SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

INJURIES IN THE REGION OF THE SHOULDER-JOINT

I. CAPSULE AND TENDON INJURIES

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Shoulder injuries other than fractures and dislocations are often misunderstood and indifferently treated because neither the functional importance nor the vulnerability of the supraspinatus tendon is recognized. The majority of the painful shoulders of domestic life are due to minor injury of this tendon, and complete rupture, though rarely diagnosed, is a common and disabling industrial accident. The tendon of the supraspinatus, with that of the subscapularis and of the infraspinatus on either side, forms a thick continuous fibrous sheet fused with the underlying capsule of the shoulder-joint and separated from the deltoid and the acromion process by the subdeltoid bursa. With every abduction movement of the shoulder, particularly through the range of 60 to 120 degrees, there is impingement and friction of the supraspinatus tendon against the acromion process (Figs. 1a, 1b, 1c). It is to

Supraspinatus Tendinitis

The symptoms are often attributed to a minor strain, and the patient complains of pain on the outer aspect of the shoulder and over the deltoid insertion. It does not radiate to the elbow and forearm as in brachial neuritis due to cervical osteo-arthritis. There is tenderness on pressure, accurately localized to one spot—the great tuberosity of the humerus where the supraspinatus tendon is inserted. Movement is not limited in any direction, but there is an acutely painful arc of abduction between 60 and 120 degrees—the range during which the tender area impinges against the margin of the acromion. Movement of the limb by the side is painless. When the painful arc is passed the tender region lies protected beneath the acromion and not in contact with it, and movement is again entirely painless. As the arm is brought down to the side there is once more sharp pain from 120 to 60 degrees of abduction. Radiographic examination shows no abnormality.

Dramatic results may be secured by injecting 5 to 10 c.cm. of 2 per cent. novocain into the painful area. The skin is anaesthetized and the point of the needle is introduced into the tendon and capsule. Pain is at once

FIGS. 1a, 1b, 1c.—In supraspinatus tendinitis, calcification, and incomplete rupture there is a painful arc of abduction between 60 and 120 degrees, due to impingement against the acromion. There is no impingement and therefore no pain when the arm is by the trunk or by the side of the head.

minimize this friction that the subdeltoid bursa lies between the two structures. As years go on, especially in the case of labouring men accustomed to strenuous shoulder exercise, the protection of the bursa becomes inadequate and the constantly repeated trauma gives rise to degenerative changes in the tendon and capsule. The fibres undergo wearing and attrition—*supraspinatus tendinitis*. This degenerative process occurring in a relatively avascular tissue may lead to a calcareous deposit—*supraspinatus calcification*. The worn and necrotic fibres become unusually susceptible to injury: a simple fall or a sudden muscular effort may cause incomplete or complete rupture of the supraspinatus tendon. In the more severe cases the tendinous and capsular degeneration extends to the bicipital groove and accounts for spontaneous rupture of the biceps tendon. Years of latent tendinitis, possibly associated with a distant toxic focus, may be lighted up by a simple strain to culminate in an attack of "periartthritis" with periarticular adhesion formation.

relieved, and for the first time the patient is willing to move his arm freely and without caution in all directions. He must be warned, however, that within five or six hours, as the analgesia passes off, pain will recur and may be intensified. Morphine may be necessary. The exacerbation generally subsides within a few days, and in many cases the symptoms are permanently relieved. Presumably the infiltration of the tissues is followed by an irritative reaction causing swelling, which temporarily increases the effect of impingement against the acromion, and hyperaemia, by which the degenerated avascular tendon is subsequently revascularized. If the symptoms are incompletely relieved by the injection diathermy and radiant heat are of value in encouraging the necessary revascularization.

