Ministry of Defence

Synopsis of Causation

Dislocations of the Elbow

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Disclaimer

This synopsis has been completed by medical practitioners. It is based on a literature search at the standard of a textbook of medicine and generalist review articles. It is not intended to be a meta-analysis of the literature on the condition specified.

Every effort has been taken to ensure that the information contained in the synopsis is accurate and consistent with current knowledge and practice and to do this the synopsis has been subject to an external validation process by consultants in a relevant specialty nominated by the Royal Society of Medicine.

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1. Definition

1.1 A full dislocation is defined as the permanent loss of contact or anatomical relationship between the bones forming the joint. A subluxation is defined as the temporary and usually partial loss of the physiological and anatomical relationships between the bones forming the joint.

1.2 Elbow instability is defined as the inability of the joint to maintain its anatomical relations under physiological (normal) loads.

2. Clinical Features

2.1 In adults, the elbow is the most commonly dislocated joint after the shoulder. It is the joint most commonly dislocated in children. Despite its prevalence, there are relatively few series analysed in the literature.[1]

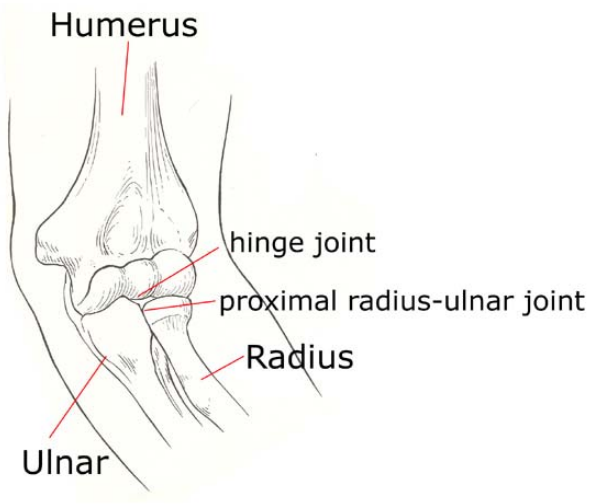

Figure 1: Anatomy of the elbow

2.2 Until recently, chronic instability of the elbow was considered to be rare, but substantial improvements in the understanding of the physiopathology and increased recognition have led to the appreciation that it is more common than previously thought.[1,2,3]

2.3 It is impossible to provide a simple classification for dislocations of the elbow. To be useful for treatment, at least 6 criteria must be considered:[1,2,4]

2.3.1. **Timing**. Elbow dislocations can be classified as acute, chronic or recurrent.

2.3.2. **Articulations involved.** The elbow can be considered as two distinct articulations within the same capsule: the hinge joint, which is formed between the radius and ulna and the humerus; and the proximal radio-ulnar joint, responsible for the pronation-supination movements. It is possible to have combined or isolated dislocations.

2.3.3. **Direction of displacement.** At least 4 directions of displacement must be considered, posterolateral rotatory instability, which is the most common pattern, anterior instability, valgus instability, and varus instability.

2.3.4. **The degree of displacement.** This is particularly important for posterolateral rotatory instability, which can have several degrees depending on the level of injury to the ligaments involved.

2.3.5. The presence or absence of **associated fractures**, as these may further destabilise the joints and produce articular surfaces that are incongruous.

Particular attention must be paid to Monteggia fractures, which consist of a combined fracture of the proximal ulna with dislocation of the radial head.[5,6]

2.3.6. **The age group** of the patient. Elbow dislocations may be quite different in children and adults, and some of these may be due to congenital or developmental deformities.[1,7]

2.4 The elbow is the most frequently dislocated joint in children. The elbow in children has several particularities such as more elastic and strong ligaments, patent epiphyseal plates, and several secondary ossification centres, which make interpretation of radiographs particularly difficult.[1]

2.5 The most frequent instabilities in the paediatric elbow are those associated with dislocations of the radial head. In relatively simple terms, these may be classified as congenital dislocations, developmental dislocations, and post-traumatic dislocations or subluxations.[1]

2.6 Congenital dislocation of the radial head is a controversial entity and many authors contend that these are either post-traumatic or developmental. However, some authors accept that those atraumatic dislocations of the radial head associated with hypoplasia of the capitellum are true congenital dislocations.

