**Disorders of the inert structures**

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**Limited range of movement**

**Capsular pattern**

The capsular pattern at the elbow is characterized by limitation of flexion and extension (Fig. 18.1), flexion usually being more limited than extension, although equal limitation of both movements does occur. Rotations remain full and painless except in advanced arthritis, in which they can be painful at the end of the range.

The following conditions are the most common.

**Traumatic arthritis**

A traumatic arthritis presents as an isolated condition at the joint between humerus and ulna; hence there is isolated impairment of flexion and extension. The arthritis can be the result of either trauma (not necessarily severe) or – in middle-aged or elderly patients – overuse of the joint.

The patient usually states that, immediately following an injury or the day after doing heavy work or exertion, the elbow hurts diffusely. The pain is quite constant, and there is stiffness and difficulty in moving the joint.

Clinical examination shows a capsular pattern: flexion and extension movements are markedly limited and painful; rotations are of full range and painless.

On palpation, some swelling may be detected. If the swelling came on immediately after an accident, it is probably caused by blood and this should be aspirated at once. If not, the effusion is secondary and disappears as soon as the arthritis subsides. Also, a positive fat pad sign on a lateral radiograph – a response to distension of the joint capsule – is indicative of intra-articular fluid.1,2

There are two situations that are worthy of attention.

**Fracture of the olecranon**

The olecranon lies superficially and is therefore very vulnerable. Injury to the elbow, and especially a fall on a bent elbow, may result in fracture of the olecranon. It is, of course, tender to the touch and marked articular signs are found on examination: warmth, swelling and limitation of passive movement in the capsular pattern.3,5 Resisted movements are also positive in that isometric extension, an action of the triceps muscle, is painful and weak (see also p. 453). Radiography confirms the fracture and its type: it is mostly displaced but stable, and then requires surgery. When it is not displaced, immobilization suffices.5
Fracture of the head of the radius

Radial head fractures account for about 30% of all elbow fractures and mostly occur as a result of falling on to an outstretched hand. They are most common in females.

Should pronation and supination both hurt in an acute traumatic arthritis at the elbow, the head of the radius is almost certainly fractured. A radiograph confirms the diagnosis.

Treatment options for radial head fractures include conservative treatment, excision, open reduction–internal fixation, and arthroplasty, all depending on the type of fracture and the degree of displacement.

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Warning

Traumatic arthritis in combination with pain on pronation and supination and/or painful weakness during isometric testing is suggestive of an intra-articular fracture.

Treatment

Traumatic arthritis recovers spontaneously but may take several months. Treatment with massage and/or exercises only irritates the joint and is therefore contraindicated.

The treatment of choice consists of two intra-articular injections of 20 mg of triamcinolone acetonide. The injection is given when the patient is first seen. The arm is kept in a sling for a couple of days. A week later a second injection is given and the joint should have recovered in 2 weeks' time.

**Technique: intra-articular injection**

The patient lies prone on a couch with a small pillow under the elbow. The arm is held by the side with the forearm fully supinated. In this position the joint lines between humerus and radius and the radial side of the olecranon are both easily felt. A 2 mL syringe is filled with triamcinolone acetonide 10 mg/mL and a 2 cm thin needle is fitted. The needle is inserted at the joint line and aimed slightly obliquely under the olecranon (Fig. 18.2).

**Rest in flexion**

Another valuable treatment is rest in flexion. It can be used in those patients who cannot tolerate an injection. As soon as the patient is seen, the elbow is immobilized in as much flexion as possible by means of a collar-and-cuff bandage. Every day the elbow is flexed more, until full movement can be achieved; thereafter it is held in this position for 2 weeks. The elbow is then rested in slightly less flexion. Three days later the joint is re-examined and, if the range of flexion is still full, the forearm is allowed to extend a little further. Some 6 weeks later, the patient reaches the stage in which the arm can be worn in a sling. After 2 or 3 months, movements of the elbow should be full and painless. Another static progressive splinting method by means of a turnbuckle splint has proved to be useful in the treatment of long-standing post-traumatic stiffness of the elbow.
Arthrosis

This condition may come on spontaneously in late middle age and is often bilateral. It may also occur as the result of a fracture or dislocation. Intra-articular distal humerus fractures, for example, are most often associated with the development of degenerative joint disease over time. Repeated minor injuries or a loose body in the joint may also account for early arthritic changes.

