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A

PROBATIONARY ESSAY

ON

DISLOCATION

OF THE

PROCESSUS DENTATUS,

SUBMITTED,

BY THE AUTHORITY OF THE PRESIDENT AND HIS COUNCIL,

TO THE EXAMINATION OF THE

ROYAL COLLEGE OF SURGEONS OF EDINBURGH,

when Candidate

FOR ADMISSION INTO THEIR BODY,

IN CONFORMITY TO THEIR REGULATIONS RESPECTING THE ADMISSION OF

ORDINARY FELLOWS,

BY

WILLIAM HOWISON, M. D.

SURGEON,

EXTRAORDINARY MEMBER OF THE MEDICAL SOCIETY; AND OF THE

CALEDONIAN HORTICULTURAL SOCIETY.

EDINBURGH:

PRINTED BY P. NEILL.

1819.

ON

DISLOCATION

OF THE

PROCESSUS DENTATUS.

By the term *dislocation*, in Surgery, is understood, the articular surface of a bone being displaced, or forced out of its natural situation, by any cause whatsoever. There can be no reason, therefore, why the subject of the following pages, (viz. Rupture of the Ligaments of the Atlas, allowing the Processus Dentatus to project from its natural situation, and so produce pressure upon the spinal marrow, in certain positions of the body, which must, sooner or later, prove fatal to animal life,) should not also be allowed the same appellation; and that such an occur-

rence does take place, it remains for the history and accurate dissection of the succeeding case to prove.

It may be thought necessary, however, before proceeding further, in order to recall the recollection of the profession to my present subject, that I should give a short anatomical description of the upper parts of the Neck; of the Atlas, and Dentata, with the Ligaments which maintain them in their natural situation, and which prevent the dreadful and irremediable effects which arise from pressure on that part of the spinal marrow. The atlas and dentata form the first, and second, of the cervical vertebra. The Atlas, so named from supporting the head, and being in immediate connection with the condyles of the occipital bone, instead of a body, like the others of the cervical vertebræ, is supplied with a small arch, the upper and under surfaces of which, are marked by the ligaments which fix it to the head and second vertebra; and the back part of which is hollow, and covered by a smooth cartilage where it turns upon the processus dentatus. Upon the inner parts of the sides of the atlas, between the supe-

rior and inferior oblique processes, the lateral ligaments which go to the processus dentatus, and the transverse ligament which goes behind that process, are attached. In place of a spinous process, the atlas, upon the back part of it, has another small arch, marked by muscles and ligaments; and its superior articular processes are hollow, for receiving the condyles of the occipital bone, at the outer and back part of which, there is a depression, for the passage of the vertebral arteries into the head, and the tenth pair of nerves out of it. The transverse processes are longer than any of the other cervical vertebræ, for the attachment of muscles; and its connection to the occipital bone, admits of flexion and extension of the head, but of no other motion.

The second cervical vertebra, called *dentata*, from the remarkable tooth-like process which projects from the upper part of its body, which is of a conical figure, and larger than the rest of the cervical vertebræ, is situated under the atlas, and in immediate connection with it, by means of its superior articulating processes, which are received into the hollow inferior ar-

ticulating processes of the last-mentioned bone, where the head has its principal rotatory motion, and by means also of the tooth-like process, which passes up through it; and is retained in its fixed situation, by various ligaments to be afterwards mentioned. The Processus dentatus upon its fore part is convex, and covered with cartilage, where it turns upon the atlas; and its present the same appearance behind, when it moves upon the transverse ligaments, its sides being also marked by the insertion of the lateral moderator ligament, and its point by the attachment of the perpendicular ligament, which is fixed to the edge of the foramen magnum of the occipital bone. Its spinous process is thick and strong, to give origin to muscles of the head, and turned down, to allow of their actions to be readily performed. This bone, in the fœtus, is composed of four pieces, three of which are common to all the vertebræ, and the fourth is the Processus dentatus, which is joined by a cartilage to the body of the bone.

