

## **Remarks on the angular curvature of the spine / [William Pirrie].**

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9

# REMARKS

ON THE

## ANGULAR CURVATURE OF THE SPINE.

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[*Extracted from the Monthly Journal of Medical Science.*]

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ANGULAR curvature may arise from one or other of the five following causes :—

1st, It may be the consequence of scrofulous caries of the spine. The bodies of the vertebræ, from their spongy texture, are peculiarly liable to this disease. It is unnecessary to trace the progress, or explain minutely the nature of the local changes which precede the occurrence of scrofulous caries. The first deviation from the healthy condition is, that part of the cancellated structure becomes preternaturally vascular; that at an early period the affected part becomes unusually soft from a deficient proportion of earthy matter, and that a thin fluid is deposited in the cancelli. These changes constitute the anatomical characters at an early period of the disease. As the disease advances, the bone becomes still softer, and instead of a thin fluid a caseous substance is deposited in the cancelli. Sometimes the substance occupies only the cells, while the cancellous structure still remains; sometimes the cancellous structure of a part of the bone is removed, and its place occupied by the caseous substance, and sometimes the whole of the cancellated structure of a vertebra has been found to be absorbed, and caseous matter deposited in its stead. I have in my own collection a vertebra, the whole cancellated structure of which has been absorbed, and replaced by caseous matter retained in its place by an exceedingly thin shell of bone. This variety, in the quantity and extent of deposit, corresponds with what is observed in other bones affected with this disease. When the disease, for example, is situated at the joint ends of bones, the deposit is usually very limited; but in a long bone the same substance is sometimes found to occupy the whole of its interior. I have specimens in which the whole of the femur is occupied with this substance, contained within a very thin encasement, which is formed by the outer part of the original shell



of the bone. That an inflammatory process occurs in the progress of the disease all agree ; but as to the nature of the morbid action of which the caseous substance is a result, there is a difference of opinion. Sir Benjamin Brodie, Lloyd, Rust, and others, regard the deposit as a product of inflammation, while many others consider it a result of a morbid action, different from inflammation.

From many facts which have been ascertained, there seems reason to conclude that in scrofulous constitutions, caseous deposits in certain textures are direct effects of inflammation, and may be arrested if the inflammation be subdued ; but it seems equally certain from many observations, and from the history of many cases, that when the constitutional diathesis is very decided, they may take place wherever there is any congestion of blood, and even sometimes, where there is no trace whatever of any congestion, inflammation, or any disturbance of the circulation. In a practical point of view, this is not a matter of very great importance to determine, with reference to the caseous substance in this disease ; for it is generally allowed that depletion has less control over scrofulous, than over common inflammation, that when adopted to any great extent in persons of a scrofulous diathesis, it is very injurious ; and further, that even if the first deviation from a healthy condition were a consequence of a low grade of inflammation, it could scarcely be expected that the inflammation within the bone could be much affected by any extent of depletion, which it would be safe or judicious to institute. The tendency to this deposit is believed, in part at least, to depend on a peculiarity in the condition of the blood, which is unusually serous. When the blood is morbidly defective of fibrine, exudation of albuminous matter seems very apt to take place on the occurrence of local congestion, or inflammation ; and in many instances it has been found, even where no trace whatever exists of any disturbance of circulation. I have, in my own collection, many specimens in which bones are almost entirely filled with the caseous deposit, where the outer encasement of the bone is very thin, and no trace whatever discoverable of increased vascularity, but quite the contrary. The diminution of vascularity, after the occurrence of deposit, has been remarked by others.

