ON THE CAUSES OF ROTATION OF THE VERTEBRÆ IN SCOLIOSIS.¹

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THE question, What is the cause or what are the causes of rotation of the vertebræ in scoliosis, or so-called lateral curvature of the spine? has always been a troublesome one to answer, and although for many years the subject has been fruitfully studied by orthopædic surgeons both in Europe and America I believe that we may say that the question has never been fully and satisfactorily answered. In all diseases, whether they most concern the physician or the surgeon, it is to the evidence from the dead house that we look to solve the difficult problems that they present, and this is more especially true of diseases involving the skeleton and those in which mechanical problems are the most important. In scoliosis, however, it is very rarely that we have an opportunity of dissecting the subject, for the disease is not a directly fatal one, and most of the few recorded necropsies have been on advanced cases of great deformity, the subjects having died by accident or from some disease long after the beginning of the distortion. These considerations have led me to make some observations on the spine in children and young adults in order to find out under what circumstances if any rotation can occur in the dorsal and lumbar regions of the column.

My first observations were made on the normal spine in the living, in order to ascertain whether rotation normally accompanies lateral flexion. I found that in the erect position, both in children and adults, on extreme voluntary lateral flexion of the spine apparent rotation occurred; but that this appearance of rotation was due to the muscles on the convexity contracting to support the trunk, and that it did not appear when flexion was produced voluntarily or passively in the prone position, although the flexion was such that the spinous processes deviated from the straight line as far as in extreme scoliosis. I next examined the phenomena of lateral flexion in the dead body, in which, however, the natural conditions were so far altered that the sternum and cartilages of the ribs had been removed, together with all the viscera. On forcibly bending the trunk laterally, the body resting on its back, no rotation accompanied the movement, and I then divided the anterior common ligament between each of the vertebræ, and finally also the intervertebral discs and posterior common ligament, without, however, succeeding in producing any evident rotation.

The next experiments were undertaken with a view to determine the effect of vertical pressure on the spinal column in producing flexion and, if possible, rotation. The scarcity of available subjects in London prevented my trying this on the trunk as a whole, and I had to content myself with experiments on the dorsal and lumbar regions of the spine removed from the body *en masse*, with portions of the ribs *in situ*. The subjects were children of from three to seven years of age. The spine was placed on a carpenter's bench, its posterior surface resting as far as regards the dorsal region on the bench, and pressure was applied by means of a powerful wooden screw clamp. A single general curve was the result without rotation. The twelfth dorsal vertebra was then held in the middle line by a cord, and pressure again applied. A double curve was thus produced the radius of which in the dorsal region in one case was only seven centimetres, the transverse processes nearly touching on the concavity. There was no rotation, the line of the spinous processes being as curved as that of the bodies. I now examined the effect of fixing the spinous processes in the middle line by inserting them into a narrow groove in a piece of deal. Pressure was applied until the wood gave way, without producing rotation. Oak was then substituted for deal, and as much force applied as possible, but distinct rotation was not produced. The ends of the ribs were removed, and first the anterior common ligament and afterwards the discs and posterior common ligament and all the tissues between the transverse processes on one side were divided, but the result was still negative. On removing the spine, a very slight twisting effort of the hands was

enough to separate it into two or three portions, with separation of the bodies of the vertebræ. The principal obstacles to this rotation appeared to be the articular processes, which obstacle was overcome by the overriding of the superior by the inferior processes of the vertebra next above, with consequent separation of the vertebræ. In the spine with the ligaments intact the greatest twisting force that I could apply with my hands did not produce at most a greater rotation than 25°. It would thus appear that, while a certain limited amount of rotation is possible in the normal spine, it is not a normal accompaniment of flexion, and, indeed, that it is difficult to produce artificially. We know also that in lateral curvature of the spine, resulting from pleuritic adhesions, rotation is absent, as it is also in those temporary curves which occur in those whose lower limbs are of unequal length.

