ACCOUNT
OF
A DISLOCATION,
IN CONSEQUENCE OF DISEASE OF THE FIRST AND SECOND
CERVICAL VERTEBRÆ.

By JAMES PAGET,
ASSISTANT-SURGEON TO ST. BARTHOLOMEW'S HOSPITAL, ETC.

Received March 24th—Read April 11th, 1848.

THE bones which I propose to describe to the Society were presented to the Museum of St. Bartholomew's Hospital by Mr. George Banks, Assistant-Surgeon in the Naval Service, at Plymouth. He found them in a graveyard at Aberdeen, but has not been able to gain the least information respecting the person of whom they once formed part, though their texture and general aspect indicate that they were but a short time exposed to decomposition.

The specimen consists of the first and second cervical vertebræ of an adult, firmly united by bone, in such a position that the uppermost part of the spinal cord, during and after the process of osseous union, must have been confined within an exceedingly narrow space.

On the atlas, the surface for articulation with the odontoid process is somewhat irregular, as if from ulceration which has healed, and is surrounded with a slightly-elevated narrow border. By the sides of this surface, on both aspects of the anterior half of the ring of the atlas, numerous small perforations for blood-vessels indicate that the vascularity of the bone was increased. Both the inferior articular processes

appear to have been superficially ulcerated, and to have been healed, after the corresponding articular surfaces of the axis had been moved from them and rested on only their posterior borders. On the right side, the surface of the inferior articular process of the atlas is smooth, but has lost its naturally sharp-edged border. The surface of the left inferior articular process is cancellous, as if it had been slightly ulcerated and incompletely healed. In the centre of the posterior half of the ring of the atlas, close to its upper border, is a funnel-shaped aperture, through which it is most probable that one or more blood-vessels passed to or from the membranes of the spinal cord.

With these exceptions nothing abnormal appears in the atlas. It presents a complete ring for the transmission of the vertebral artery behind its left condyle, and one nearly complete behind the right condyle; and the depressions for the attachment of the transverse ligament are deep and strongly marked, especially on the right side, as if the ligament had retained its hold and been drawn tightly on the bone.

The axis exhibits, on the anterior surface of its body and on the inner and inferior surfaces of its arch and processes, such numerous minute foramina as characterise an increased vascularity, and which here, also, appear to indicate that these parts were covered with a thin layer of new bone, completely organised and closely united with them.

The upper part, or head, of the odontoid process appears to have been superficially ulcerated, for its whole surface is porous and rough, though hard. On the anterior and lowest part of the same process is a small growth of hard, new bone, of irregular shape and coarsely-fasciculate appearance.

The disease affecting the ligamentous connections of the vertebræ must have been more considerable than that which themselves suffered; for the axis, as if quite loosed from its natural fastenings, has been moved backwards, with a very slight deviation to the left, till its odontoid process is close to the posterior portion of the atlas. The space within the ring

of the atlas is thus divided, by the displaced odontoid process and body of the axis, into two unequal parts. The anterior part is of an irregularly quadrilateral form, and a little larger than that usually occupied by the body of the axis, measuring eight and a half lines from side to side; and, at the most, seven lines from before backwards. What filled this space, besides the remains of the ligaments passing from the odontoid process to the occiput, cannot now be determined. The posterior division of the space within the ring of the atlas, through which must have passed the upper part of the spinal cord, together with its membranes and the remains of the common posterior ligament of the spine, is of an elongated, transversely-oval form—or, rather, reniform. Its extreme width is nine and a half lines from before backwards. It measures, in the middle line—i. e. from the odontoid process to the posterior arch of the atlas—two lines; and on each side, from the body of the axis to the same posterior arch, three lines, at the most.

The vertebræ thus displaced are not diminished in size, nor materially altered in form; they are slenderly constructed, but of average dimensions.*

I need not refer to the numerous cases of dislocation, after disease, of the upper cervical vertebræ, already published, for all the most interesting of them are quoted in a paper by Mr. Lawrence in the thirteenth volume of the Transactions of this Society. Neither, while I refer to that essay, need I

* The following table shows their principal dimensions compared with those of three healthy, well-marked vertebræ.

	Diseased vertebræ.		Healthy vertebræ.		
	lines.		lines.	lines.	lines.
Antero-posterior diameter of the ring of the atlas	16		16	14·5	15
Transverse diameter of the same	14·5		15	13·5	13
Width between the inferior articular processes of the atlas	8		8·5	7	7
Antero-posterior diameter of the canal in the axis	8		10·5	7·5	8·5
Transverse diameter of the same	10·5		13	11	11·5

dwell on the morbid processes which precede and attend such dislocations, or the mode in which the change of position is effected. Only, it may be remarked as a peculiar feature in the present case, that the slight appearances of disease in the atlas, and the depth of the depressions for the attachment of the transverse ligament, make it highly probable that the disease was almost limited to the surface of the articulations between the atlas and the axis; and that the transverse ligament, though diseased enough to admit of elongation, was neither destroyed nor so weakened as to allow the odontoid process to be suddenly or violently pressed upon the cord.