The deposition is succeeded by a low grade of inflammation of the bones and intervertebral substances, which ultimately terminates in caries ; and, in consequence of destruction of the bodies of the vertebræ, as well as of the intervertebral substances, the sound part above the portion destroyed falls forward on the part below, and thus gives rise to angular curvature. The commencement of the destruction is almost invariably towards the anterior parts of the bodies of the vertebræ, but sometimes, though very rarely, on their posterior aspect ; in this case the parts which naturally furnish attachment to the arches are destroyed, and a separation takes place between them and the remaining portions of the bodies of the





vertebræ. In my own collection there is a particularly interesting preparation illustrative of this fact. In this preparation, destruction has taken place of the posterior surfaces of the bodies of certain vertebræ, so that the arches and transverse processes are detached, the anterior portions of the bodies remaining entire. There is no breach of continuity along the front of the column, but there is a large chasm in its posterior portion, communicating with the vertebral canal. There was no curvature in this case; for the anterior parts of the vertebræ being entire, there could not have been angular curvature with the projecting angle backwards, nor could there have been angular curvature with the projection forwards; for, though the arches were detached from the bodies, the spinous processes and the arches remained impacted together, and prevented the spine from presenting a concavity along its posterior aspect. There is considerable variety as to the relative position of the two extremities of the diseased portion; sometimes the upper part falling forward, comes to be directly in contact with the under part; sometimes it is otherwise; but this will depend upon the number of the bodies of the vertebræ destroyed, and the extent of the destruction backwards. As the bodies of the vertebræ and the intervertebral substances form the part of the column which supports the superincumbent weight, when a chasm or gap is produced in front, the superincumbent weight sends the upper part forward, producing incurvation in front of the spine, and projections behind of the spinous processes, and, from the incurvation being of an angular form, the disease is denominated angular curvature. The spinal cord traverses the spinal canal, having its sheath in contact with the arches, and not the bodies of the vertebræ; that is to say, it directs its course along the greater curve. In most cases of decidedly marked angular curvature, complete or partial interruption of the functions of the spinal cord comes on sooner or later: the portion of the cord at the affected part of the spine is as far as possible from the bodies in front of it; but still the bones do in some cases press upon the cord, and interrupt its functions, especially when the destruction has been rapid, and the curve is very abrupt. This cause of pressure and consequent paralysis may not be permanent. The projecting portions of bone may ultimately become smoothed down by absorption, and in some cases this, no doubt, explains the discontinuance of the paralysis. The functions of the cord may also be interrupted by pressure upon the membranes, produced by matter formed in the progress of the disease. These are the causes, external to the membranes, which may occasion pressure on the cord and interrupt the due performance of its functions. The same interruption, however, is often produced by results of inflammation, with which the membranes or the cord, or sometimes both, become affected; and in such cases there is usually found on dissection, a thickened condition of the membranes, or the formation of matter between or



within them, or a preternaturally injected state of the cord, or a softened condition of it, which may vary in degree from a slight deviation from the healthy appearance, to that state in which it is almost entirely fluid. Paralysis, however, has been known to exist where none of the above conditions, nor any morbid alteration of structure, was discovered on dissection; and Stafford and others suppose that it is sometimes to be referred to longitudinal compressure of the anterior portion of the medulla. "The effect of angular curvation," Mr Stafford remarks, "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 arise from 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, while the posterior portion or back of it would be stretched."

It may be regarded as a general law, that of the two functions, voluntary motion and sensation, the former is almost invariably first removed, and the latter first restored; the rationale of which is, that the anterior columns of the spinal cord, which give off the anterior roots of the nerves, by which they preside over voluntary motion, are nearer to the seat of the disease, and therefore more exposed to pressure than the posterior columns which give off the roots presiding over sensation. Although pressure on the spinal cord is usual in angular curvature, it is surprising how nature, even in some cases where the destruction is very great, and the deviation from the natural form of the spine very remarkable, yet continues to maintain the integrity of the vertebral canal, so as to preserve the cord from being compressed. Of many examples of this remarkable fact I shall only refer to the following: Mr Stafford mentions the case of a child in whom, though the bodies of six dorsal vertebræ were destroyed, and the angle of the curve was very acute, paralysis did not occur. Professor Cruveilhier gives the particulars of a case in which the bodies of five dorsal vertebræ were completely destroyed; where the fifth dorsal vertebra rested on the eleventh, the two becoming ankylosed, and the angle was very acute; and yet the medulla was preserved free from pressure. I have at present under my care a girl ten years of age, in whose case the bodies of the fourth, fifth, sixth, and seventh dorsal vertebræ must be entirely removed; an abscess is formed, and is pointing about the middle of the seventh rib; and judging from the appearance of the spine behind, the parts above and below the seat of the disease must be for a short distance almost parallel with one another, so abrupt is the curve; and still the patient is as yet quite free from any symptoms of compression of the spinal cord. The only explanation given of such cases is, that the process of destruction must have been very slow, and the deviation from the natural form extremely gradual. Mr Stafford remarks, "The completeness and incompleteness also of the symptoms very much depends upon the rapidity with



which the curve 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 often very imperfect."