With regard to the other five cervical vertebræ composing the neck, they have their bodies smaller, more flattened before and behind, and

more hollowed above and below, than the others composing the spinal canal. Their transverse processes are perforated, for the passage of the vertebral bloodvessels, and hollowed above, for the transmission of the spinal nerves; whilst their spinous processes, placed horizontally, are shorter than the rest, and forked, for the attachment of muscles. The cervical vertebræ admit of free motion, in consequence of the thickness of their cartilages, and the nature of their processes, but give less protection behind to the spinal marrow, than is given in other parts of the spine.

Having thus described the cervical vertebræ, and particularly the atlas and dentata, as being more intimately connected with the subject of the succeeding pages, I shall now take notice of the various ligaments by which they are connected and retained in their natural position, allowing the important functions of the spinal marrow, which passes through the osseous canal thus formed, to go on uninterrupted and unimpaired. Of these, the two first are the two capsular ligaments, arising from the margins of the superior articulating surface of the atlas, and in-

serted into the base of the condyles of the occipital bone, where the head has its flexion and extension, without rotation. *2dly*, The Circular Ligament, which arises from the edge of the spinal hole of the first vertebra, is connected with the capsular ligament of the superior articulating processes of the atlas, and inserted into the edge of the foramen magnum of the occipital bone. *3dly*, The two capsular ligaments which fix the inferior oblique processes of the atlas to the superior oblique of the vertebra dentata, admitting of the rotation of the head, with a small degree of flexion to either side. *4thly*, I shall take the liberty of calling the particular attention of my readers to the Perpendicular Ligament which fixes the processus dentatus of the second vertebra to the edge of the anterior part of the foramen magnum, and is twisted in the rotation of the head ; To the two Lateral or Moderator Ligaments, which arise each from the side of the processus dentatus, and run outwards and upwards, to be fixed to the inner parts of the side of the atlas, and to the inner edge of the foramen magnum, which are short, but of great strength, and prevent the head

from turning too far round; and, *lastly*, To the Transverse Ligament, which, arising from the inner side of the atlas, and going across behind the processus dentatus, is fixed to the opposite side of the atlas. The edges of this ligament extend upwards and downwards, forming two processes called its Appendages, which are fixed to the foramen magnum and processus dentatus; and its middle is remarkably firm, where that process plays upon it;—as it is the natural healthy state of these ligaments which keeps the processus dentatus in its place, and prevents it from injuring the spinal marrow in the various motions of the head; and by the rupture, or destruction of these from disease, the life of the unfortunate individual is sooner or later destroyed, as it is my intention in these pages to demonstrate.

It may not be altogether out of place here, that I should take notice of other two ligaments, common to the whole of the vertebral canal, viz. the Anterior and Posterior Common Ligament of the vertebræ. The former, a strong tendinous band, extending along the outer part of the vertebræ, beginning at the dentatus, and

reaching as far as the sacrum, where it spreads out, and vanishes upon the under part of that bone, becoming thinner in the neck and loins, where the motion of the spine is greatest, and assisting in binding the vertebræ together, so as to prevent the spine from being bent too much backward; and the latter, beginning at the anterior edge of the foramen magnum, passing along the inner part of the bodies of the vertebræ, terminating at the lower part of the sacrum, and preventing the spine from being too much bent forward.

Through the osseous canal of the vertebræ, thus formed, strengthened, and protected by ligaments, the spinal marrow, the continuation of the medulla oblongata, invested by its own proper membranes, as also by a partial covering from the ligamentous membrane which lines the bodies of the vertebræ, accompanied by the spinal arteries, the sinus venosi, tenth pair of nerves, &c. pass down in safety.

Having made these few remarks upon the anatomy of the spine, particularly the upper part of it, I shall now proceed to consider the Dislocations to which these parts are liable, and

principally that of the Processus Dentatus. The os occipitis, and first cervical vertebra, are so firmly connected by ligaments, that there is no instance of their being luxated from an external cause; and were the accident to happen, it would immediately prove fatal, by the unavoidable compression and injury of the spinal marrow. An anchylosis, however, has been observed, between the occiput and the atlas, attended with a change in their relative position, and a lessening of the foramen magnum,—a preparation of this kind being preserved in the Museum of Natural History at Paris. LAVEILLE conceives, that it must be this specimen of which mention is made in the writings of DUVERNEY and BERTIN, and that the case originated from some chronic disease.

