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FROM THE PRESIDENT'S DESK

It isindeed a very humbling experience to communicate with each dignified member of the esteemed Gujarat Orthopaedic Association (GOA)as President of this esteemed organization.

I am thrilled to announce the release our latest e-bulletin that has raised itself to the status of e-Journal, marking another milestone in our organization's commitment to academic excellence and knowledge dissemination.

Our e-Journal represents the culmination of rigorous clinical practices, scholarly contributions and intellectual engagement from our esteemed members and invited scholars beyond the boundary of our state. As the President of GOA, I take immense pride in presenting this compendium of cutting-edge knowledge and thought provoking insights to our academic community, this issue being dedicated to everything around elbow joint, by contribution from SaurashtraKachchh zone of GOA.

This edition showcases a diverse array of topics, reflecting the interdisciplinary nature of our GOA and the breadth of expertise within our community. Each article encapsulates the spirit of inquiry and intellectual curiosity that defines our members.

I extend my heartfelt gratitude to the chief editors Dr. Ketan Shah and Dr. PareenKantesaria for their unwavering single focus of excellence in our scientific publication. Dr. DipakParmar, Guest editor for this special issue and a personal support has conceptualized this edition along with excellent coordination without getting tired; his zeal and enthusiasm are reflected throughout this edition. Authors are to be thanked specially for their contribution and readiness to edit and re edit their original work. They are the cornerstone for any such scientific publication and we salute their commitment for advancement of knowledge. It is through their collective efforts that our e-Journal stands as a testament to the pursuit of knowledge and scholarly excellence.

I encourage all the members to explore the latest issue, engage with the research findings and continue to foster a culture of academic inquiry within our community. Together, let us celebrate this achievement and reaffirm our commitment to advancing knowledge and scholarship in our respective fields. Also I do extend invitation to contribute to our forthcoming journals. Please be in touch with your zonal EC member for further information.

A big thank you for your continued support and participation in our organization's endeavors.
With warm regards and folded hands,

Dr. Vijay R. Sata
President, Gujarat Orthopaedic Association

FROM THE DESK OF SECRETARY

The reintroduction of the academic GOA bulletin was a certified hit last year. As we embark on fresher pastures this year, the challenges of sustaining quality and practicality are going to be exciting. We are on safe grounds, considering the continuity and consistency provided by the stable and staple chief editors- Dr. Ketan Shah and Dr. Pareen Kantesaria whose smart and efficient coordination spelt the success story last year.

The goal is of course to be better, bigger and bolder. The nitty- gritty and the integrity will always be top notch. Dissemination of scientific knowledge and sharing of operative endeavours amongst members is always a beauty; and as Keats would say, " A thing of beauty is a joy forever" .

Dr. Dipak Parmar, who is an experienced academician is at the helm as the guest editor for this bulletin. His meticulous planning and active inputs will definitely shine out to herald a busy new year of ' karo zyada education ka irada' !

Various zones and regions of Gujarat will obviously get adequate representation and Ketan and Pareen have also lined up a delectable and enticing menu of super specialty articles which would encompass all orthopaedic fields.

So fasten your seat belts and be ready to rock and roll!

Dr. K. C. Thakkar
Secretary, Gujarat Orthopaedic Association

GUEST EDITOR MESSAGE

Dear Colleagues,

Happy April to everyone.

Thanks GOA and President Dr Vijay Sata, for providing me an opportunity to work for GOA.

Our theme for this E Bulletin is **All around Elbow**. Elbow joint is act as a connecting joint between two joints of different functions; Shoulder joint with relatively stable but wide (global) and coarse range of movement And Wrist joint with stable but but fine and precise activity. Saurashtra and Kutch region where tremendous Orthopaedic work is happening but getting unnoticed and unpublished, so, more numbers of Orthopaedic surgeon from Saurashtra and Kutch region are encouraged to present their knowledge and work in this E Bulletin.I hope this E Bulletin is fulfilling this motive.

I thank to all authors who made possible this E bulletin. Once again many many thanks to GOA, GOA president Dr Vijay Sata and GOA - Secretary Dr Ketan Thakkar editors of E Bulletin - Dr Ketan Shah and Dr Pareen Kantesaria for their constant guidance and encouragement.

