BRACHIAL PRESSURE NEURITIS.

Illustrated by Three Cases of Varying Etiology.

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The cases herein detailed seem worthy of record because of the difficulties underlying the diagnosis, and because of several interesting points of similarity in their symptomatology.

They all exhibited definite signs of pressure in the dorsal root or lower trunk of the brachial plexus of the left side, and were very suggestive of the presence of a cervical rib but had vague shoulder and other pains which masked the typical symptoms of the anomalous rib.

The cases had all been under treatment for some time before being seen by the writer, and each represented a different class of practice, one being from a private practice, one from a civil hospital, and one a pensioner from the army. They have all been under treatment in the last two years, and in each case the symptoms were so severe that the continuance of their occupations was impossible.

Case I.—Pressure from Normal First Rib—W. K., male, aged 23. Admitted to Bangour Hospital, 8th March 1920. Wounded, June 1915, in the right shoulder; six weeks after this he lost power in the left shoulder, and was invalided out of the army on account of paralysis of the left shoulder, April 1916. On admission to hospital he had a considerable paresis of the left arm, which seemed to be functional in origin to a great extent. The man was markedly neurasthenic. He was treated for this by re-education and suggestion, and after a period of a few weeks the arm became comparatively useful. The suggestion and re-education were preceded by faradic stimulation of the muscles, and the response in all of them was present, but in the small ulnar muscles of the hand and some of the shoulder muscles, the response was slightly below normal. After the use of the arm had been to a great extent recovered, he complained of a great deal of pain about the shoulder and shooting down to the fingers, particularly into the hypothenar eminence. There was also a feeling of "pins and needles," or tingling in the area supplied by the ulnar nerve. He stated that he had to lie in bed in a particular way with his arm folded across his chest. This relieved him and enabled him to sleep. Relief was also got when sitting with his arm supported on the arm of a chair.

Examination.—There was very slight wasting in the small muscles of the left hand, particularly in the hypothenar eminence. All
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acted comparatively well, however, although weaker than normal. The faradic response in these muscles was also slightly below normal. The shoulder muscles—the trapezius and rhomboids—and the supra- and infra-spinatus were also somewhat weak. There was some sensory loss in the ulnar area, sensation to pain and heat being most affected.

The wound that he sustained in his right shoulder was a superficial wound, and could have no possible connection with his symptoms.

On examination of the neck there was some prominence in the posterior triangle of the right side, which was slightly tender on pressure. The subclavian artery could be felt pulsating in front of it. On the left side of the neck there was no prominence, but the posterior triangle did not give the impression of being normal in contour.

X-ray examination showed the patient to have a well-marked cervical rib on the right side, but no rib was evident on the left side.

Diagnosis.—In view of the definite symptoms of the left side, and the fact that he had a cervical rib on the right side, it was thought possible that the man had a fibrous band stretching from the costal element of the 7th cervical vertebra towards the anterior end of the first rib on the right side, possibly causing pressure on the lower roots of his plexus. Accordingly an operation was advised.

Operation 7.9.20.—The posterior triangle of the neck on the left side was exposed by a supraclavicular incision, with an upward extension from the posterior end along the front of the trapezius. The omohyoid was divided, the suprascapular and transverse cervical vessels were ligated and divided. The scalenus posticus was then identified, and dissection was carried out behind the posterior margin. No cervical rib was present nor any fibrous band. The scalenus anticus was next traced down to its insertion to the first rib, the artery and lower roots now being identified. The relationship between the first rib and the lower trunk was seen to be a very close one, and the edge of the rib sufficiently sharp and close to cause pressure and consequent neuritis. It was accordingly decided to remove sufficient of the rib to preclude the possibility of a continuance of this pressure. The insertion of the scalenus anticus was divided close to the rib and the lower trunk and the artery pulled forwards, while the insertion of the scalenus medius was divided. The rib was then carefully isolated for about 1½ in. to 2 in., a small periosteal elevator being used. The pleural cavity was entered at this stage, but no particular attention was paid to this opening. The isolated rib was then cut in two places—in front of the artery and well behind the lower trunk—and then removed.

