

TRAUMATIC ANEURYSM OF THE RIGHT SUBCLAVIAN ARTERY TREATED BY LIGATURE OF THE FIRST PORTION OF THE SUBCLAVIAN TRUNK AND VERTEBRAL ARTERY.

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I THINK the notes of a case of traumatic aneurysm of the subclavian artery, associated with a concurrent brachial monoplegia, which came under my care over three and a half years ago, are of sufficient interest to be placed on record. The patient has been under observation ever since, so that now the results of the operative treatment may be fairly regarded as reliable and permanent.

A. P., age 24, a discharged soldier, was admitted to the London Temperance Hospital on May 25, 1916. He complained of a painful swelling in the right side of his neck, of a constant ache in his right shoulder and chest, and of a burning pain along the inner side of the corresponding arm and forearm. Before he joined the army he had had no illness of any importance.

History of Present Condition.—At five o'clock in the morning of January 15, 1915, the patient was shot through the lower part of the right side of his neck by a "stray bullet from a machine-gun or sniper." He was standing erect in the act of transferring a small bag of potatoes from his right to the opposite shoulder when he was hit. His right arm "dropped powerless" and he fell to the ground unconscious. He remembered nothing more until about 5 p.m., when he spat some blood. This continued for a few hours and then stopped. There was no bleeding from the wound in the neck.

For four weeks he was unable to move his arm; but at the end of this time he recovered some use of the limb, though his fingers still remained "weak when using a knife and fork."

Two days after he was shot he reached the base hospital, and, three weeks later, "nearly three pints of blood were taken from the right side." To ease the pain he was in the habit of rubbing his shoulder and chest with his left hand, and on one such occasion he felt a lump above his collar-bone 'beating like a hammer.' It was then the size of a walnut. On the whole it has only increased to its present dimensions slowly, and indeed remained stationary for months at a time. He was discharged from the Army on June 2, 1915. Three days later he started work as a gateman on the tube railway, where he worked continuously as such up to the date of his admission to hospital in May, 1916.

Condition on Admission.—The scars of the entrance and exit wounds were situated at the junction of the inner and middle thirds of the clavicle close to its upper border, and about $1\frac{1}{4}$ inches below the middle of the spine of the scapula.

A tumour exceeding the size of a foetal head occupied the whole of the posterior triangle of the neck, and extended inwards beneath the sternomastoid muscle, backwards and outwards under the trapezius to the scapula, and downwards beneath the clavicle, where its lower limit could not be determined. It appeared, however, to become continuous with an ill-defined mass which could be felt in the axilla and which pushed the pectoral muscle forward. The skin over it was tightly stretched, but there was no distention of the superficial veins, nor œdema or lividity in the arm or face. The main part of the swelling was round, fairly regular in outline, tense but resilient, and very tender to pressure posteriorly. The clavicle seemed to constrict and indent the swelling, as though a firm unyielding band had been tightly stretched across, dividing it into a larger supraclavicular and a smaller infraclavicular portion. The former pulsated visibly, and the pulsations

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were expansile. A systolic bruit was audible over a limited area of the part above the clavicle. There was no thrill. The right brachial and forearm pulses could not be felt.

Motor Functions.—The right upper eyelid drooped, and narrowed the palpebral fissure, but the voluntary excursions of the eyelid were not at all diminished. The eyeball had definitely receded into the orbit, the right pupil was smaller than the left, and though contracting normally to light and to accommodation, it did not dilate as quickly as the left. There was no difference in sweating on the two sides of the head and neck, trunk, or arm. The ciliospinal reflex, tested by painful irritation of the skin of the neck, was present, and the pupil dilated after the instillation of a solution of cocaine.

With the exception of the thenar, hypothenar, and interossei muscles, which gave no response to faradic stimulation, the muscles of the upper extremity reacted to faradism, though not as briskly as the corresponding muscles of the opposite side. There was some



FIG. 382.—Skiagram taken on October 16, 1916, four months after operation. The absence of the inner end of the clavicle and atrophy of the first rib are clearly shown. There is an oval shadow indicating the outline of the sac, which extends into the upper part of the chest.

wasting of the supraspinatus muscle ; but any disability resulting from its paralysis was slight, for abduction of the humerus, though definitely weakened as compared with the left side, could still be performed by the deltoid. The intrinsic muscles of the hand were much wasted. When tested, these muscles exhibited the reaction of degeneration, and the typical *main en griffe* deformity was present.

Sensory Functions.—Although clinical data obtained by investigation of sensation were at times conflicting and uncertain, owing to the patient's restlessness and pain, it seemed pretty clear that there was an area anæsthetic to cotton-wool and pin-pricks over the front and back of the inner side of the arm and forearm as far as the wrist, corresponding to the cutaneous area subserved by the first thoracic posterior root.

