

SPASMODIC TORTICOLLIS  
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THIS paper is based upon a study of thirty-two cases of spasmodic torticollis. All of these cases were operated upon one or more times by either one of us, and observed both before and after operation. In this study we have been most fortunate in having the benefit of the advice and assistance of Dr. H. M. Thomas, Neurologist to the Johns Hopkins Hospital, who has seen and examined practically all of our cases.

Of these thirty-two cases, thirty-one have either been seen personally, or have been heard from by letter within a short time, so that the late results of the operation are well known.

In this study we shall concern ourselves only with the spasmodic variety of torticollis, leaving out of consideration, except for the purposes of classification, the more common congenital and other acquired forms.

The disease under consideration derives its name from a sudden convulsive movement or spasm of one or more muscles or groups of muscles that move the head on the body. In aggravated cases other groups of muscles may also become involved, *e.g.*, those of the shoulder and arm, and those that have to do with speech and deglutition. Two of our cases showed definite changes in the voice. In one, the muscles of the chest were affected, and in another the muscles of the abdomen and leg, while four showed involvement of the shoulder and arm. This would seem to indicate that we are dealing with a more or less complex process. This idea is still more accentuated by the fact illustrated by several cases in our series, namely, that not infrequently when one muscle or group of muscles—those primarily involved—are put out of commission by operation, the affection immediately manifests itself in an adjacent set of muscles, or may even involve the opposite side. This fact adds greatly to the uncertainty of the result, and renders unsatisfactory any form of surgical treatment hitherto employed. Either for this reason or because incomplete operations have been performed, in a comparatively large proportion of cases repeated operations have been found necessary before a cure has been effected. Two of our series were operated upon four times; one, three times; and eight, twice, before relief was obtained. This was particularly true of the earlier and more or less incomplete operations in the series, that is, before a satisfactory technic had been developed.

Another observation of importance was the fact that while moderate improvement, as a rule, has followed immediately upon the operation, in a fairly large proportion of the cases the improvement did not reach its full extent for a considerable time—from six months to two or three years. This

fact at once raises the question of the actual relationship between the operation and the result in those cases where the improvement has been so long delayed. At the present time no satisfactory answer to this question can be given. It will be sufficient simply to call attention to the fact that, while occasionally cases of this very troublesome affection do recover spontaneously, or after one form of treatment or another, nevertheless, a large percentage of our cases had been under observation and treatment for long terms of years without benefit until operated upon by the radical method.

Various types of this disease have been differentiated from time to time, depending largely upon etiological considerations, *e.g.*, the congenital, infectious, traumatic, compensatory, neurotic or mental, and spasmodic. It is an undoubted fact that certain children are born with abnormalities of one kind or another giving rise to wry neck and due, in all probability, to a faulty or constrained position of the foetus *in utero*. But the pure congenital form is certainly rare. More common are the forms of wry neck—often wrongly called congenital—that develop soon after birth and probably result from injury received at that time to the sternomastoid or other muscles or nerves of the neck, or in connection with congenital spinal deformity.

Those cases which cannot be classified in any of the groups just mentioned are, by most authors, included under the general term of neuroses or psychoses. The differentiation of this general type and various forms of tic from the spasmodic form with which this paper is chiefly concerned, is by no means always either easy or possible; but we believe that the evidence is sufficient to justify the assumption that such a difference does actually exist, even if the present state of our knowledge of the subject does not always admit of a positive conclusion.

The development of the surgical treatment of torticollis from the first reported open section of the sternomastoid muscle performed for the relief of this affection by Isaac Minnius, a German army surgeon, in 1641, to the introduction of modern methods, is of sufficient interest perhaps to warrant a brief review. In this same century Hendrick van Roonhuyze, among other difficult and unusual operations, reported several performed for wry neck. But the operations consisted in little more than the section of the affected muscles, at that early date quite a formidable undertaking.

During the Eighteenth Century interest in the subject remained alive, although advances in the knowledge and treatment amounted to practically nothing. However, in 1737 Jaeger took "Torticollis" as the title of his inaugural thesis as Professor of Surgery in Vienna. Dupuytren, in 1812, had the distinction to be the first to perform closed tenotomy of the sternocleidomastoid muscle at its sternal origin. This operation, owing to the reputation of its originator, had considerable vogue for a time, but several reported fatalities due to injuries to the underlying vessels discouraged its further use and made the open operation the method of choice.