2.7 In contrast, developmental dislocations are defined as any progressive dislocation that results from maldevelopment of the forearm. A large number of conditions may cause such developmental dislocations, such as arthrogryposis, diaphyseal aclasis and cleidocranial dysplasia.[1]

2.8 Post-traumatic instability in children is often associated with fractures, such as fractures of the radial head and Monteggia fracture-dislocations. The latter are relatively rare in children and, unlike their counterpart in adults, can often be treated by closed methods.[1,8]

2.9 A special kind of paediatric subluxation is the pulled elbow syndrome. It happens after a longitudinal pull in the forearm, resulting in the radial head being pulled into the annular ligament. The characteristic presentation is that of a child with an elbow that is painful and difficult to move, with or without a history of longitudinal pull. Affected children typically keep the elbow in pronation and express discomfort and anxiety if someone tries to move the elbow. Attempts to supinate the forearm may be particularly uncomfortable.[1]

2.9.1. Treatment of this condition is relatively simple and consists of supination of the affected elbow, if necessary under general anaesthesia or sedation. When the radial head is reduced, there is often an audible snap of the ligament returning to its original position under the radial head.

3. Aetiology / Mechanisms

3.1. A fall on the outstretched hand with the elbow semi-flexed is the most common cause of dislocations or subluxations. The elbow suffers a compressive axial force, associated with external rotation or supination of the forearm, and a valgus stress, which results in an injury to the lateral collateral ligament. This mechanism results in the posterolateral rotatory subluxation or dislocation of the elbow. It is essentially the only way in which the elbow is free to suffer a complete dislocation without an associated fracture. The anatomy of the elbow constrains the joint in such a way that the radial head must rotate out of the capitellum with a simultaneous disengagement of the ulna from the trochlea, and that is only possible in supination. In pronation, even if the ulna could be disengaged, the radial head would migrate to an anterior position to the humerus, preventing the posterior movement that results in the final complete dislocation.[1,2,9]

3.2. The complex pathoanatomy of the posterolateral rotatory instability has been described by O'Driscoll,[2] who proposed a model in which the soft tissue injury happens in three progressive but continuous stages leading to increasingly severe degrees of instability. This model suggests a circle of soft tissue disruption from lateral to medial.

3.2.1. In stage 1, the ulnar part of the lateral collateral ligament is disrupted, resulting in a posterolateral rotatory instability which reduces spontaneously. The remainder of the lateral collateral ligament complex (annular ligament and radial lateral collateral) may or may not be disrupted. In fact there is still dispute in the literature as to the degree of distinctiveness of the ulnar component.

3.2.2. Further disruption of the anterior and posterior stabilising components results in stage 2, which is characterised by an incomplete posterolateral dislocation in which the medial edge of the ulna rests on the trochlea. This situation can still be reduced promptly with little force or even by the patient with manipulation of their own elbow.

3.2.3. Stage 3 is, of course, the final stage characterised by a complete dislocation. Because the resulting balance of forces in the elbow always presses the ulna posteriorly and proximally, the final position will show the olecranon lying posterior to the humerus. This situation almost always will require a general anaesthetic or heavy sedation and manipulation by a knowledgeable doctor.

3.3. There are reports of recurrent symptomatic subluxations after "minor" injuries such as sprains of the elbow. In addition, generalised tissue laxity such as in Ehlers-Danlos syndrome has been implicated as well as, or in association with, chronic overload such as in patients who use crutches to walk.[1]

3.4. It is possible for purely anterior or divergent dislocations to occur. Divergent dislocations are those in which the radial head moves apart from the ulna at the same time as the ulna dislocates from the humerus. These are extremely rare and often associated with fractures of the olecranon, frequently the comminuted ones, with the resulting insufficiency of the coronoid process anteriorly or the tip of the olecranon posteriorly, or any combination of these.[1]

3.5. The medial (ulnar) collateral ligament is the main structure resisting valgus stress at the elbow. Trauma to this ligament only rarely leads to symptomatic instability of the

elbow. However, in throwing sports, the repeated high valgus stress may result in symptomatic instability, occasionally requiring operative treatment to restore overhead athletic function. The medial collateral ligament is usually divided in three bundles, of which the anterior is the most important and the major component resisting valgus stress.[1,2]

4. Prognosis

4.1 The overall outcome of a single elbow dislocation is generally good and most patients will heal fully with no sequelae. Mehlhoff et al.[3] reviewed the long term result of simple elbow dislocations in 52 patients. According to these authors, despite the generally good expected outcome, 60% reported some symptoms. Fifteen percent of the patients in this series presented with a flexion contracture of more than 30 degrees; 45% complained of residual pain at rest; while 35% described pain on valgus stress. The limitation of the range of movement was strongly related to prolonged immobilisation. Most patients will note some degree of improvement in their symptoms for up to 6 months, while some report improvements for as long as 18 months.[1,10]

4.2 Several complications have been described as a consequence of elbow dislocations whether or not associated with concurrent fractures. Neurovascular injuries can happen to any nerve around the elbow and stretching and distortion of the anterior structures may result in spasm, intimal damage, thrombosis or rupture of the brachial artery. Ischaemic myositis, impaired vascularity and late claudication may occur.[5,8]

4.3 McKee et al.[11] have recently published a series of 36 cases of dislocations associated with fractures of the coronoid process and the radial head. Eight of his patients had poor results and complications, such as stiffness, recurrent instability and infection following surgical repair.

