REFRESHER COURSE FOR GENERAL PRACTITIONERS

THE PAINFUL SHOULDER

BY

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Pain in the shoulder may result from lesions of a gross nature, such as fractures, dislocations, tuberculosis, bone tumours, and infective arthritis, or may be due to abnormal conditions of the cervical spine, the apex of the lung, and the pleura, or to obstructive lesions of the cervico-axillary outlet. Pain may also be felt in the shoulder from visceral disturbance, notably from heart and gall-bladder disease.

When these lesions are excluded there remains a well-defined group of conditions of the shoulder in which there is pain, limitation or alteration of shoulder movement, sometimes muscular wasting, and usually no radiographic evidence of abnormality. It is to this group that the term "painful shoulder" is applied, and in considering the underlying pathology certain anatomical and physiological features of the shoulder must be recalled.

Normal Shoulder Movement

The movement of full elevation of the arm includes motion at no fewer than four joints: the sterno-clavicular joint is involved mainly in the early phase of elevation, the acromio-clavicular mainly towards the end of this movement, whilst gleno-humeral and scapulo-thoracic movements are occurring throughout all phases. The participation of each of these four components in the entire movement of elevation of the arm is simultaneous and not successive, and each shoulder muscle is known to contract throughout the full range of elevation, though with a peak of maximal contraction at a selective and critical phase.

The muscles acting at the gleno-humeral joint can be divided into two groups—a superficial set, essentially the deltoid, and a deep set consisting of the spinati, the subscapularis, and the teres major and minor. These two groups are separated by the subdeltoid bursa, and each has a different though equally important part to play in shoulder movement. The deep muscles act by tensing, fixing, and depressing the humeral head against the glenoid cavity, so that the superficial muscles, the deltoid, can effect elevation of the humerus at a stable hinge. One set is useless without the other. If the hinge is unstable, as in ruptures of the tendons of the deep muscles, the deltoid cannot elevate the humerus or at best can only do so weakly or incompletely. If the hinge is fixed, "stuck" as it were, by inflammation or adhesions in the deep tendons, elevation is again impossible no matter how powerful the deltoid may be. The deep muscles therefore assume an extremely important position in gleno-humeral movement and their anatomy is worthy of further consideration.

Effect of Advancing Years

In the adult the capsule of the shoulder-joint is fused with the overlying deep muscles, but in the infant these structures are separated by areolar tissue, the tendons

being short and the muscle fibres extending to within a few millimetres of their humeral attachments. As age advances the tendons become longer, and the degree of adhesion between them and the capsule also increases, so that in old age the fusion may well be complete. These changes are most marked at the upper part of the capsule, so that in adult life the entire supraspinatus tendon and the upper parts of the tendons of the subscapularis and infraspinatus are intimately fused with one another and with the shoulder capsule. I have called this fused structure the physiological hinge.

Post-mortem investigations have shown that degenerative changes, ranging from superficial fibrillation to complete rupture, of this fused tendino-capsule occur in arithmetical progression as age advances, and that after 75 years fully 50% of all subjects coming to post-mortem examination have incomplete or complete ruptures of the upper part of the fused shoulder capsule. The physiological hinge of the shoulder-joint therefore tends to degenerate as one gets older, and it is suggested that most cases of "painful shoulder" are due to this degeneration, influenced by trauma or by irritative and inflammatory changes in the tendino-capsule itself. Support is given to this suggestion when it is realized that few cases of "painful shoulder" are seen before the age of 45—that is, before the age when degeneration starts. If it is accepted that the pathological changes usually start in the capsule in relationship to the supraspinatus tendon, it is easiest to consider the clinical states produced under an all-embracing term "the supraspinatus syndrome," thereby avoiding the confused and often misleading nomenclature which has been adopted in the past, though never forgetting that other parts of the shoulder capsule are affected by degenerative or inflammatory change in the worst cases.

Clinical Groups

Three groups can be recognized, all painful and each with a characteristic symptom.

1. The arm cannot be elevated by the patient nor can he sustain it in an elevated position when so placed by the examiner, but it drops uselessly to the side. This is the *useless arm or drop-arm* group, and the underlying pathology is a rupture of the supraspinatus tendon.

2. The arm has a full though often weak range of movement at the shoulder-joint, but there is pain with or without partial "locking" of a momentary nature during the middle phase of elevation, or when the arm is descending from the elevated position. This is the *painful arc* group, and the underlying pathology is a partial rupture of the supraspinatus tendon, an irritable area in the tendon due to inflammatory change, an exostosis at the tendon's humeral attachment, or a calcified nodule in the outer part of the tendon itself.

3. The arm cannot be moved actively or passively at the shoulder-joint at all—it is completely "stuck" or, as the Americans so aptly put it, "frozen." This is the *frozen shoulder* group, and the underlying pathology is an inflammatory change in the shoulder capsule.

