REDUCTION OF CERVICAL DISLOCATION.

A Successful Case.

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REDUCTION OF CERVICAL DISLOCATION: A SUCCESSFUL CASE.[1]

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THE frequency of cervical dislocation without fatal result, is a subject to which I have already called attention in various articles,[2] the number of cases coming under my observation showing that the lesion is not one of great rarity, although probably frequently overlooked. The discomfort of this disability, even where no paralysis or special pain is present, can hardly be overestimated, and the disfigurement is by no means trivial. Relief of the condition is certainly a desideratum, and such cases as the one I have to report seem to show that such relief is within easy reach when the relations of the parts are thoroughly understood.

CASE. R. H., a boy ten years of age, fell from a shed about a week before his application to the hospital. He came to the Surgical Out-Patient Department of the Massachusetts General Hospital, in the service of Dr. Mixter, who recognized the trouble at once, and who kindly asked me to see the case.

The boy was fairly developed and well nourished. The head was bent towards the right shoulder, the face turned to the left, and the chin somewhat elevated, the position being that of torticollis from spasm of the sterno-cleido-mastoid on the right. This muscle

[1] Read before the Surgical Section of the Suffolk District Medical Society, November 1, 1893.

[2] Journal of Nervous and Mental Diseases, 1889; also Boston Medical and Surgical Journal, March 31, 1889.
Boston Medical and Surgical Journal, May 8, 1890.
International Clinics, 1892, 2d series, ii, p. 207.

was, however, lax, while the muscles on the left side of the neck were put upon the stretch. He could not

FIG. 1. Before operation.

voluntarily straighten the head, although it could be forced around so that the face pointed forward, but immediately relapsed when left to itself. There was

a hollow over the spinous process of the fourth or fifth cervical vertebra. Examination of the chest was neg

FIG. 2. After operation.

ative, the respiration was normal (21), the pulse 71, the temperature 98.5°. The gait was normal. There was no paralysis of motion or sensation in either ex-

tremity, and no other abnormality, except the displacement of the neck. There was no special complaint of pain, except on lying down (practically impossible), and no special swelling or bogginess of the tissues. The diagnostic features of typical unilateral dislocation were therefore present: namely, immobility and displacement, with the head in the position of torticollis, with laxity of the sterno-cleido-mastoid on the side which would produce such deformity, together with a stretching of the muscles on the other side of the neck.

We decided upon immediate operation, and the patient was admitted to the house for this purpose, in the service of Dr. Beach. Dr. Beach decided, at my suggestion, to attempt reduction by retro-lateral flexion and rotation without extension.

The patient was etherized, the vertebræ first unlocked by bending the head diagonally backwards and towards the left, then rotated into place. No force was required. Reduction was immediate and complete. The hollow over the spinous process disappeared. There was no click heard. He was sent to the ward, recovery from ether being good. The next day, all motions of the head were perfect, and no pain was complained of on lying down. The patient was not allowed, however, to raise the head from the pillow. On the fifth day after operation the boy was apparently well, and was allowed to have his clothes. Going into the yard without permission, he ran out of the back gate. He was heard of at intervals after this time, remaining well as far as the head was concerned, although he had an attack of diphtheria in the course of the summer. The second photograph, taken about three months after the operation (the earliest opportunity), shows perfect position of the head.

This case represents the complete form of unilateral

dislocation, the right articular process of one vertebra slipping forwards and falling down upon the pedicle of the vertebra below — that is, into the intervertebral notch, this accident being rendered easy by the comparatively horizontal position of the articular processes in the cervical region. The position of the vertebræ is seen in the cut (Fig. 3).

Völker considers rotation the essential factor in the displacement, differing from those who regard abduction as also important. Such dislocation is practically

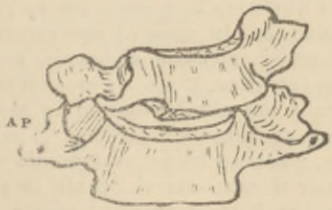

FIG. 3. Anterior view of vertebræ in complete unilateral dislocation, as seen in Fig. 1. A P, articular process of upper vertebra displaced forwards.

impossible in the dorsal or lumbar region without fracture. Fracture of this process also sometimes occurs in the cervical region, together with displacement — a fact which should be taken into consideration before recommending operation. This complication is, however, fortunately rare. The combination was present in one case, however, which was seen by Dr. Richardson, Dr. Hildreth and myself, in which the position of the head was much the same as in the case here reported; but the probability of fracture rendered attempt at reduction dangerous, for fear of producing injury to the cord or nerves, which were hitherto intact. This immunity will be made clear if two cervical vertebræ are placed in the position indicated, it

being perceived that the lumen for the spinal cord is little if at all invaded.

