RECURRENT DISLOCATION OF THE ELBOW

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Recurrent dislocation of the elbow is uncommon, but in the past three years eighteen cases have been discovered through the cooperation of colleagues in Liverpool, Birmingham and Oswestry. The pathology of this condition has not been well described nor is there a standard method of treatment.

A study of the anatomy, mechanism of injury and clinical features suggested that there was a constant capsular defect with secondary articular changes analogous to those that occur in recurrent dislocation of the shoulder. Eight elbows have been treated during the past three years by an operation to repair the capsular defect.

Recurrent dislocation of the elbow usually follows simple traumatic dislocation, but there may be congenital laxity of the capsule in some cases, and bilateral recurrent spontaneous dislocation has been reported (Milch 1936). Furthermore, both simple and recurrent dislocations of the elbow are commonest in children and adolescents, in whom there is greater laxity of the ligaments than is found in adults. It is interesting that most children under the age of ten are able to hyperextend the elbow joint, but gradually lose this ability during adolescence.

The natural stability of the elbow against dislocation is provided partly by the shape of the articular surfaces but also by the triangular collateral ligaments. In flexion, posterior dislocation is prevented by the impaction of the radial head and coronoid process against their humeral articulations, but in full extension, dislocation is prevented solely by the ligaments.

SIMPLE DISLOCATION OF THE ELBOW

The common posterior or postero-lateral dislocation of the elbow is caused by a fall on the outstretched hand with the elbow incompletely extended. The force of the fall is first transmitted up the forearm to the trochlear notch and coronoid process which strike against the trochlea of the humerus. In this position the laterally sloping surface of the inner two-thirds of the trochlea, by a "cam" action, converts the vertical thrust into a lateral rotation and partly valgus strain. The upper ends of the radius and ulna are displaced backwards and then laterally, swinging on the intact biceps tendon. The greatest movement is on the outer side of the joint where the lateral ligament is stripped superiorly and the postero-lateral capsule torn, allowing the radial head to rotate backwards from the capitular surface (Figs. 1 and 2).

In simple dislocation, damage also occurs to the medial side of the capsule, and considerable bruising and swelling is often present on the inner side of the joint. The medial epicondyle may be detached in children and the medial ligament stretched or ruptured. After reduction, however, it is not always possible to strain the joint to open into valgus, which indicates that the ligament remains in continuity with the periosteum, although its attachment has been stripped off the bone, usually superiorly. The weak anterior ligament, which does not contribute significantly to the stability of the joint, is necessarily damaged in posterior dislocation.

Greater damage occurs to the lateral ligament because the lateral side of the joint moves through a greater arc during dislocation. The lateral ligament is torn at its upper attachment, often with detachment of a fragment of the lateral epicondyle. The posterior part of the capsule, particularly where it lies behind the lateral ligament, is torn from its superior attachment.
Knowledge of this lateral rotation displacement mechanism is useful in the reduction of the dislocated elbow joint. Initial hypersupination to free the head of the radius and the coronoid process, is necessary. Forward flexion with traction then complete reduction, which in some cases can be achieved without an anaesthetic.

Associated fractures may occur, including the separated medial epicondylar epiphysis in childhood and fractures of the head of the radius in adults. Ununited fractures of the coronoid process do not predispose to recurrent dislocation.

**PATHOLOGY OF RECURRENT DISLOCATION OF THE ELBOW**

The essential pathological defect causing recurrent dislocation of the elbow is failure of the postero-lateral ligamentous and capsular structures, torn or stretched at the time of an initial simple traumatic dislocation, to become reattached. A pocket of capsule is created.
Case 1. Figure 5—Recurrent dislocation of elbow joint showing a defect at the back of the capitulum and an epicondylar fragment. Figure 6—The dislocation has been reduced but the deformity of the rim of the radial head, and the bone fragment, are shown.

Case 2. Figure 7—The marginal defect of the radial head is shown. Figure 8—Dislocation occurs when the forearm is pronated.

Figure 9—Case 3. A small capitular fragment is shown. There is also osteochondritis of the radial head. Figure 10—Case 4. Subluxation of the elbow with slight capsular ossification and a capitular defect is shown.
into which the head of the radius is received as it slides off its articulation with the capitulum. The intact lateral ligament would normally prevent this displacement, but if its superior attachment has been stripped up, or if it is more lax than normal, the head of the radius is no longer obliged to follow the curve of the capitulum and at some point in extension backward slipping of the forearm bones occurs. The medial ligament may also have a laxity which contributes to instability of the joint.