With hope of future assignments

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COMPLEX SUPRACONDYLAR HUMERUS FRACTURES: IDENTIFICATION AND MANAGEMENT

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Abstract
Supracondylar humerus fractures are the most common elbow fractures observed in pediatric patients. They are typically categorized into three types according to Gartland's classification. Most of these fractures are presumed to be uncomplicated transverse fractures, for which a standardized treatment algorithm advises splinting for stable, undisplaced Type 1 fractures. Children with type 2 fractures typically undergo closed reduction and casting, while type 3 fractures often require closed reduction and percutaneous pinning. Nevertheless, numerous variations to this traditional classification have been observed. This paper highlights the complex supracondylar humerus fractures and proposes an approach for their identification and management.

INTRODUCTION
Supracondylar fractures of the humerus (SCH) account for approximately 18% of pediatric fractures and 60% of elbow fractures in children [1, 2, 3]. Initially classified by Gartland into three types based on displacement—mild, moderate, and severe—the modified classification system further refines these fractures [4].

Type I fractures are non-displaced, with the anterior humeral line passing through the center of the capitellum. Type II fractures display an evident fracture line with an intact posterior hinge, while type III fractures are completely displaced and lack cortical contact [4]. Treatment guidelines have been established based on these fracture types, including cast immobilization for type 1, closed reduction and casting for type 2, and closed reduction with pinning for type 3 [6–10]. However, certain fracture patterns cannot be adequately identified with the original Gartland's classification, leading to uncertainty in their management strategies, as evidenced by a scarcity of literature on their treatment and the long-term impact on patient outcomes if not managed properly.

Mubarak and Davids further subcategorized type I fractures into subtypes I A and I B. Type I A injuries are non-displaced fractures without comminution, collapse, or angulation [12]. In contrast, type I B fractures

involve comminution or collapse of the medial column in the coronal plane and may exhibit mild hyperextension in the sagittal plane. Wilkins' modifications introduced subtypes A and B for Gartland's type II fractures to address rotational and translational abnormalities, adding further clarity to the classification [5]. Type II A fractures are simply extended without malrotation or translation, whereas type II B fractures involve one or both deformities.
Initially, Gartland's type 3 fractures included extension-type pediatric supracondylar fractures [28]. However, it has been expanded to encompass flexion-type supracondylar fractures as well [29, 5]. Leitch et al. proposed a novel classification, designated as type IV, which describes fractures characterized by a torn anterior periosteal hinge, resulting in instability during both flexion and extension due to a compromised periosteal hinge. This newly identified type necessitates intraoperative evaluation to ascertain complete instability [14].

Bahk et al. described a classification system wherein they stated that not all pediatric supracondylar humerus fractures have a purely transverse pattern and various subtypes are identifiable by varying degrees of coronal obliquity, sagittal obliquity, and comminution, which are associated with unique clinical features [13]. They defined four fracture patterns in the coronal and two fracture patterns in the sagittal planes, with varying degrees of obliquity.

This manuscript aims to provide practical insights into the identification and distinct management of these variations of supracondylar humerus fractures mentioned above.

CASE SCENARIO 1:

Type 1 Supracondylar Fracture with Medial Comminution with Varus.

The management of these fractures begins with the identification of this subtype of Type 1 fracture initially described by Mubarak et al. Type I A injuries are non-displaced fractures without comminution, collapse, or angulation [12]. In contrast, type I B fractures involve comminution or collapse of the medial column in the coronal plane and may exhibit mild hyperextension in the sagittal plane [Figures 1 and b].