It is surely a fair inference to draw from the foregoing observations that there is some pathological condition present in scoliosis from the first which allows of the gradual production of rotation, and this condition I believe to be a certain tendency of the ligamentous structures to yield, that is generally known as want of tone, and which is evidenced in the flat-foot which so often accompanies it. But this laxity of the fibrous structures is not enough to account for rotation, and I believe that it is to the muscles that we must look for an explanation. On the first occurrence of lateral yielding of the column the erector muscles of the spine are called into play to correct the deformity and maintain the spine in the erect position, and the muscles situated on the convex side of the curve have obviously to perform the greater amount of work. Of these muscles, some, such as the spinalis dorsi, are attached at both ends almost entirely to points in the middle line; these can have little effect in producing rotation, although they may, and do, tend to keep the spinous processes in the straight line. Others, however, and these form a large part of the muscular mass occupying the vertebral groove, are attached at one extremity to the middle line, and at the other to the transverse processes, and the angles of the ribs, running obliquely from one part of the vertebral column to another. Such are the erector spinæ, longissimus dorsi and sacro-lumbalis, multifidus spinæ, semi-spinalis dorsi, and rotatores spinæ.

Now it is obvious that when the muscles of both sides act equally to straighten the spine there is no tendency to produce rotation. When, however, there is a lateral yielding of the spine the muscles on the convexity alone are called into action; and although they tend to straighten the line of spinous processes, they have also a distinct rotatory action, which long exerted on a column whose fibrous tissues are inclined to yield produces a twisting, their action being unbalanced by any muscles on the anterior portion of the spinal column. Absorption of bone takes place where there is constant pressure, and adaptive secondary deformity of the articular processes and bodies follows, while in some cases the transverse processes are bent in towards the middle line. This process, as we see it going on in the living subject, is of course a most gradual one, the change being almost imperceptible from month to month, but that such a force as that exerted by the muscles must tell in time must be admitted. It appears probable that some alteration in the nutrition of the bone occurs in these cases, perhaps such as the "late rickets" described by Macewen, but I am not aware that any direct evidence of this has been produced.

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REMARKS ON VACCINATION, WITH THREE CASES OF ACCIDENTAL VACCINATION.

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AT the present time, when public interest in the success or failure of compulsory vaccination is widespread and is manifested by all classes of the community, and when we have a Royal Commission at present engaged in the determination of the value of vaccination as a national institution, I presume that contributions that throw light on the subject will be welcome.

It is undeniable that since the institution of vaccination, small-pox has practically disappeared in this

¹ Read at the Tenth International Medical Congress, Berlin, 1890.

country. That the one is the result of the other is for the most part called in question only by those who lack the requisite knowledge and training to form a just opinion on the subject. If, however, we conclude that the relation between vaccination and the practical elimination of small-pox is a causal relation, vaccination should be thorough; and if it is still to be enforced, stringent rules ought to be laid down to ensure this. Single vaccination is now held by most authorities to be insufficient as a variolous prophylactic. Medical practitioners are far too apt to yield to the feelings of an anxious mother who is most importunate that he will make only one "pock," or, if two are required, that he should make them very small; for unless the practitioner humours the maternal feelings in the matter, he runs a risk of losing his position as family physician. Every practitioner should, in my opinion, be legally required to make three punctures, and forbidden under a penalty to sign any vaccination paper unless three good vaccine vesicles or cicatrices can be shown over the part vaccinated. Until such a standard is made compulsory, we cannot hope to prevent small-pox from stealing into our midst from time to time. The chances of communicating disease by means of the operation have, however, to be considered. This grave circumstance, I regret to say, has unquestionably happened to my certain knowledge even within my own brief experience. Now with so many first-class establishments for the preparation of lymph, there is not much difficulty in procuring pure calf lymph, and if all medical men were to vaccinate direct from the calf or from child to child only when there is undoubted proof of clear family history, disastrous sequences from vaccination would seldom occur. I think if this point were more carefully attended to such diseases as scrofula and syphilis, the diseases most commonly transmitted in this way, would much less frequently be seen as the apparent result of heredity. The following short clinical report and history of three cases of accidental vaccination, which recently came under my notice in the south of England, may be interesting to the profession.

CASE 1.—Mrs. J—, a young married woman about twenty-five years of age, with an infant, which had been vaccinated only ten days previously, sent to consult me regarding a very painful and rapidly swelling condition of the face. On examining the patient I found her suffering from an erysipelatous inflammation of the left cheek, but on inquiring into the case I suspected that it was not a case of true erysipelas. At the left ala of the nose I observed a small red papule, becoming vesicular as it developed, and on the ninth day it was distinctly pustular in appearance. After this the inflammation rapidly subsided, and a scab formed which fell off about the eighteenth day, leaving a very typical vaccination cicatrix.