The upper part of the right side of the chest was dull to percussion, and breath sounds and vocal resonance were absent over this area. No other abnormality was detected in his chest or abdomen.

X-ray Report.—Skiagrams of the right clavicular region showed great displacement of the clavicle and of the first two ribs, due to a large opaque body in the upper part of the right side of the thorax and neck. A traumatic aneurysm of the subclavian trunk was diagnosed, with injury to the first dorsal nerve.

Progress of the Case.—Absolute rest in bed was enjoined. The diet was dry, non-stimulating, and restricted. Calcium salts with large doses of potassium iodide were administered, while pain was relieved, but not abolished, by nepenthe and injections of morphia. Locally, ice-bags were applied as long as the patient would submit to their use. Instead of diminishing, however, the swelling slowly increased.

The deep gnawing pain in his chest and shoulder became almost unbearable. He was unable to sleep or rest, so that large and increasing doses of morphia were required to keep him quiet. The existence of severe and constant pain which was rapidly exhausting the



FIG. 383.—Taken Nov. 17, 1919. The present condition of the area of operation. The narrowing of the palpebral fissure is well shown, and the tenseness of the sternomastoid. The depression left after removal of the inner half of the clavicle is evident.

patient, and the increase in size of the swelling, which at no time showed any tendency to natural cure, were regarded as indications for operation. The possibilities of a sudden subcutaneous rupture, with death from syncope or gangrene of the limb, as the result of further treatment on expectant lines, as well as the risks of operation, were fully placed before the patient. He begged that something further might be done to relieve his suffering; and gave permission for disarticulation at the shoulder-joint should the necessity for this arise in the course of operative treatment. Having regard to the size and position of the tumour, extirpation or other local treatment of the sac was deemed too hazardous and therefore inadvisable; and for cure of the aneurysm it was decided to rely upon proximal ligation of the artery.

Operation.—On June 30, 1916, an incision was made along the anterior border of the sternomastoid muscle from the upper border of the thyroid cartilage to the level of the third rib, while another was carried inwards from the acromial end of the clavicle, one

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inch below the lower border of the bone, to meet the first incision at the sternum. After reflection of this triangular flap of the superficial tissues, the clavicular head of the sternomastoid muscle, which was much attenuated, was carefully raised from the underlying parts and divided with scissors close to its attachment to the bone. It was not easy to recognize the usual landmarks at the root of the neck owing to the infiltration and condensation of the soft tissues around the tense aneurysmal swelling, which was found encroaching so much upon the limited space available for working on its inner side, that it was decided to resect the inner half of the clavicle. After removal of the bone, the outer border of the infrahyoid group of muscles was identified, and what was left of the sternohyoid was cut across. The finger now felt for the pulsations of the common carotid artery, which was exposed by traction inwards of the fibres of the sternothyroid muscle and by cutting through some areolar tissue in which were the distended tributaries running from the thyroid gland to the internal jugular vein. This structure, and the vagus, were held



FIG. 381.—Shows that elevation of the arm can be carried out to nearly the same extent on each side.

outwards while the artery was traced downwards by blunt dissection as far as the innominate bifurcation. The subclavian trunk was found lying in a plane posterior to the carotid. It looked normal in size and structure. When it had been ascertained that occlusion of the vessel effectually controlled the circulation in the aneurysm, a stay-knot of soft floss silk was applied to the vessel close to its origin. No trouble was experienced in passing an ordinary aneurysm needle, unthreaded, from below upwards. Neither the recurrent laryngeal nor phrenic nerve was seen during this exposure of the artery, and the pleura was easily depressed and kept out of the way with the finger. Though all pulsation in the aneurysm had now completely stopped, it was decided to place a ligature on the vertebral artery, which was exposed as it came off from the posterior part of the parent trunk. By simultaneous ligature of the vertebral artery it was hoped to prevent the rapid establishment of a free collateral circulation. The wound was closed without drainage, a graduated pressure-dressing was applied to obliterate the dead space left as a result of the dissection, and the arm, enveloped in warm cotton-wool, was fixed to the side.

Subsequent Progress.—The stitches were removed on the tenth day, the wound having healed by first intention. Gradual solidification and diminution in size of the swelling took place, and when he left hospital on October 16 it had diminished to the size of a Tangerine orange. Its outline was nodular, and a cord-like band, movable from side to side, could be distinguished running downwards and outwards over its surface.

In December, 1919, there was no visible swelling, and, with the exception of the absence of the inner end of the clavicle, nothing abnormal could be felt in the neck.