Calcification of the Supraspinatus

The symptoms and clinical signs of supraspinatus calcification are identical with those of tendinitis without calcification, and the conditions are to be distinguished radio-

graphically. The deposit of amorphous calcium carbonate and phosphate is of the consistency of tooth-paste and lies wholly enclosed within the tendon fibres. Its volume so increases the degree of impingement against the acromion that abduction movement beyond 60 degrees may be far too painful to be attempted. With large deposits the patient sits and stands with the arm hanging from the shoulder, to increase as far as possible the space between the humerus and the acromion; the support of a sling may be intolerable.

Whereas simple supraspinatus tendinitis is very common, tendinitis with calcification is rarely seen. The source of the calcareous deposit is the impairment of blood supply from preceding tendinitis. But the calcareous mass at once produces a secondary irritative hyperaemia in the adjacent tissues, which may not only cause spontaneous absorption of the calcium but also cure the underlying tendinitis. Small deposits should therefore be treated conservatively by diathermy, radiant heat, and massage. The limb should not be supported in an abduction frame, because abduction is the most painful position of the joint. Active exercises are encouraged as soon as possible.

Large deposits should be removed through a two-inch incision. The mass is usually too inspissated for removal by aspiration. The deltoid is split, the subdeltoid bursa is incised, and a greyish-yellow mass is seen enclosed within the tendinous and capsular fibres. The fibres are divided in their long axis and the granular paste is evacuated with a small spoon. There is immediate and complete relief from the pain, and full active exercises can be practised at once.

Complete Rupture of the Supraspinatus

Although there is no doubt that the earlier degenerative changes of supraspinatus tendinitis predispose to rupture of the fibres, complete rupture of the supraspinatus tendon usually follows a definite injury—a fall or a severe muscle strain—in middle-aged hard-working men. Occasionally it occurs as a complication of disloca-

FIG. 2.—Active abduction by the deltoid is only possible if the head of the humerus is fixed by the supraspinatus. If this tendon is ruptured weak abduction to 60 degrees by scapular movement is all that is possible.

tion of the shoulder or fracture of the upper end of the humerus. There should be no difficulty in establishing the diagnosis, for active movement of the shoulder is seriously restricted. The diagnostic sign is a greater limitation of active than of passive abduction in the presence of a normally contracting deltoid.

The humerus cannot be abducted by the deltoid alone, however powerful it may be; the supraspinatus is an essential synergist. Like the workman's mate who stands on the bottom rung of a ladder to prevent sliding while it is elevated to the vertical position, the supraspinatus must anchor the head of the humerus to the glenoid to provide a fulcrum from which leverage can be obtained by the deltoid (Fig. 2). If the supraspinatus is inactive strong contraction of the deltoid pushes the head of the

humerus up towards the acromion and holds it there while the scapula rotates. Weak abduction to about 60 degrees is possible through scapular movement, but there is no true gleno-humeral abduction. The more the patient struggles to elevate the limb the more he shrugs his shoulder.

Since the deltoid is felt strongly contracting the loss of active abduction cannot be due to circumflex palsy; and since passive movement of the shoulder by the examiner is normal, or at least is possible through a further 30 or 40 degrees, the limitation cannot be due to adhesion formation or arthritis. The wince of pain at 90 or 100 degrees abduction as the limb is raised or lowered passively and the tenderness on pressure over the insertion of the supraspinatus clinch the diagnosis.

As with any other tendon rupture, if the torn fibres are approximated and immobilized with unfailing constancy satisfactory repair will usually take place. Operative treatment is not as inevitable as many recent writers suggest. The arm is immobilized in 90 degrees abduction and 60 degrees external rotation in a frame applied very carefully so that the arm cannot ever be lowered below the right angle. At least ten or a dozen wide bandages must be used to fix the frame to the trunk and to prevent it sliding down. The position is maintained rigorously

FIG. 3.—Complete rupture of supraspinatus tendon and the capsule. The articular cartilage of the humerus and the biceps tendon are visible through the rent.

for at least eight to ten weeks and until the arm can be raised actively and held 20 or 30 degrees above the right angle. Throughout this time active exercises are practised for the fingers and wrist- and elbow-joints.