Coming to the question of the proper method for reduction, if one attempts to separate the two vertebræ, which have been placed in the position indicated, by direct extension, it will be seen that the vertebræ must be very widely separated at every point in order that the displaced articular process may be elevated. In fact, the separation is so great that it would seem almost incredible that reduction had ever been accomplished in this way were such cases not on record. It is not impossible that in some of the successful cases reported as done by extension, abduction and rotation were added to extension, these three elements constituting practically the plan advocated in the "American Text-Book of Surgery" (1892). The extension may probably, however, be advantageously done away with; especially if retro-lateral flexion be substituted for abduction, the latter movement tending, perhaps, in some cases, to interfere with reduction by bringing more closely into apposition the two articular processes already impinging; whereas the backward movement is practically certain to unlock the displaced upper process. Since advocating this movement and the discontinuance of extension in previous contributions,[3] I find, on further study of the literature, that Richet[4] and Hueter[5] advocated similar plans early in the sixties, Richet[6] proposing abduction and rotation, though

[3] Boston Medical and Surgical Journal, September 15, 1892, p. 265. Journal of Nervous and Mental Diseases, September, 1892.

[4] By Richet's original report it seems that strong extension was practised by an assistant; while he, by putting his own hands over those of the assistant, performed the abduction and rotation, adding at the same time something to the extension. This seems to have been overlooked by Hueter, who made an abstract of Richet's article, and who gave him (Richet) the credit, which was rather due to himself, of abandoning extension.

[5] Langenbeck's Archiv., Bd. ix, s. 946.

[6] Gaz. des Hôp., 1863, p. 574.

not without extension, and Hueter discarding extension. Völker[7] discussed the subject in 1876, considering extension and rotation equally efficacious with abduction and rotation. Hueter's plan seems to have been disregarded in practice, and since his time, as before, extension has been generally, in fact almost invariably, relied on as an essential part of the reduction. I find no reference to Hueter's suggestion in the "International Encyclopædia of Surgery" (1884), where extension is recommended as an essential part of reduction. Stimson[8] regards Hueter's plan favorably in his work on dislocations.

The essential elements in the plan here advocated are, (1) dispensing entirely with extension; (2) using only retro-lateral flexion and rotation. The plan is not, therefore, entirely novel, but is really a reversion to Hueter's methods, with a modification of the direction of the initial movement from simple abduction to retro-lateral flexion.

The extension generally practised seems to me not simply superfluous, but to detract from the best result, in that it tends to draw up the lower, along with the upper segment, and hence only to interfere with the lever movement which really accomplishes the unlocking.

It might be supposed that the tension of the muscles would have also to be taken into consideration in the operation. Apart from the fact, however, that etherization should always be employed in the operation, which would render the muscles lax, experiments on the cadaver show that the muscles may be practically disregarded, the ligaments alone serving to hold the vertebræ firmly in the new position. Such experiments (previously reported) were conducted by Dr.

[7] Deutsche Zeitschrift f. Chirurgie, 1876, vi, p. 424.
[8] Fractures and Dislocations. New York, 1888.

Richardson and myself in the dissecting-room of the Harvard Medical School. In a series of bodies all muscles were removed, leaving the spinal column with its ligaments alone intact. The vertebræ were then displaced in the typical manner. It was found that no moderate amount of traction in a direct line would raise the displaced articular process in the least degree. It was found, however, easy to unlock the displaced articular process by retro-lateral flexion, that is, by bending the head obliquely backwards and to the side — the side opposite to that of the displaced process — that is, in the typical (complete) case, to the side opposite to that in which the head is bent. For this manœuvre it was found that an inappreciable amount of force was required, and comparatively little elevation. Rotation into position completes the reduction. This was the method adopted by Dr. Beach in the case above reported, and with perfect success.