The wound healed by first intention and the stitches were removed on the tenth day. There were no after-effects of the puncturing of the pleura. The man had a fair amount of pain in the arm for a few days following the operation, but it gradually passed away, and
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following some massage and faradism to his arm muscles, exercises to his joints, he made a complete recovery and the pain disappeared entirely.

Case II.—Root Pressure Neuritis from Scoliosis—B. M., a youth of 20. Had been complaining of his present symptoms for about three years, previous to which he was perfectly well. Patient is a professional pianist, and while playing the piano he began to feel a "tightening" in the left arm. In spite of this he was able to carry on for some time, but his hand felt "funny" and was very stiff. There was no dullness of sensation at that time. He saw his own doctor, who suggested that it was "cramp," but prescribed no treatment. No treatment has ever been prescribed further than physical exercises. These were tried for a short time, but had to be given up as they were too strenuous and the patient was too tired to continue. He had then to give up his professional career owing to the condition of his left hand. There are no points of importance in his personal or family history, further than that he has recently gone through a severe nerve strain through the conduct of a relation who disturbs him at all hours and threatens him to such an extent that little sleep is got.

Present Condition—August 1920. Symptoms. The patient feels exceedingly run down, and is very easily tired. He is a keen tennis player but recently has had to give that up, and at present leads a very quiet indoor life. He says that his hand is quite numb, particularly on the ulnar side. He frequently gets slight attacks of cramp in it and is unable to play the piano. His appetite is very poor and he is losing weight.

Examination.—The patient is extremely thin and his bones, particularly his ribs, are very prominent. There are no glands present in the neck. His 6th and 7th cervical spines are very close together, very prominent and with some lateral curvature, the convexity being to the right side. In the dorsal region there is a lateral curvature with the convexity to the left. There is some prominence of the left scapula. All the muscles of the left arm and shoulder act normally, but there is slight but definite wasting in the small muscles of the ulnar area in the hand. There is some hyperesthesia in this area with points of almost anaesthesia. Knee-jerks, ankle-jerks, etc., normal. No eye symptoms. Slight tremor of the hands and tongue. The boy appears to be utterly run down and in a rather nervous state.

X-ray Examination.—No cervical ribs present, slight lateral curvature of the cervical and dorsal spines, as described above.

Diagnosis.—In view of the symptoms and the absence of any other definite cause of pressure on the roots of the plexus, it was considered that the lateral curvature with the concavity on the affected side (left)
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was the probable cause. In view of this the treatment suggested was suspension, with a view to straightening the curve, along with tonic medicines, physio-therapeutic treatment, especially exercises, and careful dieting.

Treatment.—He was put to bed and extension put on his head over the top of the bed, and a weight of 3 lbs. to start with applied. The youth stood this very well and the weight was gradually increased to 9 lbs., and at the same time massage and Swedish remedial exercises were started on the left hand, shoulder, and arm. About the end of the second week of this treatment hyperesthesia in the hand became more marked with slight tenderness of the abductor minimi digiti. This, however, quickly disappeared within the next two weeks, and at the end of six weeks of this treatment there was no abnormal sensation and the movements of the hand were complete and strong. He was then allowed up for part of the day, but continued to wear his suspension apparatus for eighteen hours a day. This was gradually reduced until he only wore it while sleeping at night. The hand continued to improve in strength.

At the present date—three years afterwards—he has had no return of symptoms and only occasionally wears his suspension apparatus.

Case III.—Cervical Rib with Neuritis—Miss E. K., aged 18. Admitted to Royal Infirmary, Edinburgh, 21.11.22, complaining of pain in the left shoulder and deformity of the shoulder-blade.