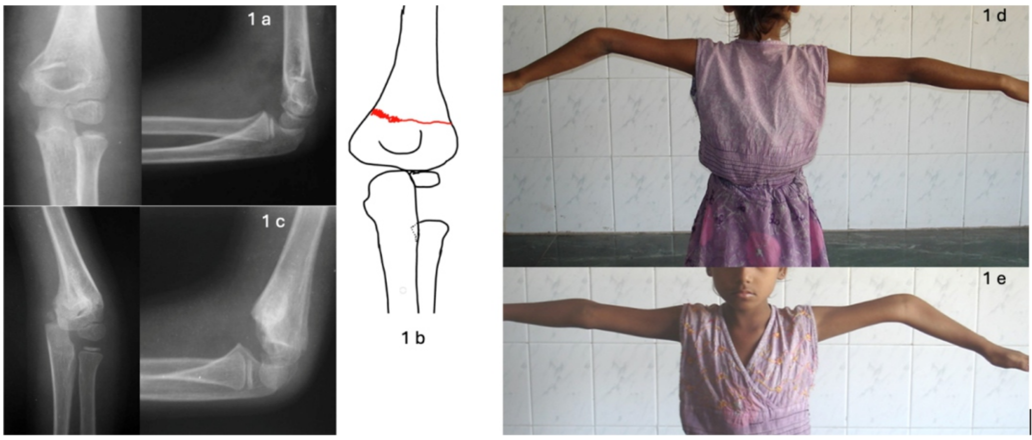

Figure1 :

a) Xray showing a Type 1 Supracondylar Fracture with medial omminution with varus.

b) Line diagram of Type 1B Supracondylar Fracture.

c) AP and lateral X – Ray showing collapse of the medial column and varus tilt.
d) Clinical images of a young girl with sever cubitus varus deformity secondary to a mismanaged Type 1B Supracondylar Fracture

One radiographic parameter that can prove to be helpful is the measurement of Baumann's angle in the AP X-ray, which is the angle formed by the physeal line and the long axis of the humerus, which can delineate the presence of coronal malalignment. [31] Studies have shown that although the normal Baumann's angle varies from 8 to 28 degrees, depending on the patient, there is little side-to-side variance in any one individual. [31,32]

Diagnosis of Type 1 B can be challenging, but conservative management of Type I B fractures with medial comminution and varus tilt may lead to deformities like cubitus varus [30] [Figure 1d and e]. Therefore, we recommend a prompt diagnosis of these fractures, followed by primary reduction and fixation with percutaneous K wires and immobilization in a cast.

CASE SCENARIO 2:

Type 2 Supracondylar Fracture with rotational malalignment.

Type 2 fractures have to be carefully assessed and classified into rotationally stable and unstable fractures [Figure 2a]. These primarily correspond to Type 2 B fractures, following the modification proposed by Wilkins et al. [5].

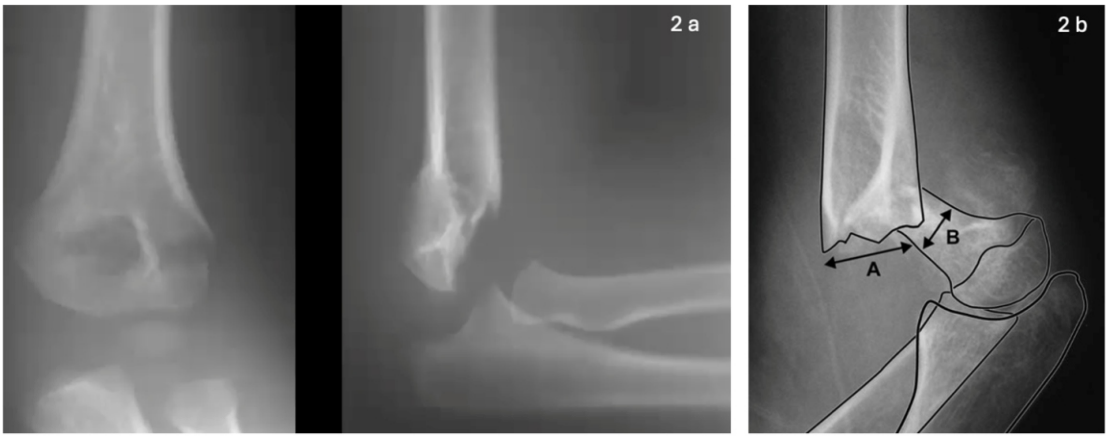

Figure 2 :

a) AP and Lateral X – Ray of the elbow joint showing a Type 2 B Supracondylar fracture (as per Wilkin's modification).

b) Lateral Xray of the elbow depicting the method of calculating the Gordon's Index.