Useless Arm

The typical case occurs in a labouring man, usually over 45, who after a fall on the shoulder or after attempting to lift a heavy weight experiences sudden diffuse pain in the shoulder, with inability to elevate the arm or to hold it elevated when the examiner places it above a right-angle. A normal range of passive movement is always present on examination and usually tenderness can be found over the tip of the great tubercle of the humerus. The arm is useless, but the pain generally subsides in a few days or weeks. The disability is due to rupture of the supraspinatus tendon, so that there is loss of the power of fixation of the humeral head in the glenoid by the physiological hinge, and the deltoid is thereby put at such a disadvantage that, although it can be felt contracting strongly by the examining hand, it is unable to effect true shoulder movement.

In recent ruptures the loss of fixation may be no more than a reflex phenomenon produced by pain, since the other deep muscles—the subscapularis and the infraspinatus—often uninjured, are also thrown out of action. This can occur in incomplete recent ruptures just as readily as in cases in which the tendon has a complete tear across its substance. It follows, therefore, that it may well be impossible to distinguish clinically between complete and incomplete ruptures. If pain is abolished by injecting into the subdeltoid bursa a few millilitres of procaine, restoration of shoulder movement will occur in a few minutes in minor ruptures, but in complete ruptures the arm will remain as useless as before. This is a helpful test and easily carried out; helpful, because incomplete ruptures will heal without any special treatment apart from a period of rest, whilst complete ruptures will require surgery.

Treatment

Conservative measures are adopted in the first instance in all cases, and the arm is put at complete rest either in an abduction shoulder splint or else with the arm at the side in a sling or bandaged to the chest wall. There is some difference of opinion about the value of an abduction splint: personally I have not seen any advantage from its use and most patients complain of the awkward and uncomfortable position which it necessitates.

If there is return of some shoulder elevation within four to six weeks conservative measures can be continued and physiotherapy and exercises will complete the return of shoulder function. When no recovery of elevation has occurred in six weeks operation is advised, to repair the ruptured supraspinatus. Several types of rupture can be met with that require slightly different techniques for their repair, which need not concern us here. The aftercare consists of rest for the shoulder with the arm in a comfortable position—I do not now use an abduction splint—until pain and joint irritability have subsided, thereafter active exercises aided by hot packs and assisted movements from the masseuse.

It must be remembered, even though an apparently effective repair of the rupture has been carried out, that the prognosis in complete rupture is still far from perfect; this is especially true if the supraspinatus area shows marked degenerative change at operation. Surgical intervention is often followed by a "frozen shoulder," and it may be six to nine months before one knows

what the end-result is to be. This is particularly true in massive ruptures or avulsions of the capsule from the humerus; in these the outlook is extremely poor for the return of useful shoulder function.

Painful Arc

After a fall, or sometimes spontaneously, a painful arc of movement during mid-elevation of the shoulder develops, with weakness of movement which may be mild or may be so marked that the patient is unable to elevate the arm against the slightest resistance from the examiner. When the arm is at the side or in the fully elevated position no pain is felt and there is characteristically a full range of shoulder movement. The symptoms are often mild to begin with, and it may be many months before the patient seeks advice. Patients frequently state that one of their main worries is putting on an overcoat: often they require help with this but are able to carry out other shoulder movements without any difficulty. Sometimes, during elevation of the arm, momentary locking occurs. In time many patients develop trick methods of shoulder elevation to avoid the painful phase, and when both shoulders are examined from the back it often becomes clear that the rhythm of scapulo-humeral action is different on the two sides.

It is thought that the symptoms are due to impingement on the under surface of the acromion process of the outer part of the supraspinatus tendon where there is a tender area from rupture, a granulation tissue swelling, or a calcified nodule. This area is in contact with the acromion only during the middle range of elevation, and so during all other phases, when the two structures are apart, no pain is felt. It is known, however, that the supraspinatus reaches its peak of contraction normally between 80 and 120 degrees elevation of the arm, and it is conceivable that active contraction of this tendon, irritable from rupture or inflammatory change and accentuated by the pull of the tendons fused to it, may generate enough tension to be in itself sufficient to cause the typical pain.

Treatment

Here again conservative measures are adopted at first and consist in teaching the patient how to avoid if possible those movements which cause pain. Repeated injections of procaine into the subdeltoid bursa also help, but it is difficult to see how physiotherapy in any form can effect lasting change. About five out of every six cases eventually clear up whether "treated" or left to their own devices. The remainder should be treated surgically.

The operation is an exploration of the shoulder exactly as for ruptures of the supraspinatus, the acromion process being excised first of all. The supraspinatus area is then examined and when the exact pathological lesion has been identified appropriate surgical techniques are employed. These may consist in excision of a band of adhesions, excision of abnormal calcium deposit, repair of an incomplete tear of the tendon, or excision of an exostosis from the superior facet of the greater tubercle of the humerus. Since it is the impingement of the pathological area against the under surface of the acromion process which is the usual cause of the pain, it is clear that the most important step in the operative treatment is the removal of the acromion. This seems to cause no disability and little or no alteration in the

appearance of the shoulder except possibly in a very thin patient. The aftercare is similar to that described under ruptures of the supraspinatus.