The girl was a typist and had nothing of interest in her personal history until May 1922, when she was operated on for tuberculous glands of the neck—the scar of which operation was quite evident though a very good one. Shortly after returning to work, after convalescing from this operation, she had vague pains in her shoulder and during the last two to three months they have been shooting down to the left hand. These pains were so severe that they prevented her from continuing her duties as a typist, and her doctor was accordingly called in.

The pain was situated in the left shoulder over the upper part of the trapezius, and about September the patient states she noticed a "swelling of bone" in this region. This swelling is stated not to have grown but the pain has got worse.

Examination, 30.11.22.—Oblique scar in the neck on left side. No visible glands. There is a marked drooping of the shoulder on this side and wasting of the trapezius over the supraspinatus. Shrugs both shoulders equally well. The hypothenar eminence is slightly less developed on this side.

On palpation there is marked wasting in the posterior triangle of the muscles, particularly the trapezius. The wasting of the supraspinatus has made the superior angle of the scapula much more

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prominent, and this is the "bone" swelling the patient referred to. All muscle movements can be carried out, including those of the small muscles of the hand. There is dulling of sensation in the ulnar side of the left hand.

The first obvious conclusion was that the spinal accessory nerve had been injured at the operation for glands of the neck. This, however, would not account for the amount of pain that was suffered or for the distribution. It was considered that a supernumerary rib might be present on this side, and this was confirmed at X-ray examination.

Operation, 22.12.22. — 2-in. incision down posterior border of the sterno-mastoid and 3-in. incision from its lower end parallel to clavicle and slightly above it. Flap reflected backwards. External jugular nerve exposed and ligated. Fat and glands from posterior triangle were then dissected with gauze to expose the omohyoid, which was divided. The scalenus posticus was next identified and then the two important nerves in front of it, the nerve to the rhomboids and the suprascapular. These were retracted carefully forwards and the rest of the operation done behind the scalenus posticus. The extra rib was quickly evident on dissecting behind the muscle, and by pulling the muscle forward a good view of the rib was got. It was carefully isolated to as great an extent as possible in front before being divided behind. The attachment to the transverse process was cut through with cutting forceps and then the anterior end further freed, the vicinity of the lower trunk being treated with due care. The anterior attachment, apparently to a fibrous band, was cut with curved scissors and the rib removed.

There was little disturbance of muscle that required repair, and the skin was stitched with a fine subcuticular stitch without drainage.

The convalescence was uninterrupted as far as the neck went, but an attack of acute appendicitis and its consequent operation somewhat delayed her discharge from hospital.

27.2.23.—Wound healed, but a slightly keloid scar has developed. The pain in her shoulder and the hypothenar eminence has entirely gone and she is now starting work again.

It is interesting to note that in each case the onset of symptoms was preceded by some very definite devitalising affection.

In the first case, there is a gun-shot wound of the opposite shoulder, a slight injury, but which made a great impression on the man, and was followed by a functional paresis of the opposite arm. This arm was not in use for some considerable time and consequently a disuse atrophy of muscle took place. This inevitably allows the shoulder to drop, and the roots of
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the brachial plexus will come into a closer relationship with the normal first rib or the abnormal cervical one. Prolonged pressure will then quickly set up a traumatic neuritis.

The second case shows a history of a severe and prolonged nerve strain, which reduced the boy both physically and mentally. His muscles, poorly developed at the best of times, became worse and showed much loss of tone. Any slight tendency towards pressure on the roots of the plexus by the scoliotic vertebrae was accentuated by the weak hypotonic muscles, and doubtless the symptoms so produced were exaggerated by the mental instability of the patient.

In the last case, perhaps the most interesting, there was a much more definite injury, causing the prolapse of the shoulder on to an anomalous rib which had previously been of no consequence to the patient; the spinal accessory being injured, the practically paralysed trapezius is unable efficiently to support the shoulder. The plexus drops down on the supernumerary rib and a traumatic neuritis becomes clinically obvious.