The greatest and most far-reaching step in advance along these lines up to that time, namely, the section of the spinal accessory nerve, has been

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generally credited to Campbell de Morgan, of London, who performed this operation successfully in 1866. However, Bujalski, in 1834, resected both spinal accessory nerves in a case of bilateral spasm of the sternomastoids. His report apparently made no impression, and the method for some time gained no popularity.

But following de Morgan's paper, for the next twenty-five years or so the operation was performed with increasing frequency. Charles Bell, among others, reported several cases. Various modifications of the method of attack on the nerve supply to the muscles were made by different surgeons. Nerve stretching, for instance, as suggested and practised by Southam, had many advocates. Collier suggested constriction of the nerve trunk with silver wire, and reported a few cases treated successfully in this way.

Multiple myotomy was also employed extensively during this period, notably by the elder Gross.

The surgical attack upon this affection, either by the nerve or by the muscle route, represents fairly clearly the opinion held respectively by American and English surgeons on the one hand, and the German surgeons on the other; for while the former preferred neurectomy, Kocher and Mikulicz strongly advocated muscle section as the operation of choice. Their success was in all probability largely contributed to by the unavoidable division of the nerves in their extensive muscle resections. In 1891, W. W. Keen first published the results of an operation performed by him in the previous year, curiously enough at the suggestion of Weir Mitchell, upon one of Dercum's patients. He divided not only the spinal accessory nerve, but the posterior divisions of the first three cervical nerves as well. This was the first really carefully studied and scientific attempt to treat the disease on a rational basis. In his report Keen described the surgical procedure in considerable detail. The

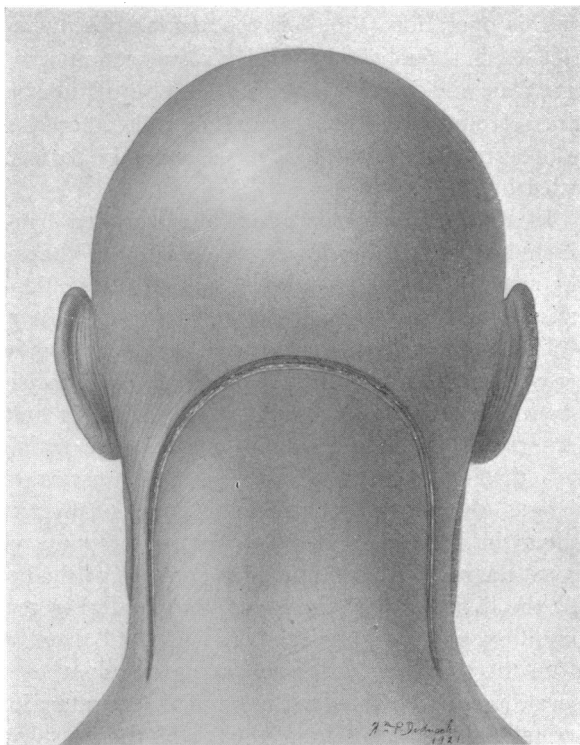


FIG. 1.—Incision. Lower limit, level of angle of jaw; upper,  $1\frac{1}{2}$  cm. below occipital protuberance.

operation involves exposure of the first three cervical nerves through a transverse incision across the back of the neck, beginning at a point 2 cm. below the lobule of the ear. Section of the intervening muscles and careful location of the posterior divisions of the first three cervical nerves are described. Keen was convinced from his observations that cutting of the muscles was merely an incident to the real object, which is division of the motor nerve supply.

Gardner and Giles, of Australia, claim priority of three months over Keen for this operation, but their report was not published until 1893, two years after Keen's publication. Keen's suggestion was rapidly taken up both by American and British surgeons, and since then surgical literature has contained, from time to time, reports of isolated cases and groups of cases treated by operative methods more or less closely patterned after the method suggested by Keen.

In 1895, Mikulicz described the so-called "myomectomy" operation, in which he excised the lower two-thirds of the sternocleidomastoid muscle. The muscle is freed from its sternal and clavicular attachments and a portion excised, particular pains being taken to avoid the spinal accessory nerve.

In the following year de Quervain, working with Kocher, published the latter's operation of multiple myotomy. Two incisions are described as necessary in the carrying out of this procedure; the first is for the division of the sternomastoid, and the second, a transverse incision across the back of the neck through which are divided the muscles overlying the sub-occipital triangle. Kocher made a particular point of dividing the fibres of the inferior oblique in addition to the long external group, convinced that this muscle played the most important rôle in rotation of the head. De Quervain believed that the division of the muscles, by interfering temporarily with the cortical stimuli, would prevent the muscle "habit" from returning.