APPENDIX.

Description of a specimen of Dislocation of the Atlas upon the Vertebra Dentata, attended with contraction and distortion of the Vertebral Canal: by ALEXANDER SHAW, Surgeon to the Middlesex Hospital.

The specimen, of which there is an accompanying drawing, was exhibited at the meeting of the Society, when Mr. Paget's paper was read. The bones were removed by me, about the year 1828, from a man whose appearance was that of a common labourer or artizan, and who had been brought into the Middlesex Hospital dead, by strangers who could give no account of the accident.

On dissection, there was found to be fracture at the base of the skull, with extravasation of blood and laceration of the substance of the brain. After the examination was thought to have been completed, an unusual appearance of the opening of the vertebral canal induced me to remove the bones for further inspection.

Description of the preparation.—The specimen consists of

the six superior cervical vertebræ, with a portion of occipital bone,—the two upper vertebræ and the occipital bone being distorted by disease, and united by anchylosis.

Before proceeding with a more detailed description, it may be stated, 1st, that where anchylosis has taken place, the ossific matter forming the union has become perfectly dense in texture, and it has its surfaces rounded and smooth, so as to prove that the anchylosis must have been completed for a long period before the death of the patient; 2ndly, that all the bones exhibit that strong marking of the processes and eminences which give attachment to the muscles and ligaments, and that solidity of structure, which denote that the individual, shortly before death, possessed full muscular power.

The portion of occipital bone anchylosed to the atlas has its external edges ragged and irregular: that appearance is explained by the fact, that the fragment was broken off by the injury which caused the death of the patient; fissures extended round it, so as to insulate it from the rest of the base of the skull, and it could be removed without the use of the saw or chisel.*

Between the under surfaces of the occipital bone and the atlas, firm anchylosis has taken place, at different points. This union is so complete between the condyles and articular surfaces, on both sides, that the original form of the bones can no longer be recognized, owing to the closeness of the junction. On the right side, the anchylosis is continued backwards from the articular surfaces, along the inferior border of the foramen magnum of the occipital bone and the superior edge of the posterior arch of the atlas, as far as to half an inch on the left of the rudimentary spinous process of the atlas, a circular opening being left for the passage of the right vertebral artery into the cranium. The anchylosis between the occipital bone and the atlas has taken place

* This suggests the idea that the sudden death of the patient was probably occasioned by the loosened portion of occipital bone having been driven forcibly inwards upon the brain.

without any considerable change in the relative position of the bones ; all that is perceptible being a slight shifting of the former bone to the left of the latter, causing the axis of the foramen magnum to be a little to the left of the axis of the atlas.

In describing the condition of the atlas and dentata, the principal circumstances to be attended to are the remarkable changes in the relative position of these bones to each other. For it is owing to these changes that the vertebral canal has become so much contracted and deformed.

The first thing to be observed is, that the vertebra dentata preserves its proper relation to the third vertebra of the column, and that all the irregularities about to be described have resulted from displacement of the atlas upon the dentata. 1st, The atlas has been carried forwards upon the dentata, so as to be advanced beyond its proper level in relation to that bone. But this advancement is much greater on the left side than on the right: for while the left articulating process has been moved forwards about three quarters of an inch, and a buttress of bone has been thrown out in front of the dentata, to support it in its overhanging position, the right articulating process has been advanced only about a third of an inch. 2ndly, Instead of the atlas having been carried forwards on a horizontal plane, there has been an inclination to the left side, so that the whole bone dips to that side. 3rdly, At the same time that the atlas inclines to the left, it has been shifted in its position to that side, so as to overhang the dentata on the left, as it overhangs it in front. 4thly, Owing to the atlas having been carried forwards on the dentata, the part corresponding to the body of the atlas has been separated about half an inch from the processus dentatus, with which it had been originally in apposition ; the space between the articulating surfaces has been filled by a new growth of bone a quarter of an inch thick and half an inch deep, which passes as a beam from one point to the other, so as to give additional support to the displaced atlas. 5thly, From inspecting the preparation and

observing the general direction of the displacements, it cannot be doubted that the disease, which was the original cause of the changes, was seated principally in the left articulating processes of the atlas and dentata. It confirms this view, that whereas there is firm ankylosis of these surfaces, there is no union, and very little appearance of previous disease, in the right articulating surfaces. All that can be observed, in the right articulating process of the atlas, is, that, besides being carried forwards on the dentata about a third of an inch, as stated before, it has been brought close to the processus dentatus, by the general shifting of the bone to the left side.