A simple vertical thrust, as in leaning on the arm, will force the coronoid process against the laterally sloping surface of the trochlea, which imparts to it a postero-lateral rotation movement. The coronoid process is disengaged from under the trochlea and the whole forearm then rides posteriorly. The lateral structures are more lax than the medial structures and the head of the radius, therefore, travels farther, rotating through a greater arc than the ulna, which simply displaces behind the humerus (Figs. 3 and 4).

Damage to the osteochondral surfaces is often significant in recurrent dislocation of the elbow joint. As the head of the radius displaces backwards, its edge can strike or abrade the posterior or lateral margin of the capitulum. An osteochondral fracture can occur with detachment of a fragment of bone which lies in the postero-lateral capsule (Figs. 5 and 6). Failure of union of this fragment, possibly because of the inhibiting effect of the synovial fluid, increases the capsular laxity on the outer side of the joint. Such small intracapsular bone fragments are common after ligamentous injuries of the elbow and may subsequently increase in size. A permanent defect or crater in the postero-lateral margin of the capitulum occurs, and, with repeated dislocation, the edge of the radial head can become similarly damaged, sometimes with a crater or "shovel-like" defect (Figs. 7 and 8). When, with rotation, these two articular lesions coincide, dislocation occurs with ease because the radial head can slide into the capitular defect.

Radiographs often show abnormality of the shape of the radial head and capitulum, but the lesions may be confined to the cartilaginous surfaces and are therefore transradiant. Osteochondritis dissecans of the capitulum can occur in association with recurrent dislocation of the elbow and one patient had osteochondritis dissecans of the radial head (Fig. 9). A shallow trochlea notch has been described as a predisposing factor but it may be a result of repeated dislocation.

Not all patients with recurrent dislocation of the elbow have complete dislocation, or need reduction under anaesthesia. The radial head may subluxate momentarily into a capitular defect or capsular pocket and can be reduced easily by the patient (Fig. 10) who may complain of "locking" and in the radiograph capsular bone fragments resembling loose bodies may lead to a mistaken diagnosis of osteochondritis dissecans. Two such patients have been

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**FIG. 11**

The comparative pathology of recurrent dislocation. Figure 11 illustrates an elbow with capitular flattening and a matching "shovel-like" defect of the radial head. A lax medial ligament and a postero-lateral capsular pocket are present with an avulsion fracture. Figure 12 compares the shoulder with a defect of the anterior margin of the glenoid, and a posterior impaction fracture of head of humerus. There is anterior capsular laxity with a detached labrum. Figure 13 shows the features apparent in a recurrent dislocation of any diaphyseal joint. Defect of both convex and concave surfaces are present, with capsular pockets and laxity with avulsion of the rim or attachments of ligaments. Figure 14 shows the general principles of repair of a recurrent dislocation. The capsule is shortened and attached to the articular margin, redundant capsule being excised or overlapped.
encountered recently and recurrent subluxation of the elbow joint should always be considered with vague instability or locking of the elbow.

It is interesting to compare the pathological lesion in recurrent dislocation of the shoulder and of the elbow (Figs. 11 and 12). The impaction fracture of the back of the humeral head and the anterior glenoid flattening resemble the defects of the capitulum and radial head respectively, and recurrent dislocation of any ball and socket joint could be expected to develop similar capsular and articular lesions. Figure 13 suggests the pathological features which may be found in recurrent dislocation of any diarthrodial joint, and Figure 14 the possible surgical methods of repair.

TREATMENT OF RECURRENT DISLOCATION OF THE ELBOW

Not all elbows need surgical treatment. If the dislocation, occurring as is usual in childhood or adolescence, is infrequent, the normal processes of growth may cause tightening of the capsule and ligaments and the dislocations may become less frequent and cease. Occasional dislocations at intervals of a few years are not an indication for operation, and an elbow may cease to dislocate after the juvenile tendency to hyperextension of the elbow joint disappears.

Surgical treatment is indicated when dislocations occur frequently with trivial violence in the older adolescent or adult patient. The operation suggested is a repair of the capsular and ligamentous laxity. Usually a capsular repair only on the lateral side of the joint is adequate, but when frequent spontaneous dislocations occur and when there is much medial ligament laxity repair of the medial ligament should also be done.