4.4 Compartment syndrome is characterised by an increased pressure within the aponeurotic compartment, which can lead to a halt in the microcirculation of the muscles in the forearm. If too severe or untreated, it may lead to necrosis of these muscles and their substitution by scar tissue in a process known generically as Volkmann's contracture. If this condition is diagnosed, careful monitoring must be kept and surgical decompression, if necessary, must not be delayed.

4.5 Heterotopic bone formation is a well-recognised complication after elbow injuries and consists of the formation of bone or calcification of muscle fibres around the elbow (myositis ossificans). Ossification of the collateral ligaments is relatively common, but seldom enough to cause severe functional impairment. For rare but severe cases, several treatments have been proposed in various combinations, including resection, radiotherapy, and indomethacin. Surgical excision should be delayed for at least one year until the bone mass is mature and has stopped increasing in size.[1]

4.6 It is usually accepted that injuries in children that are properly reduced will have relatively small or no influence on the adult skeleton. However, this statement has to be qualified by the extent of injury and the extent of damage to specific elements such as articular cartilage and growth plates.

4.7 Chronic untreated or mistreated cases present a great challenge. Although these cases are relatively rare where patients have access to medical treatment, they are seen at times. Reconstruction of the ligaments and reduction of the elbow is not always successful and, particularly in older patients (over 60 years), elbow replacements have been advocated.[1,4,7]

4.8 Monteggia fracture dislocations usually have a much worse prognosis, particularly in adults. Reynders et al.[8] have published a study showing that 46% of the patients with this type of injury still achieve only fair or poor results. Radial nerve injury, particularly of the posterior interosseous branch, is very common (as much as 20%). Recurrent

dislocations or subluxations of the head of the radius are also a frequent complication in this type of fracture. Cross union between the radius and the ulna has also been reported.

4.9 Developmental dislocations of the radial head in children seldom cause any serious problems. Some clicking and limitation of the range of motion may be noted, and if the dislocation is posterior there may be a cosmetic protuberance, which may be a source of pain with excessive motion. Monteggia injuries in children have a more benign outcome than those in adults but should still be treated carefully, although in children closed treatment is usually acceptable. Nerve injuries and compartment syndromes may also happen in children with devastating effect.[1]

4.10 The results of treatment for pulled elbow syndrome are excellent and there are no important long-term sequelae reported. In some cases repeated recurrences may be a concern for the family, but very seldom is any invasive treatment recommended and the results are uniformly good with conservative management despite recurrences.[1]

4.11 There is no substantial evidence in the literature that military injuries are different from those suffered by civilians in similar circumstances. It is possible that high energy trauma may be more common amongst military personnel due to war injuries, but these will not be substantially different from those caused by trauma of similar magnitude in civilian life, for instance, high energy trauma in motorcycle accidents.

5. Summary

5.1. Elbow dislocations are often complex and variable, ranging from those that are congenital in origin to those associated with severe trauma, such as open fractures.

5.2. In order to fully understand the nuances of this condition, several factors such as the age of the patient, severity of the injury, and the treatment received must be taken into consideration.

5.3. The prognosis for stand-alone dislocations that are treated promptly is generally good and a normal, asymptomatic elbow may be obtained in the majority of cases. However, stiffness, chronic pain, and chronic instability may ensue in those more severe cases with associated injuries, such as fractures and neurovascular damage.

6. Related Synopses

Fractures Long Bones, Upper Limb

7. Glossary

arthrogryposis	A congenital condition characterised by excessive connective tissue in the joints.
claudication	Pain or fatigue in arms or legs due to poor supply of oxygen to the muscles.
cleidocranial dysplasia	A genetic disorder of bone development affecting the collar bone and skull formation.
coronoid	The anterior tip of the ulna, where the anterior capsule inserts.
diaphyseal aclasis	A genetic disorder in which there are multiple growths on the long bones and sometimes on the flat bones, spine and ribs.
flexion contracture	A bent joint that does not extend.
heterotopic	Ectopic; outside the normal location.
olecranon	The tip of the elbow.
ossification	The process of forming bone in the body.
pronation	Position in which the palm of the hand faces down, from the Latin “pronare”, which means swear, thus reflecting the position in which Roman troops would swear allegiance to the emperor.
proximal	Referring to an area of the body, or part of a long bone or limb, that is nearer to the central axis of the body.
radial head	The part of the radial bone that allows the elbow to rotate together with the wrist.
subluxation	Incomplete or partial dislocation of a joint.
supination	Position in which the hand has the palm up, from the Latin “supinare”, which means begging.
valgus	Displacement of part of a limb outward from the midline (knock knees = genu valgus).
varus	Displacement of part of a limb inward toward the midline (cowboy knees = genu varus).

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