alludes to the modifications of form dependent upon the double influence of vertical displacement caused by lateral flexion, and of horizontal displacement caused by torsion. He was evidently aware of the existence of rotation, but he does not allude to it as at any time coexisting with an absence of

lateral deviation of the apices of the spinous processes, as in the present instance, and therefore it is not mentioned in its most important practical bearing upon the diagnosis of lateral curvature. He had probably noticed what may now be described as the disproportion between the internal and external curvatures, also a most important fact, and one of frequent, if not constant occurrence, in all the more severe forms of lateral curvature of the spine.

Rotation of the vertebræ, or a spirally twisted condition of the vertebral column, as a complication of lateral curvature, is alluded to by many English writers on this affection, but generally only as a passing observation, little or no practical importance being attached to it, and by several of the principal authorities of the present day it is altogether omitted. There can be no doubt, however, of its frequent, if indeed it may not be said, its constant occurrence as a complication of the more severe forms of lateral curvature; and when it exists in any considerable degree, it constitutes one of the chief difficulties of treatment. All the instruments at present so generally used, which make direct lateral pressure on the convexity of the curve, must tend to increase the mischief in such cases, though by their effect in flattening the ribs, this result may not at first sight be apparent.

EXPLANATION OF THE PLATES

*Illustrating Mr. Wm. Adams's description of a Case of
Distortion of the Spine.*

PLATE I.

Anterior view of the Spine of the late Dr. Mantell, *vide* p. 172.

PLATE II.

Posterior view of ditto, *vide* p. 170.