

## EXPERIENCES IN TREATING LAUGIER'S FRACTURES

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Laugier's fractures are rare because they are located deep in the elbow joint and are thus protected from any direct trauma.

This study shows two patients whose Laugier's fractures were surgically treated. Surgical interventions were performed using the Campbell surgical approach. The ulnar nerve was mobilised for a distance of 12 cm, and then a tenotomy of the triceps brachii muscle and a posterior capsulectomy of the elbow joint were performed. A temporary repositioning followed by a permanent fixation were undertaken using two 3.2mm screws. The screws were inserted from the back, through the posterolateral and posteromedial pillars of the humeral condyle, to the front and medially. The tip of the screw was kept subchondrally in the bone of the humeral capitellum or trochlea and did not go through the cartilage. The stitches of the wound were done by layers, and prior to that a transposition of the ulnar nerve was performed medially. A plaster cast was worn on the upper arm for three weeks, with mandatory prophylaxis of periarticular ossification by taking indomethacin, 25mg three times a day. Upon removing the plaster cast, the patients underwent outpatient physical therapy for two weeks followed by inpatient physical therapy with full weight-bearing.

Laugier's fractures have been insufficiently described in the literature. Surgical treatment does not have an alternative, and timely diagnosis and surgical and physical therapy yield, according to the Mayo elbow performance index, good results. *Acta Medica Medianae 2011;50(4):49-54.*

**Key words:** *Laugier's fracture, elbow, joint, trauma*

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### Introduction

Isolated fractures of the humeral capitellum and trochlea (Laugier's fracture) are not common because they are located deep in the elbow joint and are thus protected from direct injuries. These fractures most often occur in case of a direct fall on the olecranon or on the fist, with the lower arm outstretched. After a fracture, the humeral capitellum and trochlea behave like free fragments which after sustaining the fracture most often stay within the intraarticular portion of the elbow, with the joint capsule preserved. Laugier was the first to provide an original description of the fracture in 1853, and as a result it is often referred to as Laugier's fracture (1).

The articular surfaces of the humeral capitellum and trochlea are located in the distal end of the humerus (2). The humeral trochlea directs the forearm towards the upper arm. Its axis forms an angle with the humeral axis which differs by 200

from the right angle and is somewhat slanted; from the lateral position upwards and from the medial position downwards. The incisura trochlearis (trochlear notch) is in the middle and it forms an incomplete spiral and divides the trochlea into two parts, of which the medial part is bigger (2). The trochlear notch is placed in the sagittal plane: it is vertical in the anterior position and it is slanted, distal and lateral in the posterior position. That is why when the elbow is extended, the posterior part of the trochlear notch is in the front, the forearm is directed laterally and the forearm and upper arm axis forms an obtuse angle which is opened laterally. That angle is called the physiological valgus position of the forearm. When in flexion, the front part of the trochlear notch directs the forearm and puts it parallel with the upper arm. The humeral capitellum is a part of the ball facing front and is not visible from the back (3). The trochlea transfers the strength of the elbow bone by wedging, thus facilitating tangential forces not to slide. The coronoid fossa is above the trochlea, at its anterior side, and the coronoid process of the ulna enters it when flexing, and at the posterior side there is the olecranon fossa into which the olecranon enters when extending. The joint capsule is strengthened by two ligaments which take part in securing the contact between articular bodies of the elbow. These are the ulnar collateral ligament and the radial collateral ligament.

The humeral trochlea and the trochlear notch of the ulna are located in front of the humeral and ulnar axis, which makes it possible for flexion not to be limited to 90° because of the contact of the coronoid process of the ulna with the humerus (2). The convexity range of the trochlea amounts to more than  $\frac{3}{4}$  of cycle (2800 to 3200), and the distance of the trochlear notch to 1800, so that the range of elbow flexion is around 140° (3200-1800). In view of the existence of the coronoid fossa and the olecranon fossa, further flexion for about 20° is also possible (2).

The clinical presentation of Laugier's fractures is non-specific. Most frequently, the patient complains of pain, uncharacteristic swelling and a limited range of motion at the elbow. These movements can fool you by forming an isosceles triangle when flexing the elbow or the Hueter sign in elbow extension. On careful inspection of the anteroposterior radiograph of the elbow, one can only notice the fracture (Figure 1). If one does not refer to Laugier's fracture, it could at first glance be overlooked. The lateral radiograph shows a semicircular (moon-like) dislocation line of Laugier's fracture which is above the radial head in front of the distal humerus (Figure 2).

The rotation of the humeral capitellum and trochlea, inadequately placed elbow and radiograph can show a small portion of the subchondral bone, and thus render making a diagnosis and choice of treatment more difficult. CT scan is useful as it will indicate the size and position of the fracture (Figure 3).