Cases sometimes occur in which the position is not one of the complete variety. As an instance, I will cite the case (already published), of which the photograph is here given, of a boy who fell upon the ice while skating backwards. Displacement with immobility occurred, followed by paralysis of the shoulder and considerable pain in the neck. When seen at the hospital some months later, the condition was that represented in the picture. It will be seen that the head is bent to the left, and that the muscles on the right are put upon the stretch. The position of the head is, however, not that of torticollis, in that the chin is not rotated to the left, nor elevated. The obvious inference in such a case is either that the articular process on the left has slipped backwards, or that the articular process on the right has slipped forwards, but has not fallen into the intervertebral notch. Manipulation of the vertebræ on the skeleton shows that

the former dislocation would be an extremely improbable one, at least, unaccompanied by fracture,[9] and

FIG. 4. Incomplete form of dislocation.

that, even if it were possible, the head would not be bent to the left, but, if anything, rather to the right.

[9] Blasius, quoted by Stimson, only found one case of backward unilateral dislocation, and in this case fracture occurred also of the lamina and body of the vertebra below.

Displacement of the right articular process in the manner indicated would, however, explain perfectly the position of the head ; as this process, if arrested in the course of riding over the articular process below, would be higher than the corresponding process on the left (Fig. 5), and thus cant the head to the left, while turning the face in the same direction. To reduce the dislocation in this case the head should certainly have been bent backwards and to the left, then rotated. It is not, therefore, safe to blindly follow the rule of

FIG. 5. Anterior view of displaced vertebræ in form of dislocation seen in Fig. 4. A P, articular process caught before dropping into intervertebral notch.

bending the head, either in the direction opposite to, or towards that in which it is already bent.[10] Paralysis in this case (due probably to stretching of nerve roots), which included the supra- and infra-spinatus and the deltoid, gave us a clew to the height of the displacement. There was also an irregularity in the spinous

[10] Stimson regards this form as the more common, alluding to the complete form as follows : " Not only may the abduction of the upper segment of the column, which is necessary to the production of the dislocation, be almost entirely corrected by the sinking back of the articular process of the upper vertebra into the notch of the lower one." In the description of the proper method of reduction to which I have alluded, this form is also apparently taken as the basis, for he says the articular process should be freed by still further abducting the head and upper segment of the column (away from the side of the dislocation).

processes at about the height from the third to the fourth vertebra. It might be supposed that such displacement would always be easily recognized in these cases. This is, however, not the fact. Examination of the spinous processes should always be made, but in many cases will be found unsatisfactory, especially where there is a swelling of the tissues, such as sometimes occurs in comparatively fresh cases.

Bilateral dislocation, both forwards and backwards, is comparatively rare. I have seen one example of the former and have a picture (given me by Dr. Richardson) of the latter. In the former case the head was displaced forwards, and the face pointed upwards; in the latter, the chin was bent towards the chest. Direct extension in such cases has required extreme force and has not always proved successful. It would seem reasonable, therefore, as Heuter formerly suggested, that the attempt be made to first reduce one articular process, then the other, in the method indicated for unilateral dislocation, extension here also probably hindering rather than assisting.

This whole subject appears to have received little attention in comparison with its importance; partly, perhaps, because such accidents are erroneously considered extremely rare. In Lidell's elaborate article[11] on the subject the different forms are described with great accuracy, and twenty-nine cases of unilateral dislocations are quoted from Ashhurst's tables. I have already reported sixteen cases of dislocation without fatal result, since which I have seen two more typical cases and several others in which this diagnosis was taken under consideration, but in which the displacement was so slight as to render the diagnosis uncertain. Most of these cases were unilateral. This would seem to indicate that the lesion is not one of

[11] International Encyclopædia of Surgery, vol. iv, p. 709.

great rarity. The subject is renewed here for the purpose of calling attention to the importance of being on the lookout for this condition as well as of renewing the discussion regarding the proper method of reduction, and establishing the success of the method advocated. Operative interference has already proved successful in a large number of cases, as already stated, generally, by direct and forcible extension combined with manipulation of the displaced parts. Dr. Burrell informs me, however, that he has performed the reduction without extension, and I dare say others have done so without reporting the cases.

The number of cases of spontaneous reduction observed is striking, in contrast with the cases of operative interference, where extreme force has been necessary. Dr. Beach has forwarded me a communication regarding a case, hitherto unpublished, occurring in his practice, which will serve as an excellent example of spontaneous reduction. The communication is as follows:

BOSTON, October 10, 1893.