The patient, most often a male, complains that, after he uses his elbow excessively, the joint aches slightly. He may also find the inability to fully straighten the arm inconvenient.

On examination a slight capsular pattern is found with a hard end-feel on flexion. The end-feel on extension is also hard but this is because of capsular contracture and is not the normal bone-to-bone end-feel. There may be coarse crepitus. The radiograph may show the arthrotic changes, although a positive radiograph can also be compatible with full range and painless function at the joint.

The differential diagnosis is neuropathic arthropathy, which presents with gross painless limitation of movement in the capsular pattern.

An arthritic joint does not of itself give rise to the sort of symptoms that warrant treatment. What may happen is that, on top of the arthrosis, a traumatic arthritis develops as the result of overuse. This can be treated as outlined earlier. Loose bodies are quite common and may also complicate the arthrosis (see below).

Monoarticular steroid-sensitive arthritis

A seronegative arthritis may occur, confined to one elbow joint. The pain is spontaneous in onset and the elbow very soon starts to swell.

A marked capsular pattern is found and, in due course, some limitation of pronation and supination may occur. In the acute and subacute stages, the end-feel is of muscle spasm. The joint is warm to the touch and synovial thickening can be found on palpation over the head of the radius laterally. In advanced cases muscle atrophy may also be seen. If, after some years, crepitus is present, it is of the silky type.

On radiography, decalcification and later erosion of cartilage may be visible.

Treatment with intra-articular triamcinolone suspension (see earlier) is symptomatically very effective in monoarticular steroid-sensitive arthritis; it stops the pain but produces hardly any change in the amplitude of movements. The patient may be pain-free for many months, whereupon the injection can be repeated without fear of steroid arthropathy because the elbow is not a weight-bearing joint.

Crystal synovitis

Gout (uric acid crystals) and pseudogout (calcium pyrophosphate crystals) seldom affect the elbow joint during a first attack (in only 4.5% of gout cases) but more frequently cause acute olecranon bursitis. As disease develops, polyarticular attacks may occur, in which case the elbow joint is affected in 30% of cases.

The sudden unprovoked onset and the shiny red appearance of the joint are characteristic.

The following diagnostic criteria may be useful in gout. When uric acid crystals are found in the synovial fluid during microscopic, chemical or histological examination, or tophi are seen on the ears, the diagnosis is certain, as it also is when two of the following four criteria are present: history of a typical attack of gout at the big toe; history of two typical attacks of gout at another joint; clinical picture of tophus; remission within 48 hours of the acute attack after the administration of colchicine or phenylbutazone.

Haemarthrosis

Haemarthrosis may occur after injury to the joint, especially an intra-articular fracture or a direct contusion of the joint capsule, or, less commonly, in haemophilic patients. Bleeding into the joint leads to gross swelling and a marked capsular pattern. Aspiration must be carried out immediately to avoid destruction of cartilage.

Rheumatoid-type arthritis

Polyarticular rheumatoid arthritis may affect the elbow joint. Apart from the gross swelling, rapidly ensuing limitation of extension is typical. The elbow is also one of the sites of predilection, together with the knee and shoulder, for chondromatosis. Pigmented villonodular synovitis occurs most commonly at the knee, followed by elbow and ankle.

In these and the other rheumatoid-type arthritides, systemic medication is required, and sometimes even a surgical approach. Good results have been reported with total elbow arthroplasty.

Septic arthritis

A bacterial infection of the elbow joint is always very serious. It may not only lead to total destruction of the joint but may also be life-threatening.

It can be the result of an open injury to the joint (e.g. open fracture), penetration of a foreign body (e.g. rose or bramble thorns during gardening or fruit picking) or direct inoculation of a bacterium during intra-articular injection, especially injection of a steroid suspension. It can also be caused by haematogenous dissemination from focal infections: dental abscess, cystitis, urethritis, skin infections. These causes are very dependent on the patient’s resistance to infections: patients with diabetes, renal failure or a deficient immune system (e.g. rheumatoid arthritis) are more likely to suffer from haematogenous dissemination followed by a septic arthritis.

Symptoms start suddenly and are easily recognized. The joint shows the signs of a hyperacute inflammation: a great deal of pain, gross swelling, redness, warmth and gross limitation of movement in the capsular pattern. There are also general...
symptoms, such as high fever, a toxic appearance, pallor, loss of appetite and rigors.