### Case report

The first patient, 21 years old, sustained a fracture in June 2010 after falling and hitting her flexed elbow against the table. She went to the family doctor, who, based on clinical signs, diagnosed an elbow contusion and sent her back home with a Mitella arm sling. An increase in swelling and pain and reduction in range of motion brought the patient to the local hospital two days later. Based on radiographic findings (Fig. 1 and 2) she was referred to our institution. On admission, a NMR scan of the elbow was performed and the surgical treatment commenced (Figure 3).

The surgery was performed applying an Esmarch bandage. The posterolateral Campbell approach was used, the ulnar nerve freed and mobilised for a distance of 12cm. A tenotomy of the triceps brachii muscle and a posterior capsulectomy of the elbow joint were performed. After repositioning and temporarily fixing the humeral trochlea and head, we performed a permanent fixation using two 3.2mm screws. The screws were inserted from the back, through the posterolateral and posteromedial pillars of the humeral condyle, to the front and medially. The tip of the screw was kept subchondrally in the bone of the humeral head, i.e. trochlea so that it did not go through the cartilage (Figures 4 and 5).

5). The stitches of the wound were done by layers, and prior to that a transposition of the ulnar nerve was performed medially. A plaster cast was worn on the upper arm for three weeks, with mandatory prophylaxis of periarticular ossification by taking indomethacin, 25mg three times a day for three weeks. Upon removing the plaster cast, the patient underwent outpatient physical therapy, followed by inpatient physical therapy with full weight-bearing.



Figure 1



Figure 2



Figure 3.



Figure 4.



Figure 5.



Figure 6.

The second patient who was 38 years old sustained a fracture in August 2010 when she fell with her hand outstretched and hit her palm against concrete. On the same day she went to the surgery where she was diagnosed with the fracture. The surgical treatment was performed in the same way as with the already described patient. A lesion of the ulnar collateral ligament caused the post-operative subluxation of the joint which was diagnosed by radiograph (Figure 6). In this case, the answer to the question of whether there was a traumatic or iatrogenous lesion of the ulnar collateral ligament has remained a mystery. The repositioning was performed under the control of a mobile X-ray machine, and a definitive upper-arm plaster cast was put. The plaster cast was worn for three weeks, which was enough for the damaged ligament and tenotomised triceps muscle to recover. During that time the patient was taking Indomethacin per os.

In ten weeks' time, following the surgical treatment and physical therapy, the treatment results were graded using the subjective and objective parameters of the Mayo elbow performance index (1). I graded the pain, motion, stability and functions of the operated elbow according to the scale. The index was average for both patients. The result was good (flexion 1350 and extension 00) for both patients after twenty weeks, with continued physical therapy with full weight-bearing. We did not have neurovascular prolapses or periarticular ossifications in either case.

## Discussion

A humeral capitellum fracture may be connected with soft tissue injuries: medial collateral ligament or lateral ligament complex (4).

Bryan and Morrey classified humeral capitellum and trochlea fractures as: Types 1, 2, and 3 (1). McKee et al. described also a fourth type: coronal shear fracture in the frontal plane of the distal humerus, involving the capitellum and a major portion of the trochlea (5).

According to the AO classification (6), humeral capitellum and trochlea fractures are classified as the B3 group (partial articular fracture of the distal humerus in the frontal plane). B3.1. B3.2. and B3.3. indicate a capitellar fracture, a trochlear fracture and a capitellar and trochlear fracture, respectively.

In 2003, Ring D. provided a classification of fractures of a joint fissure of the distal humerus describing five anatomical parts: head and lateral aspect of the trochlea, lateral epicondyle, posterior aspect of lateral pillars, posterior aspect of the trochlea and medial epicondyle (7).

The advantage of surgical treatment by stabilising humeral capitellum and trochlea fractures with osteosynthetic material compared to conservative treatment was described in the late 1970's (8). Hahn was the first to publicly

speaking about it. Unsatisfactory outcomes following conservative treatment were observed: dislocation of the trochlea, subluxation, luxation, contracture, elbow ankylosis. The autopsy established that the humeral capitellum was dislocated in a superior position in the anterior aspect of the humerus and it caused a limited elbow flexion (8). Poyton AR. et al. maintained in 1998 that certain results were feasible through a closed anatomic repositioning, adequate immobilisation until bone consolidation (9).

Nowadays, surgical stabilisation or removal of the fractured fragment is universally acceptable if the repositioning by surgery is not satisfactory. Mazel is of the opinion that small fragments can seriously damage the joint if, in the attempt to reposition the elbow by a closed procedure, there is an excessive pressure (10). The Herbert screw takes precedence over other screws and K-wires for stabilising bone fragments (11).

Early mobilisation of the elbow is desirable (9). It depends on the quality of stabilisation and fixation of fragments, and the existence or lack of intraoperative iatrogenous injuries. Mobilisation is the best way to prevent elbow inflexibility and disability, which may be caused by a long plaster cast immobilisation (9).

In 2003, Ring et al. reported on the results of surgical treatment of humeral capitellum and trochlea fractures in 21 patients. Ten patients needed a second surgical intervention for: elbow contracture in six patients and ulnar nerve transposition in two patients, and osteosynthetic material revision was performed in two patients (11). According to the Mayo elbow performance index, the results were: excellent in four, good in twelve, and satisfactory in five patients. There was no radiographic evidence of arthritis or osteonecrosis (11).