The outstanding features then in all the cases is the general loss of muscle tone preceding the onset of symptoms. This condition of muscle hypotonus coming on in the early twenties is much more effective in producing a pressure neuritis than would a similar condition at a later period when the structures have become much more fixed in position. Possibly, too, in the cases of the rib pressure the fact that the left side was affected in both, and that both were right handed, would be a fair presumption that the left side would be more easily affected through the muscles on that side hardly being so well developed as on right side, which was somewhat more actively used.

Neuritis following on the presence of supernumerary ribs is stated to be more common in females, from which it has been deduced that a cervical rib is also commoner in that sex. It would appear that the deduction is questionable. May it not be from the fact that woman is physically the weaker sex naturally, and that the muscles are more apt to lose tone through any illness to a much greater extent than in the male sex? From which we would reason that there is little likelihood of the condition being commoner in either sex, but that the symptoms produced by the abnormality are more frequently clinically evident in women.
Pathological Anatomy.—The sites at which pressure took place in the cases detailed are two—first in the intervertebral foramen, and secondly as the trunk passes over the ribs on its way to the upper extremity.

In the foramen the roots are stated to take up less than one-half of the calibre of the foramen normally, the rest being filled in with fat which makes an excellent cushion in extremes of movement. It is certain that in the scoliotic case the fat would be reduced to a minimum, while the element of rotation in a local section of the spine present in every case of scoliosis would increase the susceptibility to pressure by diminishing the size of the foramen. A certain amount of pressure atrophy of the bodies on the concave side would further lessen the size of the foraminae. These three factors, however, hardly seem to account for the pressure as they must be present in many cases of scoliosis and root pressure is a rare complication. Possibly there was some local abnormality also present at the point of exit of the first thoracic root. There were no pupillary symptoms in this case as, of course, the majority of the fibres for the dilator pupillae are from the second and third, and only a relatively small proportion from the first thoracic nerve.

It is interesting to note that root pressure symptoms may be got in a case of scoliosis on the side of the convexity by stretching the first thoracic root over a normal first rib, and if an anomalous rib is present the onset of adolescent scoliosis would coincide with the onset of pressure neuritis.

With regard to the second possible site of pressure on the lower root, it is in such close relationship to the normal first thoracic or supernumerary cervical rib that there must be a relatively small margin of safety in it, and if there is any powerful influence at work resulting in a loss of tone of the shoulder muscles, it can easily be understood that it will fall further on to the rib and a pressure neuritis result. This close relationship is even more intimate when the first, possibly second, thoracic nerves are fairly large and when these nerves ascend to join the eighth cervical root. The descent of the shoulder to its lowest extent occurs at puberty and is greater in the female sex, so that it is at this period and in this sex that the greater liability to pressure is. All these are predisposing causes, while the actual onset of symptoms may require only a devitalising illness resulting in a loss of tone
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in the shoulder muscles to determine this. Vague arm and shoulder pains are not uncommon in cases where the spinal accessory nerve has been damaged in cervical gland cases, and it would seem that many of these symptoms are the result of pressure neuritis.

Clinical Features.—The symptoms in each case when analysed were those of a supernumerary cervical rib, but in each there were vague pains in the shoulder, and in the actual case of cervical rib it was the prominent feature of the case. It was interesting to note in the first rib pressure case the marked relief offered by sitting with the arm supported in an armchair and by elevating the shoulder in bed.

In the scoliotic case there was no muscular movement that relieved the pain, but it was accentuated by piano playing. This possibly further tired out the weakened muscles and allowed further pressure to take place.

In all cases the symptoms were unilateral and the pain which was complained of was a tingling feeling on one side of the hand and never on both sides. This is not difficult to understand in the rib cases, as the pressure would never affect two roots of the plexus. One would, however, have expected a more extensive result from the scoliosis. Pressure over the posterior triangle of the neck on the affected side caused a pain to shoot down to the hand in all cases, pointing definitely to a neuritis being present.

All the small muscles of the hand are supplied by the first thoracic root, so that it is difficult to see why the ulnar ones were picked out, as they were in each case. This selection may be due to the definite anatomical site of the ulnar fibres in the lower part of the root, so that they are the first to be subjected to pressure.