In the past few years no particular advance has been made and Keen's operation still stands as the basis of the great majority of surgical procedures directed against this disease, though Kocher, writing again in 1912, still maintained that multiple myotomy possessed great advantages over all other operations. McKenzie in the past year has advocated intrameningeal division of the spinal accessory nerve and upper three cervicals for torticollis. This means, however, an unnecessarily dangerous method of resection, and particularly so in view of the results set forth below, which have been attained by a much safer procedure.

The particular operation put forward in this paper is but a further development of Keen's idea. The special advantages claimed for the method to be described later are that it provides ready approach to and satisfactory exposure of the structures to be dealt with. The trouble with most of the operations hitherto described is that they fail to provide adequate exposure of the nerve trunks. The success of the operation depends largely upon the ability to resect these nerves after they have been accurately identified. By this method opportunity is afforded the surgeon to excise the nerve supply of all

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the offending muscles together with the section of those muscles if desired, thus insuring the complete and permanent cessation of spasm in them. This method possesses the additional advantage of affording access to both sides, a point first emphasized by H. M. Thomas, which experience has shown to be necessary in most cases.

To-day we are apparently as far from knowing the real cause or causes of spasmodic torticollis as were surgeons one hundred years ago. Innumerable suggestions have been made as to its etiology, many of them quite fanciful and bizarre, all of them without definite scientific proof. All authors are apparently agreed upon one point at least, namely, the frequent presence of some pronounced neurotic or psychopathic element. This undoubtedly is a factor of importance in some cases. Brissaud especially insists upon it, and the so-called mental type ("type de Brissaud") bears his name. The French School of psychiatrists and surgeons largely follow his lead. He treated cases with psychotherapy with apparent benefit, and also reported cases cured by hypnotism. Oppenheim believes in the hypothesis that "the cerebral cortex, particularly in the area concerned in the movements of the neck, is permanently at fault." But this in no wise explains the exact nature of the mental or physical process which makes possible this special spasmodic manifestation.

Schaller reports two interesting cases which surgery had failed to benefit. Psychotherapeutic measures brought great relief. On the other hand, surgeons with experience in this condition have observed many cases where previous psychotherapeutic measures had completely failed. Our series contains several such. Schaller says, "Torticollis is to be classed very often as a true tic, and a careful differential diagnosis must be made between true spasm and this condition." Our experience leads us to doubt the truth of this observation. Martini and Berterini express the view that: "Spasmodic torticollis is a state of irritation of the reflex arc independent of psychic effort." But this does not explain the source or nature of the irritation.

Gowers says that "any case in a woman under thirty may be hysterical." Cruchet draws attention to cases in which the slightest pressure of the patient's finger against the pull of the muscles will overcome the spasm. This group he thinks must be mental, but a possible explanation is the practical application of Sherrington's law.

Several cases in our series, in the early stages of the disease, exhibited this same phenomenon of the control of the spasm by merely holding the tip of the finger to the chin as described by Cruchet; but this procedure tends to become less effective as the disease progresses. He also speaks of the "professional type" where in certain occupations constant effort is exerted in holding the head in one position. Watson Cheyne leans towards the idea of a "craft palsy" (occupation neurosis) and cites the case of a tailor who always turned his head when tightening a stitch and who later developed a spasm of the muscles involved in this action. Many other cases of a similar character have been reported in the literature. Our series includes several

such. W. W. Richardson adds to this general idea a neuropathic heredity. Tubby thinks there is always a mind element involved, but neither can offer any very definite scientific data upon which to base his hypothesis. To the broader view that a neurotic temperament plays an important part in some as yet unknown organic pathological change, we find many strong adherents.

Toxic irritation of the central nervous system due to chronic infection has also been regarded by some as one of the most plausible explanations.