CASE 2.—Mrs. B—, a married woman aged thirty-five, was believed to be suffering from the "rose" in the face. On examination I found the very same condition as in the former case. The erysipelatous inflammation had commenced on the right cheek and was much more marked. The right eye was already closed and the inflammatory condition had passed over the bridge of the nose and also affected the left side of the face. In this case also there was a distinct red papule at the side of the nose. Having considered the condition in the light of the experience gained from my former case, and from the fact that I had vaccinated her infant only ten days before she complained, I diagnosed the affection as erysipelatous inflammation due to the irritation of vaccine matter accidentally got direct from the child's arm. In both these cases, there was distinct history of a scratch at the side of the nose, and of the mother having fallen asleep with her nose on the vaccinated arm of the child.

CASE 3.—J. W—, aged thirty-nine, a cowman, consulted me. It was a similar malady to the preceding cases, but as he was an unmarried man I had to look for something else than a vaccinated child for the explanation of the condition. On inquiring into the patient's history I found that his daily occupation was to attend the cows at a farm, and that he helped to milk them morning and evening. Having some difficulty in milking some of the cows he observed they were suffering from bladder-like vesicles on their teats, which, after a few days, became pustular, and then formed scabs, which shortly afterwards fell off. At the time he observed the vesicles on the cows' teats, he says he had a small sore at the side of his nose, and as it slightly itched he sometimes rubbed it during

the process of milking the cows. A condition very similar to the two previous cases soon appeared on his face. I firmly believe that the cows were suffering at the time from cow-pox, and that this man's case was one of true vaccination directly from the cow-pox. All these patients had previously been unvaccinated, and now I believe they have accidentally got the full protection of vaccination, and thereby most unlikely to ever have an attack of variola. If, however, they should contract the disease, it will be in a highly modified form. The treatment in each case was alike, a saline aperient being given occasionally, and small doses of quinine and iron being given four times daily, and the parts protected from cold.

I hope that the record of these observations will stimulate more eminent men to endeavour that so important a national institution as vaccination shall be put upon a proper basis, to secure protection at least for the innocent and for those who possess too little knowledge to enable them to form a reasonable opinion for themselves on this important subject.

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Clinical Notes:

MEDICAL, SURGICAL, OBSTETRICAL, AND THERAPEUTICAL.

ATTEMPTED SUICIDE BY MEANS OF OXALIC ACID.

BY R. REGINALD SLEMAN, B.A. CANTAB., L.S.A. LOND.

I WAS recently called to see H. L—, aged sixty, caretaker. On arrival at his house I found him in severe pain and much collapsed; pulse 50, small, and easily compressible; face pallid and anxious; extremities cold. The friends suspected that poison had been swallowed for the purpose of committing suicide, and on taxing him with this he admitted having taken three teaspoonfuls of oxalic acid half an hour previously. I was luckily able to get, within a few minutes, a pint of lime-water, the whole of which the patient was induced to swallow, with the result that there ensued copious vomiting of blood, mucus, and a little food, &c. A further dose of lime-water was administered after the lapse of two hours, and the patient was then put on fluid diet, and opium given internally, as there was constant gastric pain. In the second week after the attempt an attack of vomiting with hæmatemesis set in, which, however, yielded to ice and other astringents. A month later the patient was convalescent.

This case is interesting on account of oxalic acid being rarely used for poisoning purposes, and more rarely still with suicidal intent. When first summoned to the case, the extreme depression of the man's pulse at once showed me the gravity of his condition, and I am of opinion that the prompt action of the lime-water saved his life. An important point in the prognosis was the fact that the poison was not taken on an empty stomach, the patient having breakfasted about an hour previously. The motive for the act could not be discovered. He was in poor health previously to the attempt; but, on the other hand, was in a good position and well to do.

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DOUBLE PRIMARY AMPUTATION ABOVE MIDDLE OF THIGH.

BY W. A. MACKAY, M.D., F.R.C.S. EDIN.

I DESIRE to place on record the following case as an instance of recovery from a very grave injury.

W. R—, an English sailor, aged twenty-six, was run over by four waggons of a mineral train. The wheels passed obliquely over both legs well above the knees. At 8 P.M. on Oct. 4th, 1889, in the English Hospital, the right leg was amputated just below the trochanter, and the left a little above the middle of the thigh. The circular operation was performed in both instances. I was assisted by my friend and colleague, Dr. Garcia Lopez. The patient was wildly delirious through the night. On