In 1996, McKee et al. presented the results in six patients who were treated surgically for humeral capitellum and trochlea fractures. The fractures were stabilised and fixed by internal fixation. They were monitored for twenty-two months (5). The results were as follows: average flexion 141° with an average flexion contracture of 15°. All patients had good or excellent results according to the Mayo elbow performance index (5). Comparative elbow radiographs in one patient diagnosed mild arthritis and there was no evidence of osteonecrosis (5).

Mueller et al. suggested in 1990 that all fractures of the distal humerus be approached through a posterior longitudinal skin incision (6). That facilitated access to the lateral and medial condyles (if necessary), and reduced the risk of damaging the nerve. In this series, no patient had a neuroma as a complication (6). Kaplan FB, in his four-patient series where humeral capitellum and trochlea fractures were treated surgically by the Campbell approach, by olecranon osteotomy, two patients experienced early post-operative complications. With one patient, the screw did not hold and it came out backwards, and the other one was placed in the joint (13).

Fragmented fractures with a dislocation of capitellum and trochlea fracture usually require olecranon osteotomy (13, 14) in order to get an adequate presentation of the fracture, i.e. view of the entire elbow joint.

Temporary fixation can be maintained with K-wires (12). Two or three Herbert screws are directed from the back to the front through the posterolateral and posteromedial pillars towards the replaced fragments of the humeral capitellum and trochlea, and a permanent and stable fixation is thus secured (12). Multifragmentary nature of the radial capitellum can be compensated by a graft from the ilium and fixed by screws (4).

The prevalence of injuries of the lateral collateral ligament or injuries of its equivalent (lateral epicondyle fracture) is high. There has been no mention of injuries of this ligament in earlier series since it has not even been verified. In the last few years, partial or complete lesions of the medial collateral or lateral ligament have been routinely mentioned with these fractures (1, 13).

X-rays of the operated side were compared with the side that did not undergo surgery, evaluating motion, heterotopic ossification, post-traumatic arthritis, and osteonecrosis (1). Humeral trochlea fractures at the elbow joint are rare. Fractures of the distal humerus make up 0.5–2%

of all fractures. On the other hand, what may be diagnosed is myositis ossificans, heterotopic ossification in the soft tissues following trauma and haemorrhage (1).

Breaking the humeral capitellum is often connected with injuries to the radial head and, in case of a trochlear fracture, the upper end of the elbow bone may be broken.

### Conclusion

Laugier's fractures should be treated surgically. The fracture is to be treated using the Campbell approach, making the access to the lateral and medial condyles of the humerus possible and reducing the risk of neurovascular and ligament lesions.

Permanent fixation of the humeral trochlea and head is to be done with minimum two Herbert screws. Screws were inserted from the back, through the posterolateral and posteromedial pillars of the humeral condyle, to the front and medially.

Three-week plaster cast immobilisation is required. During that time, the tenotomised triceps will have healed and the bone fracture will have consolidated.

Thereafter, there will be inpatient physical therapy for a period of over two months.

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## ISKUSTVO U LIJEČENJU LAUGIER-OVOG PRELOMA

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Laugier-ovi prelomi se retko dešavaju, zbog toga što se nalaze duboko u zglobu lakta i na taj način su zaštićeni od direktne traume.

U radu se prikazuju dve bolesnice kod kojih su Laugier-ovi prelomi hirurški zbrinuti. Operativni zahvati su izvedeni korišćenjem hirurškog Campbell-ov pristupa. Mobilisan je n. ulnaris 12cm, pa je urađena tenotomija m. tricipitis brachii i kapsulotomija sa zadnje strane lakatnog zgloba. Urađena je privremena repozicija i potom trajna stabilizacija sa dva šrafa 3,2 mm. Šrafovi su se postavili od pozadi, kroz posterolateralni i posteromedijalni stub kondila humerusa, prema napred i medijalno. Vrh šrafa se zadržavao subhondralno u kosti glave, odnosno trohleje humerusa i nije prolazio kroz hrskavicu. Šavovi rane su rađeni po slojevima, a prethodno je urađena transpozicija n. ulnarisu medijalno. Nadlaktni gips je nošen tri nedelje, uz obaveznu profilaksu periartikularne osifikacije uzimanjem Indometacina 25mg 3 puta na dan. Po skidanju gipsa, dve nedelje je obavljana ambulantna fizikalna terapija, a potom stacionarna fizikalna terapija sa punim opterećenjem.

Laugier-ovi prelomi su retki prelomi i u literaturi su malo opisani. Hirurško lečenje nema alternativu, a pravovremena dijagnostika, hirurška i fizikalna terapija daju po Mayo lakat indeksu dobar rezultat. *Acta Medica Medianae 2011;50(4):49-54.*

**Ključne riječi:** *Laugier-ov prelom, lakat, zglob, trauma*