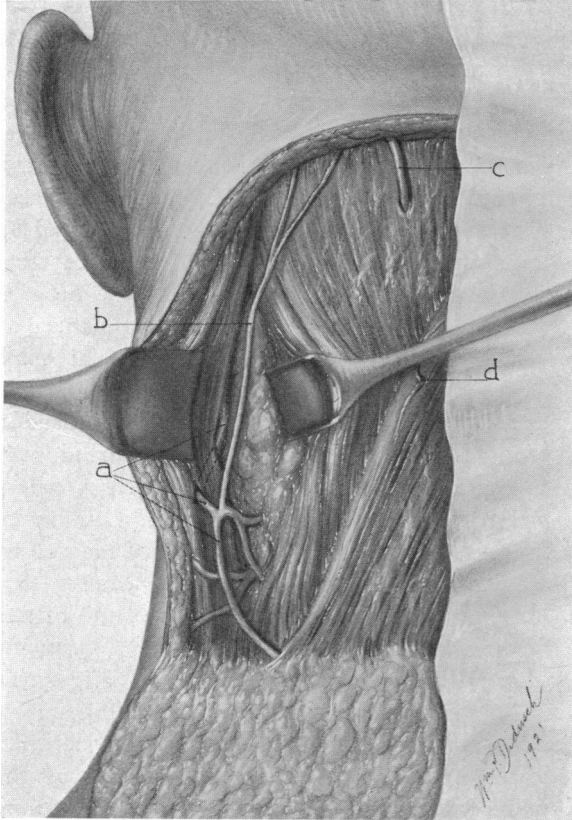


FIG. 2.—(a) Spinal accessory nerve; (b) lesser occipital nerve; (c) greater occipital nerve; (d) third cervical nerve. View after skin and subcutaneous tissues have been turned back.

Following this hypothesis, teeth and tonsils and other possible foci of infection have been removed without appreciable effect. In the majority of cases, no adequate exciting cause whatever is to be found, and recourse must be had to the rather non-committal explanation of Taylor, namely, that "mental perturbation, over-action of the muscles, and habit are responsible." Poore cured one severe case with anti-luetic treatment. Osler believed malaria to be a factor. Curiously enough, six of our cases give a history of previous malarial attacks. Lister reports a case following chorea in a boy seventeen years old. We have a similar case.

Sources of reflex irritability have been sought, especially in the eyes and ears. An important etiological factor in a small number of cases may be refraction errors or muscular insufficiency.

In a paper by Posey he quotes Duane as follows: "Tilting of the head towards one's shoulder takes place to obviate the diplopia. This attitude may be maintained so persistently as to cause an actual wry neck." Posey reports seventeen cases of insufficiency, in only one of which there was an actual wry neck, and this in a boy eleven years old. The diagnosis was "insufficiency of the superior rectus and the right external oblique." Tenot-

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omy of the oblique tendon was performed. Two months after operation no appreciable change was noted in the position of the neck. Bordley (personal communication) is quite right in insisting that an examination of the ocular muscle balance should be made in all these cases. But that this factor plays only a minor rôle in the etiology, is indicated by the fact that only a single case in our series showed any appreciable defect in vision. He reports two cases associated with disturbance in the eye muscles, in which the inferior oblique was divided. One was cured, the other unrelieved. Worry has been noted by several writers as bearing some causal relationship to the disease, but no conclusive evidence has been advanced to support their position.

So far as our series is concerned, no factor of general etiological importance was developed, although instances of almost all of the commonly assigned causes were observed.

Occupational strain seemed to play a definite part in the antecedent history in four cases.

Four of our series were physicians, two architects, six were business men, twelve housewives, one schoolgirl, one judge, one teacher, and two laborers; one had no occupation.

Heredity seemed to play but a small part. The mother of one case had been similarly affected, and there was a marked neurotic family history in two. Of the patients themselves, in ten a marked nervous element was noted; four had had actual nervous "breakdowns," so-called, four had had typhoid fever, four chronic tonsillitis.

In eight cases the trouble seemed to date definitely from some particular cause: severe trauma to the neck, two cases; hard work, involving unusual muscular strain, two cases; typhoid, one; tonsillectomy, one; osteopathy, one; chorea, one.

The trouble is very persistent and chronic, as shown by the fact that in ten of our series it had lasted for varying periods from three to forty-one years, and in twelve had existed for over six months but less than one year.

The disease is characterized by remissions and exacerbations without apparent cause, except that rest in bed with the head supported is often followed by mitigation in the severity of symptoms; while active exercise—especially walking—emotional excitement, embarrassment, and fatigue seem to aggravate the muscular spasm.

The pathology of spasmodic torticollis is even more obscure than the etiology, since no actual causative lesion has as yet been demonstrated. The trouble, whatever it is, must be either of central or peripheral origin, with the weight of authority, at the present time, rather favoring the former.