In the progress of the disease, a collection of purulent matter forms (as in scrofulous caries in other bones), constituting what in some instances has been denominated lumbar or psoas abscess, but more properly spinal abscess. The appearance of abscess is an exceedingly unpromising symptom; indeed, it is generally regarded as fatal. The period at which suppuration takes place differs greatly in different examples of this disease; in some it occurs at an early period, in others not for many months, or even for a longer period; and indeed an abscess is sometimes retained for years by the neighbouring parts becoming thickened and matted together. As a general law it may be stated, that the suppuration is much earlier when the curvature is induced by scrofulous caries than when it arises from ulceration of the cartilages. The situations in which such collections point are various. When the abscess is connected with the cervical vertebræ, it may present itself among the muscles on the side of the neck (which is most usual), or it may be directed forwards, and burst into the pharynx, of which I have seen one example. When the abscess is connected with the dorsal division of the spine, it may present itself along the lateral part of the thorax, of which I have already mentioned one example, or it may point at other aspects of the parietes of the thorax by running along some of the intercostal spaces; but usually the matter follows the course of the posterior mediastinum, escapes under the diaphragm, and then descending along the course of the psoas muscle points in the groin. Sometimes an abscess in the dorsal division forms a large swelling on the side of the abdomen, the matter descending between the peritoneum and the other structures which constitute the abdominal parietes; and I had an opportunity of making a dissection in a case of curvature from scrofulous caries of the 7th, 8th, and 9th dorsal vertebræ, in which a spinal abscess, after following the course first of the mediastinum, and then of the psoas magnus, burst at last into the under extremity of the sigmoid flexure of the colon. When the abscess is connected with caries of the lumbar vertebræ, it most commonly points in the groin near the insertions of the psoas magnus and iliacus internus muscles, or somewhere in the thigh below Poupert's ligament. In some instances, the abscess has shown itself in the loins, and in others in the nates, but these are comparatively very rare occurrences. The only favourable termination which can take place in this disease is anchylosis, to which, however, the soft condition of the bones is by no means favourable.

II. Angular curvature may result from ulceration of the intervertebral substances,—the disease thence extending to the bodies of the vertebræ.

III. It may arise from chronic inflammation commencing in the



vertebræ, followed by ulceration and caries; the vertebræ being like other bones, liable to inflammation. Such inflammation may be of a common character causing common caries; or of a scrofulous character producing scrofulous caries already referred to, or of a rheumatic character, which may end in what has been denominated rheumatic caries. Ulceration of the intervertebral cartilages is believed to be an early consequence of inflammation of the bodies of the vertebræ.

IV. It may originate in the softening and absorption of a vertebra without the production of any chasm. I have in my collection two very striking specimens of this condition, in both of which the curve is very abrupt, and yet there is no chasm or any trace of inflammation discoverable; and I have had under my care for two years a girl with angular curvature in the middle of the dorsal region, which case, from the entire absence throughout of any symptom whatever, except the deviation from the natural form of the spine and the consequent alteration of the form of the chest, I consider to be one of this nature.

V. According to some surgeons, it may arise from inflammation of the investing membrane of the vertebræ. Mr Tuson, after referring to some of the more common causes of angular projection, says, "From observations I have made, and numerous cases which have come under my care, I have formed a conclusion, that it may also arise from inflammation commencing in the membrane that covers the upper and lower surfaces of the bodies of the vertebræ, connecting the intervertebral substances with the bone, and then extending itself into that substance and cancellated structure."