That the atlas and dentata, however, are liable to be, and are at times displaced or dislocated, as the other bones of the human body; that the various ligaments affording them strength and connection, are subject to, and are at times ruptured, from external injury, or from disease; and that this dreadful accident, for the most part, proves sooner or later fatal to the un-

fortunate individual, (although luckily for mankind, it is of rare occurrence,) the records of surgery supply us with too ample confirmation. "Every surgeon is aware" (says Mr Samuel Cooper) "that the rotatory motion of the head is chiefly performed by the first vertebra moving upon the second. When this action is forced beyond its proper limits, the ligaments which tie the processus dentatus to the edges of the foramen magnum are torn; and, supposing the head to be forced from the left to the right, the left side of the body of the vertebra is carried before its corresponding articulating surface, while the right side falls behind its corresponding surface. Sometimes the processus dentatus, whose ligaments are ruptured, quit the foramen formed for it by the transverse ligament and the anterior arch of the first vertebra, and presses on the spinal marrow. In other instances, the processus dentatus does not leave its natural situation; but the diameter of the vertebral canal is always diminished at this place, and the spinal marrow consequently compressed, and otherwise injured. Persons can hardly be expected to survive mischiefs of this kind, in

so high a situation; indeed, they are frequently killed almost instantaneously."

When this formidable accident now alluded to, viz. Dislocation of the processus dentatus, by reason of its ligaments being ruptured, from external injury or disease, which must happen before it can press so much upon the spinal marrow as to prove fatal to life, has taken place; and when, under these circumstances, life is protracted for several days, as took place in the succeeding case, the most experienced medical practitioner, thrown off his guard by the rarity of such an occurrence, may remain entirely ignorant of the cause producing the dreadful symptoms under which his patient labours, until after death it is laid open to him by an accurate and persevering dissection; and even if he had previously been aware of it, all I am afraid which he has in his power to do, would be to alleviate symptoms, and perhaps by posture, or other means, to lengthen out, for a short period only, a wretched existence.

The causes which produce this dreadful disease, may be said to be external violence applied to the region of the head, or back part of the

neck, in any manner whatsoever, a twist of the neck, tumbling, standing upon the head, the rash custom of lifting up children by the ears, the habit of carrying heavy loads over any particular shoulder, in combination with disease, or wasting of the ligament; both of which latter causes appear to have exerted their destructive influence in the following case. M. Louis found, that the first vertebra was dislocated from the second, in the malefactors hanged at Lyons, at which place, the executioner used to give a sudden twist to the body, at the moment of its suspension.

When the unfortunate individual survives this dreadful accident for a few hours, or perhaps for a few days, as at times happens, the severity and progress of the symptoms, of course, must depend upon the extent of the pressure made upon the spinal marrow. Among these symptoms, we may enumerate the following, viz. A dull sort of pain, affecting first the occiput, back part of the neck, and latterly the whole head, extending down towards the trunk of the body; inability to move either the neck, or upper part of the trunk; and a difficulty, almost

amounting to impossibility, of swallowing food or liquids, which, when they are taken into the mouth, and received a very short way into the œsophagus, are immediately rejected, without any of them reaching the stomach. The breathing also becomes considerably affected, with flushing and turgescence of the face, and a great determination of blood to the head. Paralysis then comes on, affecting gradually the whole body; and at length the patient terminates his existence without a struggle.