We are able to find in the literature the report of an autopsy in but a single case of this affection, that of Kollarits. The reason for this is obvious; the disease itself is never fatal, and its operative treatment is followed by a singularly low mortality rate considering the magnitude of the surgical procedure as now advocated and practised for its relief. The report of the autopsy findings in Kollarits' case showed little but degenerative changes,

not very pronounced, in the posterior columns of the cord. The numerous specimens from the cortex, pons and upper part of the medulla showed nothing. In the medulla, the tract of Goll showed slight degeneration. In the cord slight changes were observed in the posterior fasciculi only. Since this patient died of inanition, the question at once arises as to whether or not these changes may not have been influenced by this fact.

Volkman reported finding a large amount of connective tissue in the excised muscles. This has been mentioned repeatedly since, and has been found in a majority of our cases where the tissue was examined. The cervical lymph-nodes, which are usually found to be definitely enlarged, particularly the deep chain, show a simple hyperplasia without other pathological changes. Due to the lack of necropsy material, the nature and position of the central lesions—if there are any such—are purely a matter of conjecture. Starr thinks that the muscle complex suggests a cortical origin. Tubby believes some cerebral lesion, due possibly to sclerotic changes in the vessels, may be responsible. Maurice Richardson concluded that if the lesion were central, it must follow the muscular movements, attempting in this way to connect refractive errors with the underlying cause. W. W. Richardson says that although the exact nature of the nerve lesion is not understood, it is probably central, either spinal or cerebral. The involvement of a group of muscles, he thinks, would indicate higher centres; whereas single muscles would rather point to lower centres, either in the bulbar or spinal gray matter.

“To say that it is a condition of irritation in the nerve nuclei is of small help, since we are ignorant of what such irritation may consist. The most reasonable hypothesis, as maintained, for example, by Brissaud and Oppenheim, is that the cerebral cortex, particularly in the area concerned in the movements of the neck, is primarily at fault.” (Taylor, in *Osler's Modern Medicine*.)

Attention has been called by certain observers, notably Marie and Léry, to certain changes in the cervical vertebræ. They describe certain irregularities in outline of the bodies of the vertebræ in the form of bony excrescences or lipping of the edges, as seen not infrequently in chronic rheumatic affections involving the spine. These are shown up particularly well in stereoscopic X-ray plates. In only one of our series was any such abnormality of the vertebræ noted.

Byrnes has described certain changes that he has observed in the spinal accessory nerves removed from a case in whom the spasm had existed for four years. He observed swelling and degenerative changes in the axis cylinder and axones. No connective tissue induration, or any evidence of acute inflammation was observed. There was a complete absence of myelin. The muscular tissue removed showed the degenerative changes usually described by other observers.

Rosenow has recently reported some interesting and suggestive results that he has obtained. He has been able “to produce in animals tic-like movements of the head as a common sequel to attacks of encephalitis induced by the intra-



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cerebral injection of a somewhat peculiar streptococcus isolated from cases of human encephalitis." His report is only a preliminary one, and it is too early as yet to draw any definite conclusions, but it opens up a most interesting field for further development.

From the variety of opinions expressed, and hypotheses advanced, it can readily be seen that we possess no accurate scientific knowledge as regards the pathology of this perplexing condition; and until this knowledge is forthcoming, the pathology must remain in the realm of conjecture.

In the typical case the diagnosis of this affection can usually be readily made, although in certain cases difficulty may be experienced in differentiating it from true tic or the spasm of the neck associated with general nervous diseases—athetosis, chronic chorea and the like. The striking characteristic of the disease is the involuntary movement of the head caused by the spasmodic contraction of the muscles of the neck, and in the majority of cases it is confined to these muscles. This may vary from a slight nodding or jerking movement scarcely noticeable, to contractions and contortions of extreme violence and not infrequently painful, involving not only the muscles of the neck and face, but in certain severe cases those controlling speech and deglutition, the shoulder muscles, the chest and abdomen, and in isolated cases, even the lower extremity have been involved.

The spasms are entirely involuntary and are either clonic or tonic in character. Not infrequently both are present in the same case, while on the other hand the muscular contractions in true tic always have a voluntary element and are rarely confined to one group of muscles.