*Symptoms.*—These are divided into two stages:—

1st, Before curvature;

2d, During and after its formation. In the first stage, the patient complains of a sense of weakness at the part of the back affected, and of weariness, and is unwilling to take exercise. After some time, a dull heavy pain is experienced during and after exercise. The pain, which at first is slight, becomes afterwards more severe, and is increased by exercise, by any sudden jerk communicated to the spine, and generally by percussion, and relieved by the horizontal position. From irritation of the spinal cord, there is often an altered sensation or occasional feeling of pain in the lower extremities; occasionally spasmodic twitches of the muscles, and at times spasmodic rigidity of the limbs. In the progress of the disease, and before the second stage, the muscles become wasted and lose the power of readily obeying the will, in consequence of which the patient cannot easily and quickly place his foot exactly on the spot where he may wish to place it; and when he walks, he is very apt to trip. There is coldness of the extremities, and fulness and tightness in the epigastric region; patients in this state often complain of a feeling of chilliness, and they will usually be found to exhibit symptoms of a feeble condition of the general health. In the second



stage there are found the local symptoms of the first stage, often in an increased degree, and together with these, curvature, at first slight, but gradually increasing, and in form very abrupt, a peculiarity most important to be remembered, as it is one of the best guides for distinguishing angular curvature from some curvatures which depend on a different condition, and in which, although the spine is bent backwards, the curve, instead of being abrupt and angular, is gradual, resembling a segment of a circle. There is angular projection posteriorly of the spinous processes, and the spine is bent forwards in consequence of destruction of the bodies of the vertebræ which support the superincumbent weight. As the disease advances, the patient usually loses all sensation and motion in the parts below the point of pressure on the spinal cord; in short, he becomes affected with a paraplegia; the power of motion being generally first lost, and last restored, as explained in describing the state of the parts. The patient loses control over the bladder and the sphincter of the rectum, so that the urine and fæces pass off involuntarily; or if the pressure on the cord be very great, there may be complete retention of the urine. Slight difficulty of passing urine has often been found to be an early symptom. The easy performance of the functions of the digestive and respiratory organs is more or less interrupted; the bowels are generally constipated; and the patient complains of a sense of fulness and tightness at his stomach, and in many cases of pain. These conditions of the organs of digestion and respiration are supposed to be produced through the connexion between the spinal and ganglionic nerves; and this supposition is probably correct; but there can be no doubt that the function of respiration is often rendered difficult in curvature in some situations by pressure on the intercostal nerves, which are thereby rendered incapable of calling into action the intercostal muscles (over which they preside) to assist in enlarging the chest in inspiration. To this point we shall afterwards have occasion to refer. In the progress of the disease abscess may appear, the situation where it shows itself varying (as formerly stated) according to the situation of the disease; its appearance is usually attended with increased derangement of the general health, and under the continuance of the discharge and irritation, hectic fever to a very urgent extent supervenes, and the bowels or some other internal organs becoming affected, death ensues. Such are in general the symptoms of angular curvature, but they differ considerably in different cases, particularly as to the local symptoms, which in some instances are as above described, while in others there is no pain nor tenderness—the only local symptom being the deformity. If the deformity depend on mere absorption, there may be no pain, but it is an important fact which should always be kept in view, that scrofulous caries of the spine, as is mentioned by some authors, and as I have several times found, may run its course, and yet the patient may not experience any pain or any local symptom beyond a sense of weakness and weariness of the affected