Treatment consists of systemic antibiotic therapy and daily local aspiration and drainage by arthroscopy.

**Tuberculous arthritis**

Elbow tuberculosis is a rare disease which accounts for 1–3% of all cases of osteoarticular tuberculosis. The diagnosis is very difficult to make because of the insidious onset with mild and non-specific local or systemic symptoms. The radiological findings are also non-specific in the early stage. Tuberculosis of the elbow is therefore easily misdiagnosed as degenerative arthritis or rheumatoid arthritis. Several months after the onset of symptoms, there is pain at night, and examination reveals a gross capsular pattern and a spastic end-feel. The radiograph reveals periarticular osteopenia, bone erosion and joint space narrowing. On haematological testing, the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) are elevated.

The gold standard for the diagnosis of tuberculous arthritis is identification of *Mycobacterium tuberculosis* either directly or after culture of the synovial fluid.

**Non-capsular pattern**

**Limitation of flexion or extension in isolation**

**Loose body in the joint**

A loose body in the elbow joint is not uncommon and may hinder normal movements. It prevents the joint either from moving into full flexion, leaving extension free (Fig. 18.3), or from moving into full extension, leaving flexion free (Fig. 18.4). It then changes the hard end-feel of extension into a rather soft one.

Three different clinical pictures can be considered, depending on the age group in which they appear: adolescents, adults or the elderly.

**In adolescence**

A loose body is a common cause of elbow trouble in adolescents and is the only non-traumatic cause of arthrosis encountered in a young person. The condition does not occur before the age of 14 and usually results from osteochondritis dissecans, mostly on the humeral capitellum, or an intra-articular chip fracture, conditions that may lead to exfoliation of one or more fragments of bone covered by articular cartilage. Osteochondritis dissecans is not uncommon in young female gymnasts with hyperextension and valgus of the elbow. It also affects young pitchers or athletes involved in high-demand, repetitive overhead activities.

The history is quite typical: the young person states that the elbow joint locks suddenly, usually in flexion. It is impossible to straighten the elbow to full range because of the pain. In a few days, the condition gradually subsides. One or more of these attacks may have occurred in the past, with pain-free episodes in between.

Clinical examination during an attack shows a non-capsular pattern: limitation of passive extension with a soft end-feel. During a pain-free period, examination is negative; the diagnosis is suggested by the typical history.

Diagnosis can be confirmed by anteroposterior radiography performed with the elbow in 45° of flexion, because in this...
position the X-ray beam is almost parallel to the gap between the fragment and the underlying capitellar bone. Recently, magnetic resonance imaging (MRI) has been suggested for assessing osteochondritis dissecans, and sonography also seems to be effective.

If the patient is seen during an attack, manipulative reduction can be carried out. However, arthroscopic or surgical removal or nothing, depending on the patient’s major concern. The alternatives in this case are: arthroscopic manipulation, but limitation of flexion, unless gross, is not a possibility. Nothing else should be done, unless recurrence is very frequent, in which case removal during arthroscopy would be a possibility.

A loose body that limits flexion cannot be reduced by manipulation, but limitation of flexion, unless gross, is not a major concern. The alternatives in this case are: arthroscopic or surgical removal or nothing, depending on the patient’s age, preference and functional disablement. If nothing is done, there is some danger that the loose body will become embedded and be responsible for a permanent limitation of flexion.

In a normal joint in adulthood

The cause of loose body formation in adults is usually traumatic, the injury having chipped off one or more pieces of cartilage. Middle-aged patients who develop a loose body may have multiple cartilaginous fragments in the joint that do not show on radiography; these do not tend to cause arthrosis.

The history is not as typical as it is in young people; the patient does complain of attacks of pain at the elbow, during which exertion increases the pain, but gradual unlocking in the following days does not occur; hence the importance of the clinical examination. Unless these patients are properly examined, they are thought to suffer from tennis elbow.

A very clear non-capsular pattern is found with limitation of either flexion or extension, depending on the position of the fragment. If the loose body lies in the triangle formed by the humeral capitellum, the head of the radius and the base of the coronoid process of the ulna, extension is slightly limited, while flexion remains full and painless. The end-feel on passive extension is soft. When the loose piece of cartilage lies anteriorly, flexion is quite limited, the fragment catching between the anterior aspect of the humerus and the tip of the coronoid process (Fig. 18.5).