Lastly, let me direct attention to the changes produced in the relation of the axes of the two bones, by their altered position. The principal change of this kind has resulted from the displacement forwards of the atlas: for owing to this bone having been carried forwards while the dentata remained in its place, the centre of the circle which the atlas represents has been advanced in front of the centre of the circle which the dentata represents. According to the most correct measurement I can make, it appears that the central point of that part of the atlas which enters into the formation of the spinal canal is situated in a line half an inch before the axis of the spinal foramen of the dentata: and the effect of that change is seen by the posterior arch of the atlas crossing the spinal foramen of the dentata and intersecting it about equally. Another point to be remarked is, that, owing to the atlas having been moved towards the left side, as well as carried forwards on the dentata, its axis, instead of being placed straight in front, is directed a little to the left of that of the dentata. Consequently, there must have been encroachment on the space within the vertebral canal for containing the spinal marrow at each side, as well as in front and behind.

Description of the Wood-cut.

The view represented in the drawing is that obtained by holding the preparation to the level of the eye, and looking down the vertebral canal through the foramen magnum.

- a.* Processus dentatus of the vertebra dentata.
- b.* Plate of bone which passes from the articulating surface of the processus dentatus to that on the anterior arch of the atlas.
- c c.* Posterior arch of the atlas, joined by anchylosis, on its left side and centre, to the inferior border of the foramen magnum.
- d.* Part of the anterior arch of the atlas near the tubercle.
- e.* Rough surface marking the line of union by anchylosis between the right condyle of the occipital bone and the corresponding superior articular surface of the atlas.
- f.* Anchylosis of the same named parts on the left side.
- g.* Spinous process of the vertebra dentata.
- h.* Left pedicle of the vertebra dentata.

Some measurements of the superior opening of the vertebral canal.

Greatest distance between the posterior surface of the processus dentatus and the inner margin of the posterior arch of the atlas, (being the antero-posterior diameter of the vertebral canal)—three-tenths of an inch.

Distance between the right pedicle of the atlas and left pedicle of the dentata, (being the transverse diameter of the canal)—nine-tenths of an inch.

Distance from the inner border of the foramen magnum on the right side to the centre of the processus dentatus,—four-tenths of an inch : from the corresponding points on the left side,—nine-tenths of an inch.

Distance from the posterior surface of the processus dentatus to the centre of the anterior border of the foramen magnum,—five-tenths of an inch.

Postscript, Aug. 1848.—I have at present under my care, in the Middlesex Hospital, a girl æt. 15, who has disease of the two superior cervical vertebræ; and in whom there is every reason to suppose that the atlas has become displaced upon the dentata, in the same manner and to as great an extent as in the preparation above described. The most marked peculiarity in the girl's appearance is, that the head is placed too far forwards in relation to the axis of the neck; so that the greatest projection of the occiput is in a line more in front than the projection caused by the spinous process of the dentata, and the chin and face are proportionately carried forwards as compared with the neck. By pressing with the point of the finger above the spinous pro-

cess of the dentata, a deep hollow can be felt, caused, apparently, by the atlas and occipital bone having been moved forwards, (probably by the weight of the head,) beyond their proper relation to the dentata. The head also leans obliquely to the left side, as must have been the case with the man from whom the preparation was taken.

The patient first came under my observation in the end of March of this year, when the distortion of the neck was about the same as at present. She had suffered pain in the crown of the head, but not much in the neck, for about four months (the origin of the pain being attributed to influenza). At one time she was affected slightly with incontinence of urine, and had some pain in her legs; but she did not give up work as a domestic servant till three weeks before she applied at the hospital. Her chief complaint was then stiffness of the neck; she had also pains in both shoulders and arms; but there were no indications of paralysis in any part of the body. To give her the advantage of rest in the recumbent position, and counter-irritants to the neck, and to provide her with supports for the head, she was kept in the hospital till the middle of May. Early in June she was readmitted. She stated that soon after being discharged she had weakness in her legs, which prevented her from standing or walking; but as she lay on her back she had perfect power over her limbs; she had neither numbness nor spasms in the legs; occasionally she had incontinence of urine. Having been kept quiet for some weeks, without any symptoms of paralysis manifesting themselves, she was allowed to get out of bed and take moderate exercise. For some time back, wearing the supports to her head, she has sat up at her needle, and assisted the nurse in the light work of the ward; and arrangements are now being made to send her to the sea-side.

A cast showing the distortion is preserved in the Museum of the Middlesex Hospital School.