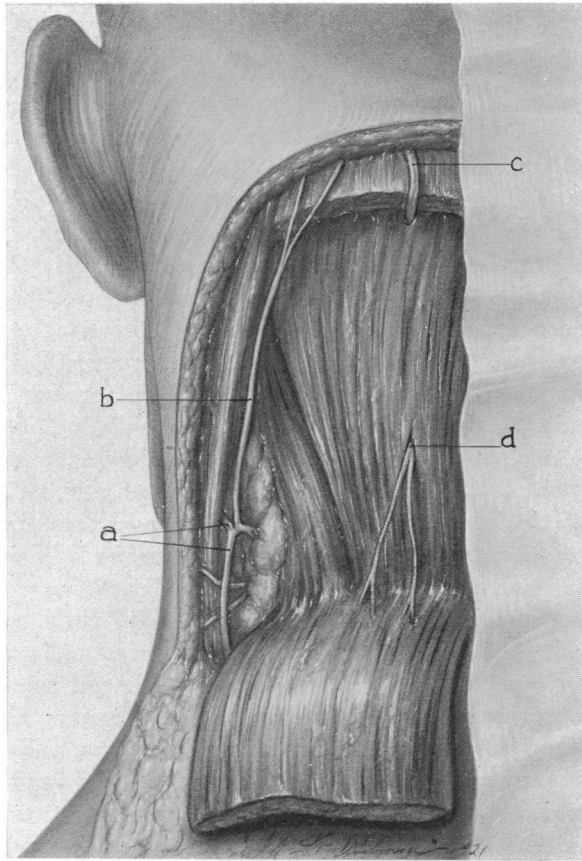


FIG. 3.—(a) Spinal accessory nerve; (b) lesser occipital nerve; (c) greater occipital nerve; (d) third cervical nerve. Splenius and trapezius muscles have been divided and turned back.

The most characteristic position assumed by the patient is extension of the neck, with the head drawn over toward one shoulder, the face rotated to the opposite side and the chin elevated. However, many variations from this position are observed, the most frequent perhaps is that known as the retro-capital, where the head is drawn forcibly backward, either with or without rotation. In cases of long standing the prominent features not infrequently observed, in addition to those just mentioned, are facial asymmetry, together with well-marked hypertrophy of the muscles involved. Spasm of the facial musculature is rarely observed in our experience.

In doubtful cases, a hereditary neurotic taint, a history of certain postural occupations or antecedent factors, such as infections, errors of refraction, disarrangement of the normal balance of the muscles of the eye, nervous overstrain, and trauma have been mentioned by different authors as causative factors, and should be given due consideration.

Medical treatment in almost every conceivable form has been tried and found wanting with discouraging regularity. From time to time occasional benefit has been claimed from some particular drug or form of therapy. The various hypnotics and narcotics are extremely dangerous, for obvious reasons, particularly their tendency toward habit forming in a chronic disease such as this. Cross, in 1880, reported a case which represents fairly well the therapeutic possibilities. The treatment included the administration of the alkalies, iodides, bromides, colchicum, quinine, arsenic, valerianate of zinc, and cannabis indica; external remedies such as iodine, sinapism, atropine ointment, compound camphor, belladonna and aconite liniments. Due attention was paid to general hygienic measures. No benefit was derived from any of these, so Noble Smith performed a neurectomy of the spinal accessory nerve in this case, and effected a cure. Massage occasionally proves helpful. Mechanical supports are of little use as a rule, although many different kinds have been recommended. The muscles involved show no change to electrical reaction. Electrical therapy has proved of little or no value. Richardson and Walton studied carefully the effect of electricity and confirmed this view. Much was expected from alcohol injections, but extended use of this treatment did not confirm earlier expectations. Hydrotherapy and massage, psychotherapy and reëducation, and many other therapeutic measures have been tried from time to time, with disappointing results on the whole. Stress is laid, particularly by French writers, upon psycho-analysis in the so-called mental type of torticollis, and they report some cures. Clark also favors this method and reports three out of five cured, all of them severe, and in whom all sorts of physical and drug treatments had been previously tried in vain. He insists that nothing but a complete reconstruction of the whole mental attitude can make these patients well.

Williams makes a strong plea for psychotherapy in all these cases, insisting upon the proposition that they are all amenable to this form of treatment. The difficulty is in its proper application, the length of time, expense incurred, etc.