A loose body that limits extension can usually be reduced. Manipulation under strong traction shifts the loose piece of cartilage to a position at the back of the joint. It then no longer blocks movement, which becomes normal again. The manipulation can be repeated each time derangement occurs. Nothing else should be done, unless recurrence is very frequent, in which case removal during arthroscopy would be a possibility.

A loose body that limits flexion cannot be reduced by manipulation, but limitation of flexion, unless gross, is not a major concern. The alternatives in this case are: arthroscopic or surgical removal or nothing, depending on the patient’s age, preference and functional disablement. If nothing is done, there is some danger that the loose body will become embedded and be responsible for a permanent limitation of flexion.

Technique: manipulative reduction of a loose body

The patient sits on a couch. The arm is abducted to the horizontal and the elbow bent to a right angle. An assistant grasps the patient’s arm just proximal to the elbow with both hands and fixes the arm against the couch. A second assistant steadies the patient’s thorax with a hand on the lower ribs; the other hand holds the shoulder on the affected side against the couch. When assistants are not available, the patient’s body and arm can be fixed with straps.

In this manipulation different elements are incorporated: traction, movement from flexion towards extension, and rotation movements, either pronation or supination (Figs 18.6 and 18.7).

The manipulator puts the contralateral foot against that of the first assistant vertically below the patient’s elbow. This is the fixed point around which pivoting takes place as the elbow is moved from flexion towards extension. The patient’s lower forearm just proximal to the wrist is then grasped with both hands. The position of the hands is slightly different, depending on the chosen rotation (see Fig. 18.6). The use of the manipulator’s body weight is then able to exert the traction required to distract the joint. Pivoting on the foot, movement is gradually made from flexion towards extension while the patient’s forearm is moved in either pronation or supination through the full range. At the last moment as extension is approached, the manipulator’s trunk is side-flexed away from the patient to exert maximal traction. Extension movement is not performed beyond the degree of limitation; if this should happen, it would, of course, result in traumatic arthritis of the joint.

After each attempt, extension is re-examined. The chosen rotation is continued for as long as the signs improve. When no further improvement is found, the alternative rotation can be tried. Treatment should be stopped when the end-feel has become normal — i.e. hard.

One does not expect to reach a painless range of movement during the manipulation session but the change in end-feel
Between attacks, the elbow presents a capsular pattern with a hard end-feel at the end of the achievable range, the result of the arthrosis. During the attacks the limitation becomes of the non-capsular type; it has a soft end-feel and is particularly restricted.

The fragments are osseous and visible on radiographs. However, it is possible to have loose bodies in the joint without having attacks of internal derangement.

Manipulative treatment can be performed during the attacks, although it is not strictly necessary because the condition subsides spontaneously. It is enough to explain the mechanism to the patient. Alternatively, arthroscopic removal can be considered.
Disorders of the inert structures

CHAP T E R  1 8

Limitation of extension in tennis elbow

In some cases of tennis elbow, a slight limitation of passive extension may be found with a softish end-feel. The primary signs of tennis elbow will, of course, suggest the diagnosis (see p. 304).

Acute limitation of supination and extension in children

Radial head subluxation also known as pulled elbow, dislocated elbow or nursemaid’s elbow, is one of the most common upper extremity injuries in young children under 8 years of age. The injury usually occurs when forceful longitudinal traction is applied to an extended and pronated arm, as in lifting a child by the forearm or pulling the forearm of a resisting child. This manoeuvre is immediately followed by pain and limitation of movement; the elbow is held flexed at about 90° and in pronation – hence the French name, ‘la pronation douloureuse’.

A ‘pulled elbow’ is actually a displacement of the annular ligament between the capitellum of the distal humerus and the radial head. The latter is pulled distally through the annular ligament, which becomes displaced from its normal position covering the radial head, into the radiohumeral joint (Fig. 18.8).

The subsequent disturbance of the lower radioulnar joint is responsible for the limitation of supination. Ultrasonography of the radiohumeral joint shows that the distance between the radial head and the capitellum is increased, probably because of the interposition of the annular ligament into the radiohumeral joint. A radiograph of the wrist shows a distal shift of the radius compared to the ulna, which is restored after manipulation.

Reduction is easy. Sometimes spontaneous reduction occurs just by bringing the forearm into supination and flexion, as in examining for passive flexion of the elbow. When this does not happen, manipulation is performed.