part. So little pain is there, that in many instances the curve has been formed before the real seat of the disease has been suspected. In scrofulous caries there is generally less pain than when the disease depends on ulceration of the cartilages, but suppuration usually takes place earlier. These differences—the history of the case, and the presence or absence of a scrofulous diathesis may assist us in forming some opinion, but we have no sure guide enabling us in the living body to arrive at a certain knowledge, whether the disease has originated in scrofulous caries of bones, or in ulceration of intervertebral cartilages. The symptoms of curvature vary also according to the part of the spine affected. When it occurs in the lumbar region, and more especially towards its lower part, it is not usual, unless the disease be to a great extent, to find the altered sensations and spasmodic twitches in the early stage, or the paraplegia in the latter, as the great size and the form of the bodies render the contents of the canal less liable to pressure. When the curvature is in the dorsal region, the projection, owing to the great length of the spinous processes, becomes very marked, and the chest considerably altered in shape, being flattened laterally, the ribs projecting backwards, following the vertebræ with which they are connected, and the sternum appearing too far forwards. There is at times palpitation, and in some instances difficulty in breathing, occasioned by compression of the intercostal nerves, or of the spinal cord above their origins, but this symptom is not so frequent when the curvature is in the dorsal, as when it is in the cervical region. When it is in the cervical region, the head is bent forwards, the prominences behind are not large, unless the seventh cervical vertebra be involved, and the respiration is difficult. In the early stage there may be pains and twitches of the muscles of the upper extremities as well as of other parts inferior to the seat of the disease. Sometimes when the disease is in the cervical region, especially in its upper part, it proves fatal by producing effusion in the brain, and in some cases the odontoid process having lost in the progress of the disease, the attachments of the ligaments which keep it in its proper situation, presses on the spinal cord, and thereby causes immediate death, the seat of the pressure being higher up than the origins either of the phrenic or of the intercostal nerves which preside over the actions of the muscles of respiration. Having thus given a short account of the symptoms of angular curvature of the spine generally, and the additional symptoms peculiar to curvatures in particular situations, we shall next refer very briefly to the treatment.

*Treatment.*—Any attempt to remove the curvature would be most injudicious. Anchylosis is the only favourable termination to be hoped for, and therefore the object aimed at in treatment should be to place the patient under the circumstances most likely to conduce to that result. With that view it is indispensable, first, to keep the patient in a recumbent position, so as to remove from



the diseased parts the pressure of the superimposed weight, and to preserve the parts as much as possible in a state of perfect quietude in that position, and secondly to use all means, judicious and available in the circumstances of the case, for maintaining the general health. In some cases local remedies are highly beneficial.

That it is necessary to confine the patient to the recumbent position, does not admit of question, for it is evident that the superimposed weight pressing on the diseased part, must not only act as a source of irritation, but must also tend to increase the curvature; and it can only be effectually removed by placing the body in the horizontal position. And that any effort which nature may make to effect ankylosis may not be defeated, it is further necessary that the parts should as much as possible be prevented from being moved upon each other. Another advantage which results from preserving the parts at perfect rest in the horizontal position, is that the removal of the irritation caused by the superincumbent weight from the diseased parts, diminishes the danger of the formation of abscess, which (as formerly stated) is a most unpromising occurrence, and must induce the gloomiest apprehensions as to the ultimate results. One of the best means for fulfilling the above indication is to place the patient in the supine position on Earle's bed, which, besides other advantages rendering it very convenient for this part of the treatment, allows the relative position of the trunk and limbs with regard to each other to be slightly changed, without any risk of moving the diseased parts on each other. The slight change thus allowed renders the confinement to the recumbent position much less irksome than it otherwise would be. As an additional precaution for preserving the diseased parts from any movement, it is in many instances advisable to apply splints on each side of the spine. The splints in such cases must suit the shape of the parts to which they are applied. Some recommend the patient to be placed in the supine posture, but others give the preference to the prone position, because in that attitude the superimposed weight is more effectually removed, there is no risk of heat and irritation from pressure, it favours the return of venous blood from the bodies of the vertebræ, and the approach of paralysis it is thought may be deferred, as matter will gravitate away from the medulla. This position is also very convenient when local applications are necessary, and in some cases the curve is so abrupt, that it is almost impossible with every precaution to keep the patient long on his back without producing irritation of the soft parts. But notwithstanding the above mentioned advantages, I confess I have in the majority of cases found treatment conducted in the supine posture more satisfactory, and chiefly I believe from the diseased parts being more easily preserved in a state approaching to complete immunity from motion, than is possible when the treatment is conducted with the patient in the prone position, in which I have often been annoyed by find-



ing it impossible to prevent the patient from moving the upper part of the spine by frequently moving the head and shoulders; and as far as my experience goes, the supine position is preferred by patients. Rest, however, of the diseased parts, and the recumbent position, whether the body be prone or supine, are of the utmost importance from the very commencement of the disease until a cure is effected by ankylosis. When it is believed that ankylosis has taken place, and the patient is allowed to resume the erect attitude, it is a judicious precaution to employ for some time an apparatus such as that generally known by the name of the spine supporter, for removing the superincumbent weight.

