

Safe Elbow Surgery

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Abstract

Today, the surgical treatment is being done for most of the elbow diseases and fractures openly, minimally invasive and arthroscopically. The complications after elbow surgery are also in significant proposition. This review exhibits the need of applied anatomical knowledge and operative skills for the surgeon who intends to operate the elbow safely.

Keywords: Safe Surgery, Trauma, Injury, Elbow

Introduction:

The elbow is a highly congruent trochoginglymoid joint allowing motion in both flexion-extension and pronosupination across 3 articulations. Therefore, treatment of fractures of the elbow can be technically challenging to manage, even after initial surgery [9]

The surgery for elbow fractures and other diseases are common practice in Orthopaedic surgery. During the last two decades, the use of arthroscopic elbow surgery has increased tremendously. The proximity of neurovascular structures and narrow joint spaces make it a technically demanding procedure with many potential complications like Ulnar nerve injury, surgical site infections, elbow contracture. But these technical hitches can be well prevented when performed in a standardised fashion by experienced hands [1,5].

Modifications in implant design and improvements in surgical technique have expanded the applications of total elbow arthroplasty. Complications associated with reconstructive elbow surgery persist, however, often leading to profound and sometimes non-salvageable disability. The most recognised complications include implant loosening, peri-prosthetic fracture, implant failure, infection, triceps

insufficiency and nerve palsy. Although far fewer elbow arthroplasties than lower extremity arthroplasties are performed, the proportion of complications is greater with elbow arthroplasty and the outcomes of secondary reconstruction are less favourable [4].

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The surgical anatomy around the elbow, its neurovascular structures and their plane are important for the surgeon to know in executing the operation. To say an example, In fractures of the distal third of humeral shaft there is a close proximity of the radial nerve and the fracture, since in this location occurs the passage of the nerve to the anterior compartment, through the lateral intermuscular septum. At this point, the nerve has lower mobility and is closer to the bone. Thus, there is a greater concern for iatrogenic nerve injury after reduction of the fracture [8]

MIPO – Minimally Invasive Plate Osteosynthesis techniques are recommended for the treatment of comminuted fractures today, because they promote a biological fixation without devitalisation of bone fragments. These principles been widely used in the treatment of fractures of humerus with good results [7].

This article explains the necessitate of anatomical understanding and operative expertise for the orthopaedic surgeon who plans for surgical management in the elbow safely.

Principles of Safe Elbow Surgery [2, 3, 8, 11, 12, 13, 14, 16]

The surgeon must hold the detailed anatomical knowledge in elbow surgical approaches and accurate skills for the safe surgery. He/she must know the perfect instrumentation techniques needed in the elbow operations. Identifying the vital structures and understanding their relationship are the keys to operating successfully in the cubital fossa and the elbow joint.

Safe steps in Posterior Approach to Elbow Joint

- Fully dissect out the Ulnar nerve and pass tapes around it so that, it can be identified at all the times. This nerve is no danger as long as it is identified early and protected. Also excessive traction is to be avoided
- The Median nerve lies anterior to the distal humerus. It may be endangered if the anterior structures are not stripped off the distal humerus.
- The Radial nerve is at risk if the dissection farther proximally than the distal third of the humerus, one handbreadth above the lateral epicondyle.
- The Brachial artery lies with the median nerve in front of elbow. It should be given the same protection as is the nerve

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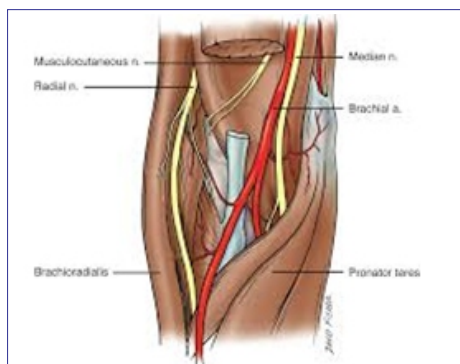


Figure 1: The Elbow Joint with the closely related neurovascular structures

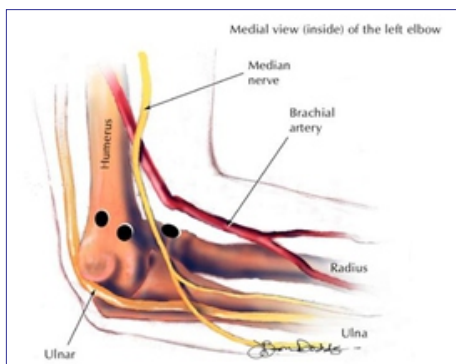


Figure 2: The Safe Portals in the Elbow Arthroscopic Surgery

Safe steps in Medial Approach to Elbow Joint

- Palpate the Ulnar nerve as it runs in its groove behind the medial condyle of the humerus. The fascia over the nerve may be carefully incised starting proximal to the medial condyle, then do isolate the nerve along the length of the incision.
- Define the interval between the pronator teres and brachialis muscles, taking care not to insult the median nerve which enters the pronator teres near the mid line.
- Gently retract the pronator teres medially, lifting it off the brachialis. Make sure the ulnar nerve is retracted inferiorly, then perform osteotomy of the medial epicondyle if it is needed