MY DEAR DR. WALTON: With this I forward the notes of a case which occurred in my private work, and may be added to the hospital case if you would like to have it.

In June, 1889, a child between six and seven years of age was brought to me with the deformity characteristic of dislocation in the cervical region of the vertebræ. She had fallen from a hammock a few days before that, and, either in falling or striking, produced the luxation.

There was no contusion or tenderness to indicate the location of a blow, nor could she give any clear idea of being struck in the fall. Upon examination of the spines of the cervical vertebræ, the line from the second to the fifth was concave, the convexity towards the pharynx. An inspection of the larynx disclosed a convexity corresponding to the body of the third vertebra. For the first few days after the injury the muscles of the neck were rigid, and there was lameness on both sides of the neck, not well

defined. Very little motion was possible. Rotation began first, and afterwards flexion. With the exception of some difficulty in eating there was no impairment of any function.

At the time of her visit to me, she had lost a certain amount of muscular rigidity and could flex and rotate the head to a limited degree. In view of her improvement, I advised against any extension under ether, and requested that a plaster cast be made to preserve a record of the deformity. Before this could be done, however, a spontaneous reduction took place on the second night after my examination, when, after being much fatigued by her journey, she slept very soundly. On the following morning the cervical vertebræ were in perfect position and she had free motion of the head in every direction.

Yours sincerely,

H. H. A. Beach.

There was considerable controversy in former times as to whether pure dislocation of the vertebral column was possible even in the cervical region. This point has, however, become so fully established as to require no discussion here. It is certainly true that pure dislocation in the dorsal and lumbar regions is practically impossible; in the cervical, however, it constitutes a large proportion of the cases. Lidell's estimate that dislocations of the cervical vertebræ constitute one-half the cases of vertebral injury met in civil practice, is probably not an over-estimation. Bryant [12] treats this subject as being of comparatively little importance to the practising surgeon. Still, as Lidell has pointed out, the establishment of this fact and the diagnosis of dislocation from fracture, or the combination, is of great importance when we come to consider the question of operation. On this point, namely, the advisability of operation, there has been in the past more or less difference of opinion. Boyer and Dupuytren, for

[12] Practice of Surgery, Chapter xviii.

example, object to attempts at operation as dangerous. Erichsen considers the attempt only justifiable where the danger is imminent. Porta, Bryant, Ashhurst, Lidell and others, on the other hand, favor operation. Lidell states that there is a hope that the fatality will be considerably diminished by improved methods. It would seem that successful cases of reduction have been already sufficiently numerous to warrant the attempt, with care, even under the methods commonly employed. Successful cases have been reported, for example, by Gray,[13] Wood,[14] Völker,[15] Hickerman,[16] Schuk,[17] Schranth,[18] Stout,[19] Aubert,[20] Van Walther,[21] Guerin,[22] and others. Ashhurst, in his list of twenty-nine cases of unilateral cervical dislocation, reports sixteen in which attempts at reduction were made, all but one being successful. It seems probable that this is a rather large proportion, many unsuccessful cases having probably not been reported. Among unsuccessful cases followed by death may be mentioned those reported by Gaitskill,[23] Spencer,[24] and Petit Radel.[25] There have been unsuccessful operations followed by spontaneous recovery.

To recur to Völker's views: this writer has reduced a case of complete unilateral dislocation by extension and rotation (the reduction requiring, however, several attempts for its completion), and argues that this

[13] Annals of Anatomy and Surgery, February, 1882; also, American Journal Medical Sciences, April, 1882.
[14] New York Medical Journal, January, 1857, p. 13.
[15] Loc. cit.
[16] Buffalo Medical Journal, vol. x, p. 702.
[17] American Journal Medical Sciences, July, 1841, p. 207.
[18] Hamilton: Fractures and Dislocations, 1880, p. 606.
[19] University Medical Magazine, 1891-2, iv, p. 296.
[20] Contrib. à l'étude des luxations des vertèbres cervicales; Quelque cas hereux de reduction, Paris, 1889.
[21] J. der Chirurgie und Augenheilkunde, Berlin, 1822, iii-i, p. 197.
[22] Revue Medicale, 1840, p. 276.
[23] London Repository, vol. xv, p. 282.
[24] Boston Medical and Surgical Journal, vol. xv, No. 11.
[25] Note to Boyer, Malad. Chir., vol. v, p. 118.

method is equally logical and easy with that which he has credited to Richet — an opinion which seems generally to have prevailed since that time.