That this disease at times happens, there is no doubt, and, I am inclined to think, that it does so much oftener than the Medical Profession are aware of; the causes which give rise to the distressing and fatal symptoms now enumerated, remaining unknown, until they are detected and made obvious by an accurate and persevering dissection, which is too often neglected, and but too superficially performed. The result of an accurate and careful dissection, generally exhibits a turgescence of the ventricles, and vessels of the brain, and consequently, a great determination of blood to the head; rupture, or destruction in one part or another of the ligaments

retaining the processus dentatus in its natural position, the transverse, lateral, or moderator and perpendicular ligaments; protrusion of the processus dentatus in certain motions of the head; contraction of the vertebral canal; pressure upon the spinal marrow; and consequently the death of the patient.

With regard to the Cure, or means to be used to alleviate or remove the distressing and fatal symptoms in this disease, it must be evident, that, in the majority of instances, little or nothing can be done, many patients expiring almost instantaneously, before it is discovered, or even suspected what could have given cause to such a rapid and unfortunate event. In those instances in which the unfortunate individual is able to exist for a few days, and in which the function of swallowing is greatly impaired, or completely destroyed, life may be protracted by nourishing clysters of strong beef-tea, &c. thrown up by the rectum. Turgescence of blood in the head, or inflammatory symptoms, may be alleviated by general bleeding; by the application of leeches, or by blistering. The processus dentatus may be preserved in its natural position for a shorter or

longer time, by proper position. A patient under such circumstances, of course, must be supported in the semi-erect posture, with his head inclined backwards; and to this position, he is obliged of his own accord rigidly to adhere, as the moment he alters it, the processus dentatus projects, (the ligaments, the means of retaining it in its natural position, no longer existing,) makes injurious pressure upon the spinal marrow, and proves fatal; and if it was within the reach of human power to retain the processus dentatus, after its ligaments had been ruptured or rendered useless, in its natural position, by posture, for a sufficient length of time, I am afraid we have no reason as yet to believe that their re-union would again take place, or that the process would become so fixed by any other means, as to enable the functions of life once more to be carried on with safety.

"If the luxation produces no symptoms which indicate a compression of the spinal marrow," (says BOYER), "it is prudent to abstain from all attempts at reduction. When the symptoms are urgent and alarming, and some attempt to relieve the patient is the only chance he has of

living, we are to begin by inclining the head to the side towards which it is directed, in order to disengage the articulating process of the upper vertebra: this part of the operation is extremely dangerous, as it may instantly produce death, by increasing the pressure on the spinal marrow: when the process is disengaged, the head and neck are brought to their right direction, by making them perform a rotatory motion the contrary of that which has taken place in the luxation. A relapse is to be prevented, by keeping the head and neck perfectly motionless."

This paragraph can only apply to dislocations of the lower cervical vertebræ, or to those in which the processus dentatus does not leave its natural position, and in which the diameter of the vertebral canal at that place is diminished, if such cases ever in reality do occur. If the processus dentatus be dislocated, and projects in such a manner as to produce urgent and alarming symptoms, threatening immediately to prove fatal to the patient, the ligaments which bind it down in its natural situation, must be ruptured or torn; and allowing that it is in the

power of the medical practitioner to replace the bone, in what manner is he, by keeping the head and neck perfectly motionless, to prevent this process from again protruding in the necessary movement of the body, and proving fatal? Will the torn or ruptured ligaments reunite? Will anchylosis take place? Or upon what principle is it possible that the processus dentatus can once more be retained, and fixed in its natural position? And, lastly, granting even this to be possible, is it in the power of the surgeon to retain the head and neck of a human being, by any means with which we are acquainted, perfectly motionless, for such a length of time as would be necessary to fulfil this end? Until such time as we can be convinced that such a thing can or actually has taken place, we must conclude, I am afraid, that when once the processus dentatus has been luxated, and its ligaments ruptured, so as to produce pressure upon the spinal marrow, if the death of the individual is not instantaneous, no human power or assistance can prevent it from ultimately taking place, and that there can be no cure for dislocation of the processus dentatus.

Many dislocations of the cervical vertebræ do not prove fatal; but these occur at the third, fourth, fifth or sixth of these bones, and only one articular process is luxated. In these instances, the vertebral canal is not so much lessened as to compress the spinal marrow, and occasion death.