Conservative treatment cannot be really successful unless it is instituted promptly, within a few days of the rupture. If there has been delay in establishing the diagnosis, or if there is doubt whether the frame treatment will be carried out with absolute efficiency, operation is to be preferred. Fairly satisfactory results are possible even many months after injury. Through an anterior split deltoid incision the triangular-shaped rent in the tendinous expansion and capsule is exposed, with the articular surface of the head of the humerus visible through it (Fig. 3). The apex of the triangle is the

retracted supraspinatus tendon; the base is the great tuberosity from which it has been avulsed. The humerus is moderately abducted to approximate the torn fibres, and several mattress sutures of No. 6 chromic gut are employed. A "bone needle" should be used and the stitches passed through the tuberosity itself, so that cutting out from the short distal fibres is avoided. An abduction frame is worn to prevent early strain on the sutures, and is retained for several weeks, until the patient can easily lift the arm and hold it 20 or 30 degrees above the right angle. If in addition to the tendinous rupture there is adhesion formation limiting the terminal degrees of abduction, this movement must be regained by the patient's own active exercises, repeated many times during the day.

Incomplete Rupture of Supraspinatus

Between the case of simple supraspinatus tendinitis and that of complete rupture of the tendon there is a whole range of cases of varying degree of incomplete rupture of the tendon fibres. These are the cases which may present difficulty in diagnosis and treatment. Although common, they are more often overlooked than diagnosed, and there is no doubt that the victim's suffering has frequently been increased by an unjust charge of malingering. Evidence of incomplete rupture may be found during routine necropsies in no less than 30 per cent. of all cadavers. Radiographic examination is negative and the clinical features are all-important.

There is pain over the shoulder, often referred along the circumflex nerve to the region of the insertion of the deltoid; this is increased by active use. Tenderness is localized to the insertion of the tendon at the great tuberosity. Active abduction is probably possible through a normal range, but there is the characteristic "catch" of pain at 90 or 100 degrees as the torn fibres pass the acromion. The movement cannot be sustained against resistance. As the rupture becomes more complete active abduction becomes increasingly difficult. It may only be possible to abduct the humerus if it is first *fully* externally rotated. There is a characteristic reversal of scapulo-humeral rhythm. Whereas normally the first half of abduction movement is mainly a movement of the humerus on the scapula, and the movement of the scapula on the chest wall is most pronounced during the second half of the range, in the case of incomplete rupture of the supraspinatus the movement is initiated by rotation of the scapula, and humero-scapular movement is most pronounced in the second half of the range.

Conservative measures should usually be given a trial. The shoulder is immobilized in abduction and external rotation. The frame is retained and no single downward movement of the limb is permitted until full power of abduction is restored and the painful catch at 90 or 100 degrees abduction is relieved. This may necessitate fixation for only three or four weeks, or in more severe cases for several months. If there is no sign of real improvement after six or eight weeks the tendon should be exposed and repaired.

If at operation there is no evidence of rupture of the supraspinatus the humerus should be fully rotated inwards and outwards, so that the whole of the front outer aspect of the capsule and of the subdeltoid bursa is explored. Occasionally thickened hyperaemic fringes are found within the bursa which have accounted for creaking on shoulder movement and, because they are nipped between the head of the humerus and the acromion, for all of the symptoms and signs of incomplete rupture of the supra-

spinatus tendon. Although subdeltoid bursitis has been a common diagnosis in past years it is actually extremely rare. The symptoms are relieved by excision of the thickened fringes and bursal wall, followed by regular active exercises and physiotherapy. Very exceptionally it is found that there is neither rupture of the tendon, nor calcification of the tendon, nor subdeltoid bursitis. The symptoms have been due to resistant supraspinatus tendinitis without rupture. The tendon should be lightly scarified to assist in the revascularization necessary for the relief of symptoms; after operation physiotherapy and electrotherapy are employed.