With regard to direction of abduction, when practised, there seems to have been some obscurity of expression. Völker quotes Hueter as recommending to bend the head towards the shoulder towards which it is already bent, then to rotate; but rightly comments that in cases of complete dislocation this would be exactly the wrong direction. He substitutes, therefore, the suggestion of bending the head to the side where no projection (Hervorragung) is noted; then rotating. It is not impossible that the obscurity of these directions have been in part at fault for the non-adoption of the method. These arbitrary rules are difficult to remember; but if one attempts to carry any given rule into effect, I should suggest the following: Perform retro-lateral flexion toward the side toward which the face is turned by the dislocation, then rotate back to place. The force of this rule will be appreciated by remembering that rotation must always take place away from the displaced side, except in the case (which may be practically disregarded) of displacement backwards. It is also well to remember in diagnosis, that the face is turned from the displaced process, no matter which way the head is bent.

In some cases, it is true, there may have been so little rotation in the dislocation as to render the diagnosis difficult between dislocation and inflammatory process. Gentle attempts at reduction would, however, as Völker states, be always in order in such cases, to effect the cure, and at the same time to establish the diagnosis.

The ease with which spontaneous reduction takes place in sleep was commented on by Völker as due to relaxation of the muscular strain kept up in the waking

hours to prevent pain, such reduction being easily conceivable when it is realized that the part of the articular process which bars the way to reduction is only about six millimetres in height, perhaps less.

The advisability of using ether in all attempts at reduction is too apparent to require mention.

With regard to the method usually advised and followed, Lidell says (loc cit.) p. 723:

"Had I this case now to treat, I should, as soon as it became clear that the man would not recover under an expectant line of treatment, that is, on the second morning after the accident, relax his muscles completely by administering an anæsthetic, and then by carefully made *extension and rotation, etc.*,[26] try to restore the dislocated bone to its normal position."

He quotes Ashhurst (p. 729) as saying: "In the treatment of dislocation of the cervical region, the mortality has been nearly four times greater when constitutional or general treatment has been relied on exclusively, than when attempts have been made to reduce the dislocation by *extension, rotation, etc.*"[26] Lidell continues: "It seems to me that the inference is fairly warranted from the foregoing considerations that *extension*[26] (combined, of course, with rotation or pressure, as required) should be employed in every case of spinal dislocation or of spinal fracture with dislocation where the spinal functions are disturbed.

Looking more closely into the order of procedure, we find that one plan seems to have been to first rotate in the direction in which the head is already turned, then to extend and rotate the head back to place (Maxson,[27] Wyeth[28]); another method has consisted of extension followed by rotation (Rathburn,[29] Gray,[30]

[26] The italics are mine.
[27] Buffalo Medical Journal, January, 1857, p. 479.
[28] Hospital Gazette, New York, June 28, 1879, p. 275.
[29] Peoria Medical Monthly, 1839, ix, p. 280.
[30] Loc. cit.

Perisot, Berthold,[31] Lucas[32]); another, suspension of the head and rotation of the body (Morton[33]); another, as extension and manipulation (Van Walther). In bilateral dislocation steady extension, followed by direct replacement without rotation, has been adopted (Ayers[34]); with slight rotary movement (Stout); extension with rocking movement, and finger in the pharynx (Carter[35]).

With regard to the degree of force used in extension, this seems to have been in most cases very considerable: Suspension of the head between the hands (by Morton); strong extension (by Wyeth); a considerable amount of force — "all, I believe, I was capable of exerting" (by Carter); chin and occiput held by the hands of the operator covered by those of another, strong traction being employed with counter-extension by folded sheets around the shoulders, a third physician placing the hands under those of the other two, to aid replacement (Ayers); "steady pulling, gradually increasing" (Thon[36]); three pull the head and one the shoulders with the whole weight (Schranth); place the knees on the shoulders, drawing the head, then turning it into position (Erichsen); a hand on the forehead and on the occiput covered by those of an assistant, counter-extension being firmly maintained (Gray).