Technique: reduction of a ‘pulled elbow’

The child is asked to stand against a wall. The upper arm is abducted and the elbow flexed to a right angle. The manipulator grasps the child’s lower forearm with the ipsilateral hand and pushes the radius upwards towards the humerus by pressing the elbow against the wall. In the mean time, the forearm is rapidly rotated to and fro to the end of the range in either direction (Fig. 18.9). Suddenly, on full supination, the radial head reduces with a palpable click.

Limitation of pronation

The bicipitoradial bursa is located at the insertion of the distal biceps tendon. In supination it surrounds the biceps tendon. In pronation, the radial tuberosity rotates posteriorly, which compresses the bicipitoradial bursa between the biceps tendon and the radial cortex (Fig. 18.10).
Ligamentous lesions

Ulnar collateral ligament

Partial or total rupture of the ulnar collateral ligament resulting from overhand throwing has been described extensively in athletes. Most affected individuals are high-level baseball pitchers, tennis players and javelin throwers. This condition is often complicated by irritation of the ulnar nerve. Usually the lesion results from chronic overuse of the elbow leading to ligamentous insufficiency, even in the absence of a singular catastrophic episode of ligament failure.

Commonly athletes note a history of recurrent elbow pain after or during throwing, without a specific injury. On physical examination there may be a capsular pattern if the lesion is acute. In chronic lesions, the standard clinical examination will be entirely negative and the joint must be tested for valgus instability. For this purpose the moving valgus stress test has been found to be extremely useful, given its high degree of sensitivity and specificity. The patient lies supine with the arm abducted and externally rotated. The elbow is in neutral rotation. The examiner then applies and maintains a constant moderate valgus torque to the fully flexed elbow while gradually extending it. The test is positive if the medial elbow pain is reproduced within the arc between 120 and 70°.

Surgical intervention may be necessary when conservative treatment fails and in a patient who wants to return to highly competitive sports.

In young throwing athletes, repetitive high valgus stress and pull by the common flexor tendon may result in subtle stress fracture of the medial epicondyle epiphysis. It manifests with pain at the medial aspect of the elbow and diminished throwing distance and effectiveness. The medial epicondyle is very tender to the touch and a slight capsular pattern may be found. This lesion is called ‘medial epicondylar stress lesion’ or ‘little league elbow’.

Radial collateral ligament

A lesion of the radial collateral ligament occurs rarely as the result of repetitive isolated varus stress but mostly after complete elbow dislocation. It may lead to posterolateral rotatory instability, giving rise to symptoms such as clicking, snapping and locking. Tests, such as the lateral pivot shift or posterolateral rotatory drawer test, have been devised for confirming the diagnosis. In recurrent problems, surgical reconstruction or repair seems to give good results.

Bursitis

Olecranon bursitis

Because the bursa is superficial it is very vulnerable. The lesion can be provoked by repetitive direct pressure – for example, leaping the elbow on a table – or by falling heavily on to the bent elbow. It is often associated with occupational or sports trauma, or systemic conditions, such as rheumatoid arthritis, gout, tuberculosis and rheumatic diseases (e.g. chondrocalcinosis, xanthomatosis).
The symptom is pain at the posterior aspect of the elbow. The signs depend on the type of bursitis present. In acute cases due to trauma or infection, there is swelling over the olecranon which varies in size from a slight distension to an egg-sized swelling. A variable amount of heat and redness is also found. In more chronic cases, slight swelling is the only sign. The functional examination is usually negative, although full passive flexion may cause some discomfort, described as ‘tight’. Palpation reveals tenderness over the tip of the olecranon. In chronic lesions palpable thickening of the bursal wall may be present.

Differential diagnosis must be made between a traumatic bursitis and an infected bursa. Septic bursitis presents with heat and redness of the skin and pain on resisted extension of the elbow. Analysis of the bursal fluid obtained through aspiration may be helpful.

Sometimes aspiration alone will not prevent the fluid from reaccumulating because of continued movements of the elbow. Adding non-steroidal anti-inflammatory drugs will then hasten symptomatic improvement. Arthroscopic excision can be used when conservative treatment fails. Septic bursitis should be treated immediately with antibiotic therapy and/or drainage. Sometimes, in the most stubborn cases, surgical excision is necessary.
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