The maintenance of the general health is another and equally important indication, but unfortunately some of the best means for fulfilling it are not compatible with the rest and the recumbent position which form essential parts of judicious treatment. The great importance of attending to the general health must be evident, when it is considered under what circumstances caseous deposits are most apt to take place in bone. In individuals of a scrofulous diathesis, insufficient nutriment or clothing, living in a damp and cold or impure atmosphere, want of exposure to the sun's rays, mental depression, and any cause of debility acting permanently or habitually for a length of time, have unquestionably an influence in exciting caseous deposits in bone as well as in other textures. These considerations suggest the necessity, especially in scrofulous cases, of a generous digestible diet, living in a pure dry atmosphere (the bracing air of the sea-side being often highly beneficial), exposure to the light of the sun, the cultivation of pleasing trains of thought, the proper regulation of the digestive apparatus, and the use of such remedies as from the particular circumstances of the case are best calculated to improve the general health. The tonic medicines generally found most useful are the preparations of iron. But as far as medicine is concerned, I believe the most important point is to have recourse to those remedies which, from the particular circumstances of the case, seem most likely to preserve the digestive organs in a proper state. Besides these means, in some cases local remedies are necessary; but their employment will depend on the nature of the cause of the disease. If the disease depend upon scrofulous caries of the vertebræ, or upon softening with absorption without ulceration or caries, depletion would be worse than useless, and would tend to weaken the patient. In these cases, the surgeon must content himself with advising the recumbent position, maintaining the diseased parts in a state of quietude, and prescribing all suitable means for preserving the general health. In scrofulous caries, benefit will often be found to accrue from the early and very cautious employment of counter-irritation along with the treatment here alluded to. If the curve arise from inflammation of the bodies of the vertebræ, of their investing membrane, or of the intervertebral cartilages, slight local depletion by leeching or cupping at the



commencement of the disease, and afterwards counter-irritation, are known to be highly beneficial. The repeated application of small pieces of blister to each side of the vertebral column at the seat of the disease has been found well suited for children, and caustic issues for adults. Of the various means for producing counter-irritation, Mr Pott gave the preference to caustic issues. I have used them very frequently, and in some instances with gratifying results. It is improper to produce a great discharge, which would tend to weaken the patient, and besides, the long continuance of a profuse discharge and irritation might induce hectic fever. If abscesses form, the issues should be discontinued. Mr Pott, whose valuable works contain many cases of disease of the spine, attended with paralysis, successfully treated by the application of counter-irritants, was the first who pointed out to the profession the results of such practice, and many have since followed it with equal success. About six months ago I ceased to attend a patient, in whose case I was much gratified with the result of using caustic issues, together with rest and the recumbent posture; and I refer to the case as a striking example of the complete restoration of sensation and the power of motion of the lower limbs, after they had been for eighteen months considerably affected, and for eleven months entirely lost. The patient, who was thirty years of age, had suffered for a considerable time from pain and a sense of weakness in his back; he afterwards became affected with an angular curve in the middle of the dorsal region, and after the usual train of symptoms, ultimately lost all sensation and power of motion of the limbs. The power of motion was first lost, and sensation was first restored; but the loss of both sensation and motion was as complete as possible. When I first saw him, he had lost the use of his limbs for several months, and the curve was rather abrupt, and involved three of the dorsal vertebrae. After treatment had been employed for four months, the sensibility of the limbs began to return, and ultimately it became perfectly natural, and this was followed by a restoration of the power of motion; and for six months the patient has been in every respect perfectly well, without any remains of the disease except the curve, where, I am sure ankylosis has taken place. The case is interesting, as affording a remarkable confirmation of the fact, that the functions of the spinal cord may be for a long period completely suspended, and yet afterwards perfectly restored.



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