The posterior hinge may remain intact, but there could be a discrepancy in rotation. The rotational discrepancy can be determined by observing the rotation of the distal shaft of the radius compared to the distal fragment, known as Gordon's index. A high Gordon's index suggests rotational malalignment; it is essentially a measure of the absolute amount of displacement of the proximal humeral metaphysis at the fracture site (A) divided by the width of the humerus immediately distal to the fracture site (B) as measured on the lateral radiograph as shown in Figure 2b [18]. Rotationally unstable fractures are prone to varus collapse and malunion [Figure 3]. Hence, it is advisable to achieve proper alignment and use percutaneous K-wires to prevent such complications.

CASE SCENARIO 3:

Flexion-type Supracondylar Fracture

Supracondylar humerus fractures of the flexion type are very rare injuries, accounting for 1–3% of all supracondylar fractures in children. They are often caused by a direct blow to the flexed elbow and are highly unstable [Figure 3a]. They were not initially considered in the original Gartland classification but were classified using Wilkin's modification of the Gartland classification [5]. Ulnar nerve palsies frequently arise as a complication of flexion-type supracondylar fractures, with a prevalence of up to 14%. They represent the majority, approximately 91.3%, of nerve injuries associated with these fractures [26, 27].

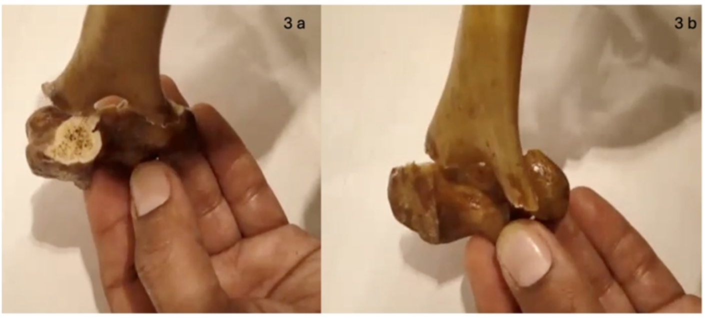

Figure 3:

a) Bone model to depict a rotaionally unstable fracture.

b) Varus collapse of a rataionally unstable fracture.

These are highly unstable fractures that are very difficult to reduce. Various techniques have been documented for their reduction [14, 15, 16, 17]. The "push-pull" method described by Chukwunyerenwa C et al described a "push-pull" method that uses a rolled towel fulcrum as a reduction aid under the fracture, Novais et al have described a technique whereby the distal segment is used as a joystick and pins are placed before reduction, which can be difficult in small extremities with subcutaneous fat as seen in children. Leitch et al. have described a technique for closed manipulation and percutaneous pinning in fractures that are unstable in flexion and extension, which requires a fluoroscopist to alternate between AP and lateral views while the reduction is held [14, 15, 16, 17]. However, it has been observed that pinning can be difficult due to the lack of ability to adequately visualize the distal humerus on the AP view while the elbow is flexed to 90 degrees.

However, we recommend the use of a "trans olecranon pin.". Our recommendation is to initiate reduction with a lateral view while the elbow is positioned at 70 degrees of extension [17]. Subsequently, a 1.8-mm K-wire is inserted starting from the olecranon, traversing the distal fragment, and reaching the proximal fragment, ultimately going intramedullary [Figure 4 b]. The correction of coronal malalignment is then addressed from the anteroposterior (AP) view by translating the distal fragment. Following the correction of coronal malalignment, pillar stabilization is achieved through the insertion of a K-wire [Figure 4 c]. The transfixing olecranon K-wire is then removed, and further pinning is carried out with additional K-wires [Figure 4 d and e]. Utilizing the olecranon and distal fragment as leverage facilitates the reduction of the fracture.

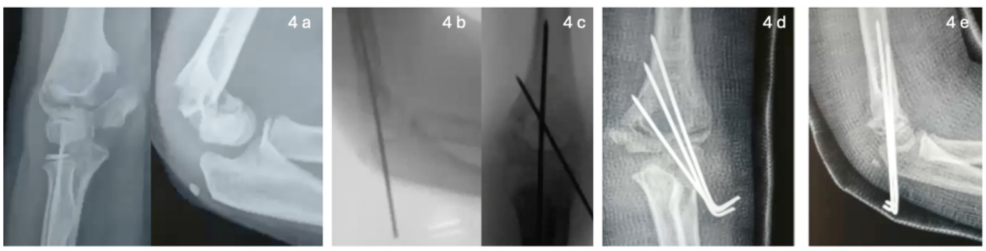

Figure 4:

a) AP and Lateral X Ray of a Flexion-type Supracondylar Fracture.

b) Lateral view of the elbow showing the insertion of the “trans olecranon” pin with elbow at 70 degrees of extension under image intensifier.

c) Correction of coronal malalignment in the AP view, and pillar stabilization.

d) Removal of transfixing K wire followed by insertion of additional pins for stabilisation.