Safe steps in Anterolateral Approach to the Elbow Joint

- Identify the lateral cutaneous nerve of the forearm (the sensory branch of the musculocutaneous nerve) as it becomes superficial to the deep fascia in the distal 2 inch of the arm just lateral to the biceps tendon in the interval between it and the brachialis muscle
- Identify the radial nerve proximally at the level of the elbow joint between the brachialis and the brachioradialis. The nerve lies anteromedial to the brachioradialis and crosses in front of elbow joint.
- The Posterior interosseous nerve is vulnerable to injury as it winds around the neck of the radius within the substance of the supinator muscle. To prevent damage to the nerve, ensure that the supinator is detached from its insertion on the radius with the forearm in supination.
- Identify the radial artery as it passes deep to the biceps tendon, aponeurosis and trace it proximally to its origin from the brachial

artery. Note that both the brachial vein and the median nerve lie medial to the brachial artery

Safe steps in Anterior Approach to Cubital Fossa

- The lateral cutaneous nerve of the forearm must be preserved. To find it, locate the interval between the biceps tendon and the brachialis muscle. The nerve emerges there to run down the lateral side of the forearm subcutaneously.
- Be careful not to injure the brachial artery, which runs immediately under the bicipital aponeurosis

Safe steps in Posterolateral Approach to Radial Head

- The radial nerve is safe as long as the elbow joint is opened laterally and not anteriorly.
- The posterior interosseous nerve is in no danger as long as the dissection remains proximal to the annular ligament. Pronation of the forearm keeps the nerve as far from the operative field as it possibly can be.

Safe steps in Arthroscopic Elbow Surgery

- The proximal anteromedial portal is located approximately 2 cm proximal to the medial epicondyle and just anterior to the intermuscular septum and is established first. The ulnar nerve is located 3-4 mm from this portal. Hence it is acknowledged by blunt dissection through this portal until the anterior aspect of humerus is palpated. This is the key step. If the portal is placed too anterior, then the neurovascular structures in the antecubital fossa are at risk. If the portal is posterior to the humerus and posterior to the intermuscular septum, the ulnar nerve can be damaged.
- Then the Anterolateral Portal is placed by

an outside-in technique. It is created 2 cm proximal and 1 cm anterior to the lateral epicondyle. If this is placed too far distally near the radial neck, it places the posterior interosseous nerve at significant risk.

- For evaluating the posterior compartment, the straight posterior portal is usually created first and is located 3 cm proximal to the tip of the olecranon. This portal passes within the 25 mm of the ulnar nerve and within 23 mm of the posterior antebrachial cutaneous nerve
- Then the Posterolateral portal is placed 2 to 3 cm proximal to the tip of olecranon at the lateral border of the triceps tendon. The medial and posterior antebrachial cutaneous nerves are at most risk residing an average of 25 mm from this portal. The Ulnar nerve is also at significant risk near the medial epicondyle and the medial gutter.
- Then direct Lateral Portal is located at the “soft spot” that is the triangle formed by the radial head, lateral epicondyle and olecranon.

Safe steps in Minimally Invasive Approach to Elbow Joint

- In MIPO of distal humerus, the Proximal access is performed between the tendon of the biceps muscle medially and the tendon of the deltoid muscle and the cephalic vein laterally. Then the arm is abducted between 60 and 90 degrees to correct the typical varus deviation. Then the plate is inserted proximal to distal
- When a plate is placed on the anterior side of humeral shaft the mean distance from the closest part of the plate to the radial nerve is 3.2 mm. The brachial muscle that covers most of the anteriorly placed plate protects the radial nerve from injury when a plate is inserted sub-muscularly through two small incisions on the anterior side of the arm away from fracture site

Discussion

Total Elbow arthroplasty is a viable option for advanced arthritis of elbow. Effective pain relief and restoration of function has broadened the surgical indication to include communitated fractures of the distal humerus, joint ankylosis and severe elbow instability. Satisfying outcomes can be expected in greater than 75% of patients, but the rate of aseptic and septic complications and revisions remains high [4].

The elbow arthroscopy is relatively a safe procedure and increasingly used now to treat

complex pathology. However in less experienced hands might lead to higher complications including infections and neurological injuries [5,6,11]. For the anterior-medial portal, it is very important to stay anterior to the intermuscular septum which protects the ulnar nerve. The use of the anterior surface of the humerus as a constant guide helps to prevent injury to the median nerve and the brachial artery, which are anterior to the capsule. While placing the posterior portal, we have to dissect the ulnar nerve well to avoid injury [12,13].

There are now new extended surgical indications. Over the last decades, the radial head is increasingly recognized as an important stabilizer of the elbow. In order to maintain stability of the injured elbow, the main goal in the treatment of radial head fractures is to restore the anatomy of the radial head and surrounding tissues. There may be associated Elbow dislocation,

Coronoid process fractures, Ulnar fractures, Capitellar Injuries and rupture of Interosseous membrane along with radial head fractures. Therefore the management of the radial head fractures should be directed to achieve a stable and functional elbow joint. Hence the surgical strategy is justified here [10].

Over the last two decades, a higher incidence of comminuted fractures of the distal humerus by the increase of injuries caused by high energy trauma has been observed. Surgical treatment is necessary for these fractures considering the articular involvement and retaining the biomechanics of the elbow joint. Minimal Invasive MIPO surgery is promising when compared to the conventional plating and Nailing in distal humerus fractures. MIPO offers advantages in terms of reduced incidence of iatrogenic radial palsies and accelerated fracture union and a similar functional outcome with

respect to shoulder and elbow function [3, 7, 14]

It is highly recommended to implement antibiotic stewardship programme in all the health establishments to prevent and manage the Surgical Site Infection [17, 18]

Conclusion

Since, the surgical treatment for all types of elbow diseases and fractures is acceptable today; the surgeon as a doctor must acknowledge the safety of the patient well during surgery.

To avoid the neurovascular and other serious complications, the applied anatomical knowledge with expert skills are essential for the orthopaedic surgeon while operating the elbow.

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