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We have already outlined the growth and development of the surgery of spasmodic torticollis. The more recent opinions in regard to the radical procedure are of interest. In the discussion which followed the reading of Keen's preliminary report of his operation before the Philadelphia Neurological Society in 1890, it was considered by several eminent surgeons who took part as an unnecessarily severe method for the cure of the condition in question. The general opinion from 1890-1895 was that division of the spinal accessory nerve should be tried before the more radical operation was attempted. Eliot believed that division of the spinal accessory nerve tended to relieve an active posterior group spasm. Powers believed that the first four cervicals should be divided, whereas the majority of operators confined their efforts to the upper three. Chiene felt that if neurectomy should fail and the patient's life still be miserable, the surgeon should not hesitate to expose the cortex and remove the portion of the brain involved. Horsley was of the same opinion, but no such cases are reported in the literature. Later still, Tubby writes of the disappointment of all half-way measures. Starr thinks little of surgery and says in general that, "treatment is unsatisfactory because we are ignorant of the cause of the disease." This is quite true, but since, as we have just seen, medical and other measures short of surgery offer so little, we are justified in taking even extreme measures, where less radical ones have proven unsatisfactory in providing relief from such a deforming and disabling condition as the one under consideration. With this idea in view and after experiencing failure with incomplete operations, we have been forced to try, especially in severe cases, more radical methods.

In planning the operation we have endeavored to make it sufficiently comprehensive to include all the offending structures, on both sides instead of only one, as experience has taught us that in the majority of cases sooner or later both sides become involved. The operation about to be described is based upon the anatomical relations as observed in operations performed upon our series of thirty-two cases and in the dissecting room findings in approximately fifty cadavers. After having tried various positions, we now employ that known as the cerebellar position, the patient lying prone with the shoulders elevated, the head slightly flexed and projecting over the end of the operating table and supported on a rest. The usual aseptic technic is employed.

The incision should be made along the posterior border of the sternomastoid muscle (Fig. 1), beginning at a point two finger-breadths below the level of the angle of the jaw and continuing upwards along the edge of the muscle to a point about the level of the lobe of the ear, then curving over toward the midline to a point about two finger-breadths below the occipital protuberance, thence carried across the midline, following the same general direction as just described, in reverse order. When completed, the incision is in the form of an inverted "U". Reflect back a flap of skin and subcutaneous tissue, taking care to identify and avoid the lesser occipital nerve, which is quite superficial and lies along the posterior border of the sterno-

mastoid muscle, in its upper half. Having exposed and identified this nerve, follow it down to the point where it emerges from behind the posterior border of the sternomastoid muscle (Fig. 2). By retracting the sternomastoid muscle, the anterior divisions of the second, third and fourth cervical nerves now come into view, together with the chain of deep cervical lymph-nodes. A little further in front of the plexus, and consequently a little deeper in the

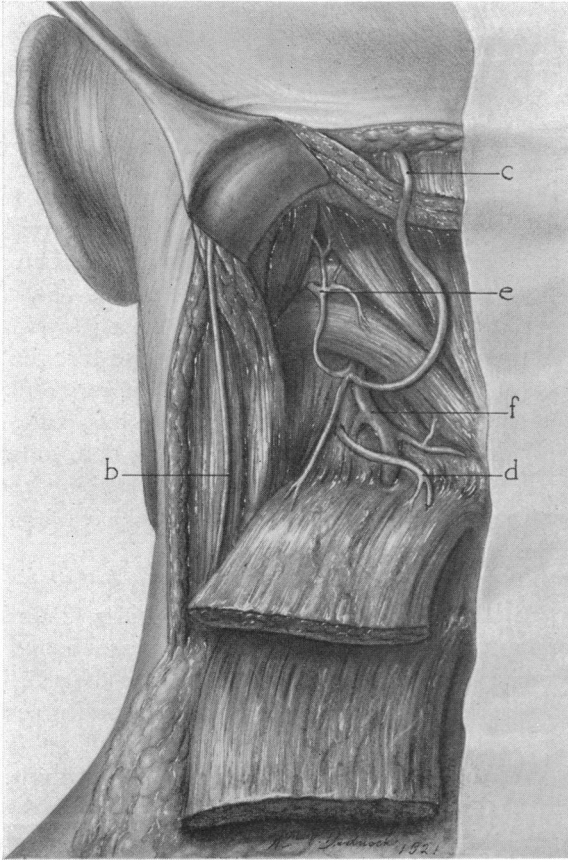


FIG. 4.—(b) Lesser occipital nerve; (c) greater occipital nerve; (d) third cervical nerve; (e) first occipital nerve; (f) branch of venous plexus. All posterior muscles have been divided and turned back, exposing the sub-occipital triangle.