Periarthritis of the Shoulder

The symptoms arise spontaneously or after a trivial twist or strain. Pain is diffuse and tenderness is not confined to the tuberosity or region of the supraspinatus. Movements of the shoulder are guarded by muscle spasm, but there is no complete limitation of all scapulo-humeral movement such as occurs in tuberculous arthritis. It is particularly abduction and external rotation which are limited; internal rotation and forward and backward flexion are free. The limitation of movement by muscle guard rapidly passes to limitation by adhesion formation, varying from a few localized bands to diffuse generalized adhesion of the whole of the capsule—"the frozen shoulder."

In the early acute stage the worst treatment is manipulation under anaesthesia, or frequent passive and forcible stretching by a masseuse. Forcible treatment tears the already inflamed tissues and increases the sero-fibrinous exudation. If the range is actually measured and recorded it is found always to have been reduced by such measures. On the other hand the patient must be urged to practise active exercises. Massage, physiotherapy, and hydrotherapy may help the patient to persevere despite discomfort, but the one essential treatment is active exercise performed for a few minutes hourly throughout the day. The resistance of gravity may be avoided by practising exercises in recumbency and in the stooping position.

Periarticular Adhesion Formation

The adhesions may follow periarthritis or a simple strain or contusion of the shoulder, or they may arise insidiously when a fracture of the elbow, forearm, or wrist is treated with the whole limb in a sling. Abduction and external rotation movements are limited. It is the limitation of external rotation which is of significance. The normal shoulder cannot be abducted beyond the right angle if the humerus is held internally rotated, and until external rotation movement is regained abduction cannot be regained. The range of rotation is tested with the elbow to the side and the forearm and hand pointing forwards. Normally it is possible to rotate the limb out through almost 90 degrees, so that the forearm and hand now point sideways. If this is completely limited it is a waste of time to practise abduction exercises. The patient should stand with his back to a wall, with his elbows touching it, and turn the forearms further and further out until the hands reach the wall. He must try to reach the back of his neck, and, with the fingers clasped, move the elbows back into the position of true abduction. As external rotation improves he reaches over the top of his head to the opposite ear. He may then practise crawling up a wall with his finger-tips, marking the level reached and trying to attain a higher level every day.

The exercises are repeated ten minutes hourly throughout the day. There must be encouragement and stimula-

tion, but no passive stretching, no sudden jerking or forcible movements, and no hanging by the affected arm from overhead beams or bars. Manipulation under anaesthesia should not be used except as the last line of treatment, to be applied only when actual measurements show that movement is no longer increasing. If a manipulation is unfortunately inevitable, it must be performed as gently as possible and not more than one group of adhesions must be broken at a time. If too much is done the reaction is so severe that the movement cannot be retained, and the joint may become stiffer. Many shoulders, temporarily stiff after dislocations and minor injuries, have been made permanently stiff by injudicious manipulations, performed too early, repeated too often, and followed by passive and forcible stretching.

THE RED CROSS CONFERENCE

CONCLUDING SESSIONS

After the opening proceedings recorded in the last issue (p. 1381) the International Red Cross Conference divided itself into four Commissions, which met at the British Medical Association House for sessions lasting for three days. At the ensuing plenary session, which was held at St. James's Palace on June 24, reports from the Commissions were presented.

The first Commission, of which Miss Norah Hill (Indian Red Cross) was rapporteur, brought forward a series of resolutions dealing with organization, all of which were passed unanimously by the Conference with one exception—namely, a resolution asking that the needs of the two international bodies, the International Red Cross Committee and the League of Red Cross Societies, should be studied with a view to suggesting the best procedure for raising the funds necessary to meet as far as possible the needs of both bodies. The German Red Cross asked that its abstention might be recorded, for reasons presumably given in private to the Commission. Another resolution, which was only carried by a majority in the Commission but unanimously in the Conference, declared that no Red Cross delegation, section, or committee should be established in foreign territory without the consent of the central committee of the national society of the country concerned, and that such consent should only be asked for in exceptional circumstances, for purposes definitely determined in advance, and for a limited period.