If the fracture is associated with an ulnar nerve injury, it can be due to entrapment between the distal and the proximal fragment or excessive stretching of the nerve over the posterior spike of the proximal fragment. Most injuries are neurapraxia rather than axonotmesis or neurotmesis and usually resolve in less than 6 months or approximately 10 weeks. Close follow-up and reevaluation are, however, needed. [33, 34]

CASE SCENARIO 4:

Type 4 - Multidirectionally unstable

Leitch et al. proposed a novel classification, designated as type IV, which describes fractures characterized by a torn anterior periosteal hinge, resulting in instability during both flexion and extension due to a compromised periosteal hinge. This newly identified type necessitates intraoperative evaluation to ascertain complete instability [14].

During intraoperative assessment, when the elbow is flexed under visual inspection using an image intensifier, the fracture tends to overreduce [Figures 5 a, b, and c]. To address such fractures, the "Arm Board technique" proves beneficial, wherein the proximal fragment is secured to the arm board using hypoallergenic radiolucent tape, allowing manipulation of the distal fragment while the image intensifier is adjusted to achieve a true lateral view of the elbow joint [19].

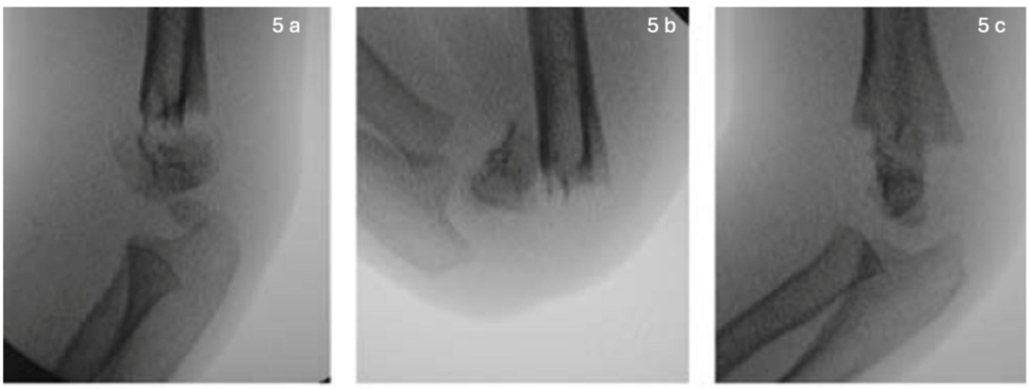

Figure 5:

a,b,c) Multidirectionally unstable fracture over-reducing in flexion and mobile with instability in flexion and extension

Next, longitudinal traction is applied, and with the fracture remaining unreduced, the elbow is flexed to approximately 90 degrees, allowing palpation of the distal fragment. Subsequently, a 2.0-mm Kirschner wire is percutaneously introduced through the capitellum under fluoroscopic guidance [Figure 6 a]. This wire serves as a joystick to facilitate reduction and should be positioned centrally within the distal fragment in the lateral projection and directed towards the medial column of the distal humerus in the anteroposterior view [Figure 6 b]. The proximal humerus is strapped to the arm board, and one hand is used to apply gentle traction to the wrist with the elbow flexed adequately to grossly align both fragments. The proximal humeral segment is then cautiously rotated until an optimal lateral image of the distal diaphysis is obtained.