Even the degree of force indicated has not always proved successful, as in the case of Warren, in which subsequent spontaneous reduction pointed the way to direction rather than force as the key to the situation.

It is certainly in the line of advance (notably illustrated by Bigelow's brilliant exposition of hip-joint

[31] Monthly Abstract Medical Science, June, 1875.
[32] Medical Gazette, Sydney, 1884–5, iv, p. 41.
[33] Medical Record, October 4, 1879.
[34] New York Medical Journal, January, 1858, p. 13.
[35] New York Medical Record, 1885, xxviii, p. 257.
[36] Austral. Medical Gazette, Sydney, 1883–5, iv, p. 82.

reduction) in other dislocations to do away with this excessive force, and to follow backwards as nearly as possible the movements made in dislocation — an object which we are here aided in accomplishing by the use of the fulcrum.

The question naturally presents itself: After how long a time shall we advise operation? Gray's case was successful after four months. The spontaneous reduction in Warren's case, already alluded to, took place after nearly as long a period. Guerin reduced a case after seven months. We should err on the side of caution when any question of fracture is present, or where great force is to be used, even in simple dislocation; but when we consider how little force is necessary by the method advocated, as shown by Beach's case, there seems little or no risk in attempting reduction after a considerably longer period than four months has elapsed, though the exact length of that period it would seem premature to determine without further experience. Attempts should be abandoned if the displacement is not easily reduced.

DISCUSSION.

Dr. H. H. A. Beach: Dr. Walton has certainly given the subject a most careful investigation. I wish to express my indebtedness to him also for suggesting the method of reduction to which a successful result is due. I do not think that one can appreciate the ease with which such a reduction can be accomplished without seeing it. There is as much difference between the method employed and the ordinary way by extension and counter-extension, which I have commonly used and seen employed in the treatment of spinal cases, as there is between the old way of reducing hip-

joint dislocation by the pulleys and that by flexion and rotation. Dr. Walton has cleared up the haze and uncertainty enveloping the directions for reduction prescribed in standard text-books, by his explanation of the mechanism of the articulation and by demonstrating conclusively how and for what purpose the force employed should be applied. An interesting point suggested by my experience in the treatment of this case is the importance of the ligamenta-sub-flava as an obstruction to reduction. Under the complete relaxation afforded by ether, the deformity persisted; eliminating, so far as one case could supply evidence, the muscles as a factor in maintaining the deformity of dislocation. This estimate of the muscles as an opposing force in reduction is strengthened by Dr. Walton's experiments with Dr. Richardson on the cadaver, the muscles having been removed from the neck before producing dislocation.

If the muscles are excluded as the factor in maintaining dislocation, what is there to explain the condition? Only the ligaments are left, as Dr. Walton has stated. Of these, it seems to me that we may eliminate those that connect the skull with the atlas, the atlas with the axis, and the latter with the third vertebra, in view of the fact that fractures or dislocations there are inevitably followed by rapidly fatal results. The supra-spinous, the inter-spinous and the inter-transverse ligaments may be excluded, as being imperfectly or barely represented in the cervical portion of the vertebral column, leaving only the anterior common ligament and the posterior common ligament as directly connecting the bodies, and the capsular ligament surrounding the articular processes, the latter permitting the greatest amount of mobility and need not be considered in the matter of reduction. Last of all let us recall the origin and insertion of the ligamenta-sub-

flava, a strong and tough structure composed of yellow elastic tissue, connecting the laminæ of the vertebra above with its fellow, below, and extending from the root of the articulating process of each side to the point where the laminæ converge to form the spinous process. It is rational in the consideration of luxation to admit the importance of so powerful a ligament, which by its close attachment to the roots of the articulating processes holds them firmly together. I must confess that no other explanation so satisfactorily accounts for the firmly locked vertebræ in their misplaced position, even after the patient is etherized; or for the elastic resistance experienced by the operator during the tension necessary for lifting the superior articulating process enough to permit its rotation to the normal position.

In short, the method provides a carefully planned manœuvre, executed without doing violence to the ligamentous structure, and well calculated to lift the articulating process of a dislocated vertebra by leverage about one-third of an inch, after a considerable resistance is perceptible, and by a slight rotation, remedy a dangerous lesion. Even with fracture I should think that if it were done carefully there would be no impropriety in an attempt at reduction.