wound, will be found the trunk of the spinal accessory nerve where it emerges from the body of the muscle. The nerve having now been definitely identified (and here as with all other nerve trunks involved, direct stimulation with a bipolar electrode makes the identification absolute) can be resected at any point desired. No effort should be made to save the sensory branches of these nerves as, in Thomas's opinion, both efferent and afferent pathways should be interrupted. Search should next be made for the great occipital nerve where it emerges through the fibres of the splenius, about one cm. from the midline, and just beneath the skin incision. Having identified this nerve, divide transversely at this point the trapezius and splenius muscles (Fig. 3), exposing the fibres of the complexus, which is easily recognized. The fibres of this muscle are divided in turn throughout its whole thickness in the same plane as the skin incision, and it is then reflected backward in the same way, care being taken all the while to preserve the great occipital nerve which lies immediately below it. This exposes the two recti muscles, major and minor, and the superior and inferior oblique (Fig. 4), each of which can be distinguished by the direction of its fibres and their common point of origin. The trunk of the great occipital nerve should then be traced down to the

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point where it emerges from the vertebral foramen at the lower border of the inferior oblique muscle. At this point will be found its anastomosis with the suboccipital nerve running across the body of the muscle to the point where it is given off from the first cervical nerve in the suboccipital triangle.

The great occipital nerve should be resected below the point of anastomosis with the suboccipital. The latter can then be traced out in the suboccipital triangle as it emerges between the vertebral artery lying deeply in the triangle and the upper border of the inferior oblique muscle. Its branches to the recti muscles and the superior and inferior oblique muscles are given off here, and the main trunk of the nerve can be readily resected at this point. Care should be taken not to injure the vertebral artery, which may be identified as it lies on the floor of the triangle. The splenius and complexus muscles should be reflected sufficiently to allow the exposure of the third cervical nerve where it emerges a finger-breadth below the great occipital. At the level of the second and third cervical nerves is located a venous plexus of considerable size which may give rise to troublesome bleeding if care is not taken to avoid or control it, which, however, can be readily done. The third cervical nerve should be resected where it emerges from the vertebral foramen, as it supplies fibres to the overlying muscles (splenius, trapezius, and complexus). After the trunks of the three upper cervical nerves have been resected as described, the muscles may be replaced, layer by layer, and held in place by a few stitches, and the wound closed in the usual manner. In our earlier operations we excised portions of these muscles, but subsequent experience has shown that with complete resection of the nerve supply this rather mutilating procedure may be omitted. Until recently we have always inserted a drain consisting of a small piece of protective at each corner of the incision, but with adequate hæmostasis this will probably be unnecessary.

Formerly we applied a plaster-of-Paris bandage reinforced with wooden splints, with the head in an overcorrected position; but this added greatly to the patient's discomfort and appeared to be rather a source of irritation than a help, and so was discontinued in favor of the ordinary gauze dressing and soft bandage, reinforced with light wooden coaptation splints if desired. Notwithstanding the great extent of the wound, the healing has been uniformly satisfactory and the resulting disability surprisingly slight.

The average time of the operation, doing two sides at one sitting, is one and a half hours. We would emphasize the fact that this operation should not be undertaken by any but an experienced surgeon, and only after thoroughly familiarizing himself with the anatomy of the part, as the success of the operation is dependent largely upon careful dissection and recognition of the different structures sought for. Careful hæmostasis in order to insure a clean, dry wound is essential for the easy recognition of the different structures, which facilitates greatly the performance of the operation.

From our experience with our group of thirty-two cases, we are convinced that the probable reason for failure to obtain cures is failure to identify and resect the nerves. We feel convinced too that it is impossible

to secure satisfactory exposure and identification of the nerves sought by any less extensive incision than that described.

Chiene says the prospect of a permanent cure of this affection by any method is in inverse proportion to the severity of the spasm, extent of the muscles affected, and duration of the disease. Starr gives a guarded but distinctly pessimistic prognosis.

These two opinions reflect very faithfully that held by physicians and surgeons alike, since no treatment up to the present time has given uniformly satisfactory results. Of our series of thirty-two operated cases, one has not been heard from recently. Of the remaining thirty-one, three are unimproved, sixteen have been improved but not entirely relieved, while twelve have been completely cured. It should be borne in mind that these operations cover a period of more than twenty years, that the earlier operations were very incomplete, and that the operation just described has been developed comparatively recently. It has been used in only a few cases, too few and too recent to enable us to pass final judgment on its merits, but in a sufficient number we believe, as compared with previously used and less radical methods, to justify its more extended use.

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