After what has now been detailed in the preceding pages, it may appear unnecessary that I should here take notice of the instance of the mother, who brought her child to DESSAULT, with what was supposed to be a luxation of the vertebra dentata, and which he succeeded eventually in curing, as related by LEVEILLÉ, Nouvelle Doctrine Chirurgicale, tom. ii.; or of that recorded by Dr SETTIN, in SCHUMACHER's Verzischte Schriften, as much doubt may be entertained in both instances, whether those accidents were really such as they were supposed to be; no other instance of such a thing, (particularly protrusion of the processus dentatus), to the best of my limited knowledge, ever having occurred again. I shall now, therefore, bring the subject of this paper to a conclusion, by the following interesting and minutely drawn up case, in hopes

that it will tend in no small degree to illustrate the contents of these pages.

CASE.

A. B. the subject of this unusual case, was admitted as a patient into the Edinburgh Royal Infirmary on the 2d of August 1817, at which time I was one of the Physicians Assistants to that establishment. He was a middle-sized delicate looking man, of a spare habit of body, sallow complexion, and forty-eight years of age. He had served as a private soldier in the army for a number of years, during which period he had been employed on very active service, in different climates, and had undergone a great deal of fatigue. After having been discharged, he supported himself and family by acting as a street porter, in which capacity he was in the daily habit of carrying heavy loads, and particularly, from custom, as he said, over his left shoulder.

He reports, that after having enjoyed good health for a number of years, he was attacked,

for the first time, nearly seven weeks ago, with a dull sort of pain, affecting his occiput, and back part of his neck; and that of late it has become gradually worse, and much more constant. About a week ago, he was attacked with pain in the anterior part of his throat, occupying the course of the trachea and œsophagus, and accompanied with considerable difficulty of deglutition, which has gradually become so bad, that now he is rendered almost unable to swallow any thing. During the course of these three last days, he has had three different blisters applied to the region of his neck, which run well, but without affording him any, or at least very little benefit. He has also had repeated laxatives, with the effect of keeping his bowels gently open.

At present, he complains of the sensation of a constant dull sort of pain, affecting his whole head in general, but particularly his forehead and occiput, from which it stretches down, attacking both the posterior and anterior parts of his neck; but at present, it is principally confined to the fore part of it, affecting the course of the trachea and œsophagus. He is unable to move

his neck, or upper part of the trunk of his body; and when food is given him, he is obliged to be supported in the semi-erect posture in bed, with his head inclined backward. When fluids are put into his mouth, and he attempts to swallow them, they appear to be received a short way into the œsophagus, and are instantly rejected, without any or very little of them reaching his stomach. For some time past, he has been under the painful necessity of keeping himself in the half-raised position, with his head inclined backwards; and when he goes to sleep, he is obliged to be supported in bed with pillows in the above position. He sleeps but seldom; and what sleep he does procure, is generally disturbed, interrupted, and is followed by little or no refreshment. His breathing at times is considerably laborious and difficult; and from the very visible flushing and turgescence of his face, there appears to exist a considerable determination of blood to his head. Pulse about 60, full, but irregular. Tongue slightly foul, and much parched; and he is troubled with urgent thirst. His bowels, he reports, are naturally costive. His skin is hot, and bedewed with clammy perspira-

tion. He experiences attacks of rigors at times, succeeded by heat.

After his admission into the Infirmary, under the care of Dr Hamilton, senior Physician to that establishment, the following reports were made by that very accurate and justly eminent man.

Aug. 3. Applicent. hirudines vi. parti cervicis qua dolet. Injicientur per anum juscul. bovini fortioris ℥viii. 3tiâ vel 4tâ qq. horâ.

Inhalet vapores aq. ferventis inter respirandum.

—— 4. Pains continue. A little beef-tea has been swallowed. The injections have been retained. Paralysis of the left side, but particularly of the superior extremity, has now supervened. Leeches succeeded rather ill.

Oblinat. cervix tam anterior quam posterior, oleo ammoniat.

Continuent. enemata, et juscul. bovin.