Zones of Immunity

After two hours' discussion on the form of a resolution it was agreed unanimously, on the motion of Mr. Norman Davis, to appeal in the name of humanity to the competent authorities in all countries to prevent or so restrict bombing from the air as to safeguard the lives of helpless women and children and aged civilians, and to urge those authorities, in all areas where civilian lives are liable to be endangered by any military operations, to arrange for the evacuation of women and children into zones of immunity under Red Cross protection. This was the unanimous resolution of the fifty-four National Red Cross Societies assembled at the Conference, and was endorsed by the Conference, also unanimously, at the plenary session.

The second Commission, which was entrusted with legal considerations, and was reported upon by M. Gorgé (Switzerland), also brought forward a resolution on the subject of the creation of hospital towns and areas. After thanking the committee of the International Congresses of Military Medicine and Pharmacy for the assistance it had given, the Commission considered that in any case the creation of hospital towns or areas could not in any way weaken the protection resulting from the rules of international law as a whole, and urged the convocation in

the near future of a commission of military and legal experts with a view to establishing a draft on the subject for the consideration of a diplomatic conference. In the meanwhile it hoped that the Governments would consider, as need arose, the possibility of concluding mutual agreements providing for hospital towns and areas. This was agreed to unanimously by the main conference. Another resolution pointed to the satisfactory results obtained during a recent conflict by the creation of an area of immunity for the civil population, and requested the International Committee to bring these satisfactory results to the attention of the Governments concerned at all times when such action might seem expedient. Other resolutions related to the protection of women and children against the suffering resulting from armed conflicts, and the role and activity of the Red Cross in civil war.

First-aid Posts on Highways

One resolution of the third Commission, reported on by Dr. de Carvalho (Brazilian Red Cross), urged that every effort be made to develop collaboration with automobile clubs and other national and international organizations with a view to providing highways and, more especially, the international trunk roads with standardized types of first-aid posts, the position of which may be shown by standardized road signs. It also recommended to the secretariat of the League of Red Cross Societies that the development of first-aid services on highways on a standardized plan should continue to be encouraged and the scope of its activities in the prevention of accidents be widened, in the first place by teaching the rules of the road and first aid to children through the junior Red Cross. This Commission also noted the great progress made in the use of aviation to bring relief in cases of disaster, to establish communication with isolated populations, to bring supplies of food and medicine, to further the transport of doctors, nurses, and relief personnel, and to evacuate the sick and wounded. It asked that the national societies should attempt to organize courses of training in aerial transport, and that the use of aviation for relief purposes be encouraged.

The fourth Commission, the work of which was reported by Miss Mabel Boardman (American Red Cross), dealt principally with the educational work of the Red Cross. One of its resolutions congratulated the American Red Cross on the splendid organization of its voluntary aids, and recommended that all Red Cross Societies should extend their activity in this field both as a particularly beneficial means of action and as a means of spreading the Red Cross spirit throughout the community.

The Next International Conference

It was decided that the next International Conference should be held at Stockholm in 1942. The following were elected a committee to act in the interval between international conferences:

Sir Arthur Stanley (British Red Cross Society),
General A. Hultkrantz (Swedish Red Cross),
Senator G. de Michelis (Italian Red Cross),
Chao Phya Bijayanati (Siamese Red Cross),
Dr. Pedro T. Vignau (Argentine Red Cross).

A large number of complimentary speeches were made by members of the Siamese, Polish, Japanese, Chilean, French, and Egyptian delegations among others, and special thanks were accorded to the British Red Cross Society for acting as host. A representative of Nationalist Spain congratulated the chairman (Sir Arthur Stanley) on the manner in which he had kept the Conference away from political questions. Senator de Michelis (Italian Red Cross) made a long statement on Italian law, which, he said, provided for the creation of safety zones for medical services and shelter for the civil population, also for prisoners of war to be dealt with according to international regulation, even in the case of a country which had not honoured the international Convention.