The severity of the subjective sensations may be judged by the fact that in all cases work has to be given up. In the first case this may not count for much owing to the mental instability present, but in the second and third there was a very strong incentive to carry on in their occupations which meant a stronger incentive to stop it.

One would have expected a much more complete distribution of symptoms in the hand of the scoliotic case as the pressure would be a circumferential one, but the presence of fat in the intervertebral foraminae would account possibly for a partial pressure.
In none of the cases were any muscular or trophic changes present.

**Diagnosis.** — The possibility of root pressure should be considered in all cases of vague, one-sided shoulder or arm pains, particularly where the patient is a female about puberty or in her early twenties. The pain itself must be carefully investigated, particularly its site, its character, and its relation to the anatomical area of a definite nerve.

Tenderness on pressure over the lower brachial plexus, particularly if there are also shooting-pains down to the hand or forearm, points to a neuritis. If the pain is increased on stretching or continuous drooping of the shoulder, and conversely relieved by some attitude or position which prevents this, there is a strong probability of there being root pressure present.

The differential diagnosis of the vague, indefinite cases will include progressive muscular atrophy, which is distinguished by tremors of the affected muscles, while there is never any sensory disturbance, syringomyelia distinguished by its tremors and spastic phenomena and other signs of a spinal lesion, while spinal tumours will also show other signs of a spinal lesion.

A careful radiographic examination will give great help in the diagnosis, though one should not expect it to be conclusive in every case, as a foreshortened view of the rib in an antero-posterior view may be very indefinite. But if no rib is present while a definite scoliosis is, then some effort at curing the scoliosis should be made if even to exclude the possibility of the curvature being causal of the root pressure. If neither of these can be shown in the X-ray in the presence of definite root pressure symptoms, then the possibility of pressure from a fibrous band or from a normal first rib will be considered.

**Treatment.** — There is no doubt that in all the cases under consideration an early diagnosis would have simplified the treatment to a great extent, for it seems evident that a postural form of treatment, as so widely advocated by American orthopaedic surgeons, would have prevented the shoulder dropping, kept the muscle tone of the shoulder at an optimum, and so obviated the possibility of symptoms in the rib cases and prevented the extension of the curvature in the case of scoliosis and its attendant sequela of root pressure.

In the majority of cases, however, the treatment must be more drastic, that is operative in the rib pressure cases, while
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the suggested line of treatment in the scoliotic cases is seen in the case herein detailed.

After the immediate cause of the neuritis is removed it is important that the case should be carefully looked after, so that a complete recovery is obtained from the paralysis present. It has been found that the only direct method of getting at the site of the neuritis is by ionic therapy with chlorine or potassium iodide. This should be carried out by a direct through-and-through current. The two pads should be arranged, the one in front of the lesion and the other immediately behind, so that the ions have a fair chance of reaching the site of the lesion. A comparatively strong current of 40 to 60 milliamperes should be used for twenty minutes using a 1 per cent. solution of the favoured drug.

At the same time massage of the limb, exercises to the joints, particularly the shoulder, galvanic and faradic stimulation of the weakened muscles should be carried out.

Summary—1. Loss of muscle tone following on any devitalising illness is frequently the actual predominating factor in the causation of symptoms of brachial pressure neuritis.

2. Brachial pressure neuritis is not an uncommon sequel of scoliosis and may be present in either the convex or the concave side according to the site of the pressure.

3. A lesion of the spinal accessory nerve allowing dropping of that shoulder to a further extent than normal will often determine the onset of pressure symptoms.

4. Vague one-sided shoulder pains in a young female increased by active exercises and diminished by rest or certain postures should be considered as a possible sequel of brachial pressure neuritis.

5. Traction for the scoliosis cases and radical operation for the rib pressure cases followed by physio-therapeutic treatment to strengthen the shoulder muscles seems to be the rational mode of treatment.