Technique—An incision is made on the lateral side of the elbow from the lateral epicondylar ridge to the annular ligament. The elbow is opened behind the lateral ligament and any fragments of bone are removed from the postero-lateral part of the capsule. The bone of the lateral epicondyle and of the lateral side of the capitulum is cleared of soft tissue and scarified (Figs. 15 and 16). One or two transverse holes are drilled with an awl, and catgut is passed through the bone and through the postero-lateral capsule in order to tie the capsule down tightly so that it will adhere to the bone of the lower end of the humerus as close to the articular margin as possible. A similar repair of the medial ligament is done if it is necessary. A plaster cylinder is applied with the elbow at about 40 degrees for four weeks, after which the patient is allowed to recover movements gradually.

DISCUSSION

Recurrent dislocation of the elbow joint was reported by Albert (1881) and we have found reports of thirty other cases. Except in two cases (Heusner 1894, Rehn 1924) all the dislocations have been posterior or postero-lateral.

The age when the first dislocation occurred was recorded in twenty-four cases. The ages ranged from nine months to twenty-nine years; and 80 per cent of patients were under fifteen. Of twenty-six cases in which the sex was stated, over 80 per cent were in males. Recurrent bilateral dislocation of the elbow has been described in three cases (Milch 1936, Reichenheim 1947, Kapel 1951).
A record of the physical examination of the joint is available in half of the thirty cases. In three the joint appeared normal. In twelve excessive mobility, laxity of ligaments, increase in lateral mobility or hyperextension were found.

Radiographs before operation showed no abnormality in six joints, a shallow trochlear notch in eight, fracture of the tip of the coronoid in four and fracture of the epicondyles in four. In one a flake of bone lay anterior to the joint and one other showed an osseous shadow close to the lateral epicondyle. Two authors (Reichenheim 1947, King 1953) reported a defect of the trochlea possibly due to osteochondritis dissecans, and loose bodies in the joint were recorded by Spring (1953).

Previous surgical procedures suggested for recurrent dislocation of the elbow. Figure 17—Reichenheim's operation. Transplantation of biceps tendon through the coronoid. Figure 18—Milch's and Wainwright's operation. Bone block of coronoid. Figure 19—Kapel’s operation. Artificial ligaments formed from strips of biceps and triceps tendon which are passed through the coronoid and olecranon fossa. Figure 20—Knofflach’s and Spring’s operation. Reconstruction of the medial ligament.

Treatment of the initial injury was not clear for most patients. The impression was gained that little immobilisation followed the first injury to the joint and that later conservative treatment seems to have been consistently unsuccessful in helping the established recurrent dislocation of the elbow.

Previous operations can be classified broadly into four groups (Figs. 17 to 20). All have given some successful results, although less than ten cases of any one method can be reviewed. The operations resemble those performed on the shoulder before Bankart (1938) described the original essential pathological lesion of recurrent dislocation. They consisted of slings, bone blocks and capsular repairs, but no method was invariably successful. An anterior approach to the elbow was usually used but never a posterior one. It appeared, however, that, as with the shoulder, any method that blocked the pathway of the dislocation would prevent it recurring and, with a joint as inherently stable as the elbow, all methods were more generally successful than was the case with the shoulder joint. Transplantation of the biceps tendon to the coronoid process (Reichenheim 1947) or the insertion of a bone block into the coronoid (Milch 1936, Wainwright 1947) both combine an anterior approach (with subsequent scar tissue formation) with a mechanical effect on the coronoid to prevent its
Disengagement under the trochlea—the initial step in dislocation of the elbow joint. Any anterior approach to the elbow joint, however, is technically difficult and the intra-articular tendinous slings described by Kapel (1951) are formidable technical procedures. Both Knoflach (1935) and Spring (1953) used either fascial strips or tendinous strips to reinforce the collateral ligaments and Sorrel (1935) used a bone block projecting from the lateral side of the humerus to achieve this effect.

Eight patients have been treated surgically by the method described here during the last four years. There has been no recurrence. One boy, playing football, fell on the right arm and strained the elbow, but redislocation did not occur. All patients recovered a full range of elbow movement and used the elbow normally without restriction.

SUMMARY

1. Recurrent dislocation of the elbow is caused primarily by collateral ligament laxity with secondary damage to the capitulum and head of radius.
2. The pathological changes resemble those of recurrent dislocation of the shoulder.
3. Subluxation or instability of the radial head is often associated with capsular ossification and deserves wider recognition because it may be confused with osteochondritis dissecans.
4. A simple method of soft-tissue repair has successfully prevented redislocation of eight elbows.

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REFERENCES