Dr. M. H. Richardson: The work that Dr. Walton has done in this subject is, I think, of great value. Even if this method was tried early in the sixties none of us have been familiar enough with it to apply the principles. Cases of dislocation of the neck are certainly not infrequent. They are certainly as frequent as dislocations of the hip. The results are quite as serious as dislocations of the hip, even where the cord is not pressed upon. In the experiments which were made at the Medical School, as I remember them, I was convinced that the trouble with the former methods

of extension and counter-extension was in traction upon the wrong ligament. In the old method of traction on the hip with extension and counter-extension, you pulled on the ligament and had to rupture it. I think the same thing is true in these unilateral dislocations, and for that matter in bilateral dislocations. Certain ligaments were put upon the stretch, and that is one reason why in dislocations there is impaired mobility. The ligament is put upon the stretch, and to reduce it by extension or counter-extension you must tear that ligament in two, whereas if you understand exactly the way in which the bones are locked together, by this manipulation the ligament is relaxed which keeps the bone in position, and the bone is lifted into place with the greatest ease. I believe also that the muscles have a good deal to do in keeping this dislocation unreduced. When the muscles have all been removed, as in the dissecting-room, it is very hard to keep that dislocation unreduced of itself. Of course, the force which produces the dislocation tears the ligaments which bind the bones together in normal position, and to reduce that dislocation these ligaments do not stand in the way. That is the reason why by proper manipulation, by going through reversely the same course by which the bones got out of place these ligaments do not stand in the way. Even under ether there is always a contraction of the muscles which keep the bones in that dislocated position; and I believe that whatever force is necessary is in overcoming that muscular contraction, and not in any opposition offered by the ligamentous structures. I have seen the method of counter-extension tried. I think that must be Dr. Warren's case that Dr. Walton referred to. I was not aware of any spontaneous reduction. Two or three of us were at one end of this man, and two or three at the other. We pulled as hard as we could, and it produced no ef-

fect whatever. This man was discharged, and sent to Tewksbury to die. I think he had pressure on the cord. I saw him some months or years afterwards running an elevator in Jordan & Marsh's. I do not think there was any reduction of the dislocation. He held his head in the same peculiar position afterwards as before. It certainly seems to be our duty in cases of dislocation without pressure on the cord, and in fact even with pressure on the cord, to go through these manipulations. If any one has a clear understanding of the lesion, I do not believe there is danger of doing harm. If you do not understand the condition of the two bones, you will be increasing the amount of displacement and encroaching upon the spinal canal sufficiently to press the cord. I feel very much indebted personally to Dr. Walton for his paper.

Dr. G. L. Walton: The suggestion of Dr. Beach's I think is a very valuable one regarding the ligamenta-sub-flava, and explains what seems rather difficult to explain without bringing into consideration a ligament which is elastic. It is a point that had not occurred to me at all. Dr. Beach and Dr. Richardson have given me a great deal of credit, but both have aided me much in reference to the anatomy of the parts and their relations, and I have to thank Dr. Beach for allowing me to publish this case. I think a great deal of credit is due to the surgeon who has the courage to attempt the reduction of these dislocations. In reference to the case Dr. Richardson has alluded to, I suppose this is the one which Dr. Warren asked me to see and from which my study of this subject dated. This man's head was bent backwards so that the face was pointed upwards, both articular processes having slipped forward. There was such pressure on the cord that he had a spastic gait, clonus, and exaggerated reflexes and numbness up to the chest. He got steadily

worse and was finally unable to get about. He was sent to the Convalescents' Home, I think. While there they were giving him a warm bath and pouring cold water down his back at the same time. He experienced a shock like an electric shock and the bones slipped into place, excepting that the head was held somewhat stiffly afterwards; but it was not in the original position. He certainly could not have recovered the use of his limbs unless there had been a reduction.

Dr. Richardson: We are not speaking of the same case. The man to whom I alluded did not hold his head up as Dr. Walton has described.

Dr. Beach: I am not quite sure that Dr. Walton referred to Ashhurst's table of twenty-nine cases, which furnish an additional argument for a trial in any case. There were twenty-nine cases altogether, twenty-one of which were successful. Extension was employed in fifteen of the successful cases. Of the eight fatal cases one only had extension.

Dr. Walton: I mentioned the cases, but did not mention that fact.