—— 5. Paralysis of the whole right side of the body has likewise occurred. Pain of the hind neck, and of the superior part of the cervix, still impeding deglutition, continue. Re-

spiration has become laborious and frequent. P. feeble.

Continuent. ol. ammoniat. et juscul. bovin. per anum injiciend.

—— 7. Accipiat enema domest. stat.

—— 8. No alvine evacuation. Respiration is less difficult, and by report, a considerable quantity of fluid has been swallowed. He is now in the recumbent posture, and asleep.

Habeat enem. purgan. juscul. bovin., ut supra prescript. ore absorbend.

—— 9. Beef-tea has been taken; and towards evening, a portion of sac-whey ordered was returned. He continues in the recumbent posture, and has enjoyed some sleep. P. is regular, but full. T. clean. No alvine evacuation. Countenance appears somewhat flushed. He complains of slight headach, and of complete loss of power of moving any of his extremities. About lb. iii. of urine passed through the catheter this morning.

Habeat seri vinosi c. vini rubri ʒiv. confect. Contin. juscul. bovini.

Applicentur hirudines vi. front. vel temporibus.

Aug. 10. Headach continues, with fulness of features, and a florid flushing of countenance. Paralysis as described. Respiration laborious.

Habeat vini rubri ℥viii. Contin. alia.

—— 11. Died yesterday, almost instantaneously, shortly after the visit.

In this very interesting and uncommon case, it became of great consequence to ascertain, what could have produced the morbid symptoms above described. Permission was therefore requested to open the body, which was immediately granted. This dissection was performed in the regular manner, two days afterwards, in presence of several of the Medical gentlemen belonging to the Hospital.

INSPECTIO CADAVERIS.

In detailing the appearances of dissection which presented themselves in the examination of the body of the patient, as both the cavity of the cranium, and also that of the neck were opened, and carefully examined, I shall describe

the morbid symptoms, as they occurred, under two divisions, viz. Sectio Cranii and Sectio Cervicis.

SECTIO CRANII.

Upon dissecting back the integuments of the head, in the usual manner, and removing the skull-cap, the superficial veins running along the surface of the pia mater, and of the brain, as also the sinuses, particularly the superior, longitudinal and lateral ones, were observed to be considerably turgid, and full of venous blood. Upon cutting down to the ventricles, and laying them open throughout the whole extent of their cavities, they were found to be entirely sound and healthy; one of them only appearing to contain a small quantity of a serous fluid. All of the other parts of the cerebrum and cerebellum, were found to be in their natural healthy state, excepting that there was a considerable turgescence of blood in the deeper seated vessels.

SECTIO CERVICIS.

The body being now laid upon the abdomen in the extended state, an incision was made from the occiput along the spinous processes of the superior cervical vertebræ, and the integuments and muscles occupying the back part of the neck, were dissected down so as to expose the upper part of the spine; which being done, the second bone of the neck was found to be much more moveable than when in its natural state. On removing the cerebellum from the skull, and attempting to thrust the finger into the spinal canal, through the foramen magnum of the occipital bone, when the head was bent forward, great resistance was given to it. On moving the head backwards, however, the resistance was removed, and the finger passed easily into the vertebral canal; but on again bringing the head forwards, when the finger was in the above mentioned position, it was very forcibly squeezed, and forced out from its situation betwixt the back part of the foramen magnum, and what

appeared to be the processus dentatus of the second cervical vertebra. The atlas and the second of the cervical vertebræ being now carefully dissected out from the spinal canal, and carefully examined, it was found that the ligaments of the left side of the processus dentatus (viz. the left attachment of the transverse and the left moderator ligaments) were ruptured, and allowed the processus dentatus to project backwards at the time that the head was bent forwards, so as to press upon, and of course destroy the functions of the spinal marrow, and consequently that this produced the paralysis, and caused the patient's death.

Upon examining the trachea and œsophagus, they were both found to be in their natural and healthy condition, except, perhaps, in a very slight appearance of inflammation being present.

FINIS.