Stereoscopic skiagrams taken at this time by Dr. Herbert Rhodes showed that the greater part of the opaque body in the upper portion of the thorax had disappeared, and that most of the first rib between its neck and costal cartilage had been eroded and destroyed by the pressure of the aneurysm.



FIG. 385.—Abduction can be carried out to a right angle. The atrophy of the deltoid and upper arm muscles is evident.

COMMENTS.

It is interesting to note that whereas the brachial paralysis and hæmoptysis appeared very soon after he was wounded, the aneurysm was a comparatively late development. No swelling was observed in the track of the bullet, either by the man himself or by his attendants, for quite three weeks. Had any such tumour been present, it would almost certainly have been recognized, for the patient was at this time under constant supervision for a hæmothorax that was aspirated before he left the base hospital. The tumour was small, with no tendency to secondary extension, and, as active surgical measures were not undertaken, it may be presumed that the case was regarded in hospital as one likely to end in spontaneous consolidation and natural cure. He was therefore transferred to England. The swelling remained stationary in size, and, save for its pulsation, gave rise to no inconvenience until some months after he started work. Further escape of blood had been prevented by the firm hard coagulum. In course of time a traumatic aneurysm was formed with walls composed of organized blood-cot, supported externally by thickened and infiltrated tissues. During the period of reduced activities associated with enforced rest, its wall was strong enough to ensure limitation of the aneurysm, but it proved insufficient to prevent extension when the man resumed work that involved the free and constant use of both arms.

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The damage produced by the bullet was not confined to the blood-vessel, for apparently all the functions subserved by the right brachial plexus were originally in abeyance. Thus the whole limb and shoulder girdle were paralyzed immediately following the receipt of the injury, and general wasting set in. Sensation was abolished, and there were evidences of interference with the right cervical sympathetic nerve. At the present time (December, 1919) it would appear that these functions as a whole are nearly restored. Although particular muscles, with the exception of the intrinsic hand group, are not noticeably weakened or wasted, there is relative diminution in power and bulk as compared with the left side, and this is accompanied by some impairment of faradic excitability. The weakness and wasting, however, are now passing off; but the flexor muscles of the wrist, deltoid, and latissimus dorsi are more affected than the middle-arm muscles; that is to say, the muscles supplied by the posterior and inner cords are slowest to recover. The wasting of the right supraspinatus muscle was due in all probability to a special lesion of the suprascapular nerve by the bullet towards its point of exit. Sensation is now normal over the inner side of the arm and forearm, but the oculopupillary phenomena of paralysis of the cervical sympathetic, that were noted on admission, still persist. The inequality of pupils, however, is not now so marked. The fibres concerned in these functions leave the ciliospinal centre and emerge from the cord chiefly by the first, but also by the second, thoracic root. As the ciliospinal reflex was present from the first in response to skin stimulation and cocaine, it is probable that some of the pupillo dilator fibres from the second thoracic root had escaped injury in this case.

It may be inferred, therefore, that—apart from the general weakening of the brachial plexus as a result of concussion at first, and later of the pressure of effused blood—there has been a special lesion of the first thoracic nerve principally affecting its anterior root fibres, which are probably destroyed, but involving in some degree also the fibres of the posterior root.

Perhaps the most arresting feature of the case was the dramatic relief from great suffering and pain that followed the application of the ligature. No narcotics were given after operation, as the patient was able to rest and to sleep well without them. His general condition rapidly improved, and in January, 1917, he resumed his work as a gate-man on the electric railway, leaving this employment in June, 1918, to become a driver with charge of a horse-van in the service of a railway company. Six months ago he left the company, and, learning the trade of a cabinet-maker, he is now fully employed in this occupation.

Active movements at the shoulder-joint are normal. The absence of the inner half of the clavicle has in no way reduced his wage-earning capacity. Indeed, the loss of this bone in its entirety seems to be followed by no disability and to detract very little, if at all, from the functional utility of the limb. Thus, in 1918, I removed the whole of the left clavicle of a nurse for sarcoma. The patient still follows her usual vocation, and notices no difference in the power and usefulness of the arm. It would appear to be, therefore, both time-wasting and superfluous to replace any portion of the clavicle that may have been removed to facilitate subsequent operative procedures, while it is undeniable that, by reducing the time consumed in operating, the risks of wound infection will be correspondingly diminished.

I wish to express my thanks to Dr. Watts and Dr. Scarborough for their assistance throughout the operation; to Dr. Constable for much valuable help and care in supervising the daily records of the case; and to Mr. Howard Jones, whose skilful administration of ether by the intratracheal route contributed materially to the successful result.