Frozen Shoulder

Half of the cases in this group give a history of direct injury to the shoulder and in the other half the onset is spontaneous and more gradual. Women are affected twice as commonly as men, and the average age is 55 years. At the onset pain may be severe, almost continuous, and felt diffusely over the shoulder. It may radiate down the arm into the fingers, and is usually worse in bed at night. Later the pain becomes less and may only be felt on attempted movement of the shoulder, when it is typically experienced at, or close to, the insertion of the deltoid to the outer side of the humeral shaft. In the early stages all shoulder movements are lost, though, of course, the patient can elevate the arm to about 60 degrees by the gliding action of the scapula on the chest wall; this is, however, purely a scapular movement; true shoulder movement does not occur.

The shoulder gradually loosens, but a period of many months elapses in the average case before there is a return to full shoulder function. In a certain small percentage movement is permanently, though usually only partially, lost. In the average case wasting of the scapulo-humeral muscles can be seen or felt by palpation, though in fat patients this may be very difficult to demonstrate.

It is believed that the essential pathology in this group is inflammation of the capsule after injury or from irritative causes within the supraspinatus area itself such as calcium deposits or the degenerative process already referred to. During the early period of this inflammatory process exudation occurs into and around the capsule, so that fluid is present in the joint and subdeltoid bursa. Limitation of shoulder movement at this stage is mainly due to protective muscle spasm, which therefore relaxes under anaesthesia. When resolution of the inflammation occurs a replacement fibrosis may develop with the formation of adhesions around the capsule, so that there is still limited movement even when the muscles are relaxed under anaesthesia. It is therefore possible in most cases to distinguish between an irritative and an adhesive stage by the simple method of examination of the shoulder under anaesthesia. It is to be expected, of course, that some cases will be partly irritative and partly adhesive if an intermediate stage in the resolution of the inflammatory process has been reached at the time the examination is carried out. This is an important test which should be done in every case of "frozen shoulder," since in the irritative stage the treatment is by rest whilst the adhesive stage calls for active exercise aided by physiotherapy and manipulation. It is clear that in such a tendinous and avascular structure as the shoulder capsule the repair process will be slow and therefore the patient may have to suffer symptoms for many months.

Degeneration or rupture, especially central or partial rupture, of the supraspinatus area of the capsule may be followed by calcium deposition. Such deposits, requiring x-ray examination for their discovery, produce symptoms which are no different from those described above and under "painful arc." They are found in about 5% of any series and their presence is clear-cut evidence of degenerative change. Sometimes they set up by irritation a repair process sufficient to effect cure;

at others they may rupture into the subdeltoid bursa and produce an explosive onset of pain and uselessness of the arm for a week or ten days, rapidly followed by complete relief from all symptoms. The long tendon of the biceps in its passage through the front of the shoulder capsule may share in the capsular degenerative changes, and these may be so marked that eventually rupture of the tendon occurs.

Treatment

It is important to divide these cases into their sub-groups of "irritative" or "adhesive," which, as previously pointed out, is best done by examining the shoulder under anaesthesia. In irritative lesions there is a full range of passive movements, whilst in adhesive cases movement is restricted though it can be freed by manipulation.

In irritative lesions treatment is primarily by rest, support of the arm in a sling being easiest for the patient. There are no real advantages in keeping the arm in an abduction shoulder splint; indeed, this often increases the pain. It has been customary to order heat in one of its various forms, but in a considerable number of cases this treatment may increase the pain and have to be stopped. If complete rest is given to the shoulder the severe pain gradually subsides in four to six weeks, and as soon as this occurs gentle exercises for the shoulder should be encouraged, aided if need be by massage. Exercises are best done while lying down on the back. In the average case return of function may be expected in three to four months, though it will not be full for eight months or even a year in the worst cases. If more vigorous measures are adopted the inflammatory process has no chance to subside and symptoms may persist for many months longer than is necessary.

In many cases replacement fibrosis occurs after the acute irritative stage has passed. At this stage pain is much less severe and usually occurs only on attempted movement. Whilst the shoulder is still "frozen" there is a little movement at the shoulder-joint, so that, along with the scapular glide, the arm can usually be elevated by the patient to about a right-angle. At this stage manipulation of the shoulder under anaesthesia is called for, when full movement can usually be obtained with palpable or even audible "snaps" which are due to adhesions breaking down. The manipulation must be carried out very gently, and, as a first measure, should be through full lateral rotation only. Often one manipulation is enough to free the joint, and it is usually found that after manipulation physiotherapy is a real help in hastening full recovery.

A few cases resist all conservative measures, and for these surgical exploration of the upper part of the joint should be advised, just as has been described for the preceding two groups. In these the subdeltoid bursa will usually be found to be obliterated wholly or in part by adhesions, and after excising the acromion process complete removal of the subdeltoid bursa and the adhesions will be necessary. Manipulation of the shoulder will bring the recesses of the bursa into view, and those adhesive areas which can be seen obviously to be limiting movement will be more readily demonstrated and their excision more accurately carried out. In not more than 5% the shoulder-joint remains permanently "frozen" despite careful conservative and operative treatment. In the other 95% the outlook is good.