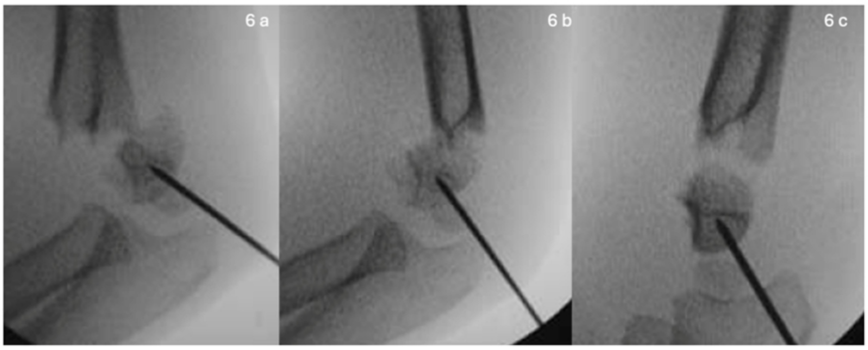

Figure 6:

a) 2.0-mm Kirschner wire introduced through the capitellum under fluoroscopic guidance.

b) Wire used as a joystick to to facilitate reduction.

c) Partial restoration of the distal humerus contour, forming a teardrop image.

The joystick pin is used to rotate the distal fragment in the axial plane until it is aligned with the proximal fragment. Partial restoration of the distal humerus contour, forming a teardrop image, should be obtained [Figure 6c]. The proximal fragment has to be held and maintained without further movement throughout the entire procedure. With the correction of the axial plane (rotation) deformity, the C-arm is rotated to the AP, and any displacement in the coronal plane is corrected by pushing the medial or lateral condyles, and fixation is done with K wires [Figure 7].

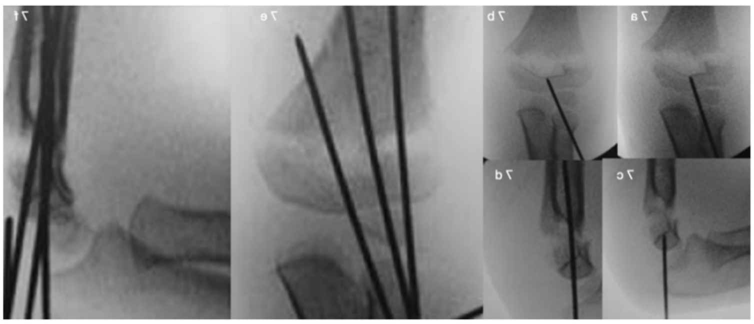

Figure 7:

a,b,c,d) Post correction of the rotational deformity, coronal plane displacement is corrected.

e,f) Fixation with percutaneous K wires after correction of coronal and axial plane deformity.

CASE SCENARIO 5:

Supracondylar humerus fractures and avascular necrosis of the trochlea

According to recent data, avascular necrosis of the trochlea after a supracondylar humerus fracture is uncommon, and a limited number of cases have been reported in the literature [21, 28, 35, 36]. A systematic review by Ott et al. suggested that the probability of getting avascular necrosis in patients with supracondylar fractures of the humerus was dependent on the type and severity of the fracture. This is mainly attributed to the vascular anatomy of the distal part of the humerus wherein the distal metaphysis of the humerus is supplied by a solitary end terminal nutrient artery, ending roughly 3–4 cm before reaching the olecranon fossa and the areas distal to this point are considered watershed areas [21]. Therefore, the probability of avascular necrosis of the trochlea is higher if the fracture line is distal to the watershed area, as seen in low supracondylar fractures [35, 36].

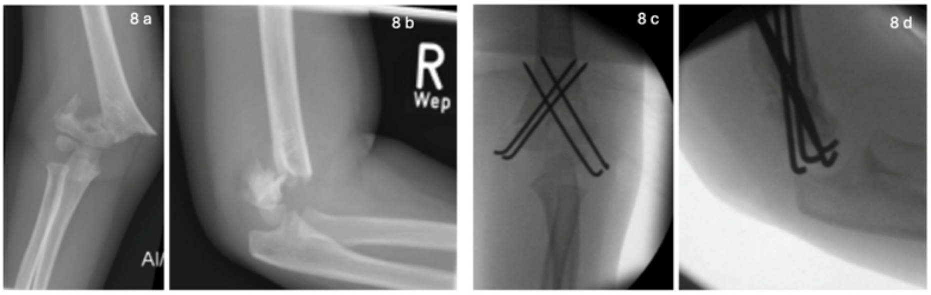

Figure 8:

a,b) AP and Lateral X Ray of the elbow joint showing a low supracondylar fracture.

c,d) Post reduction and percutaneous fixation images of AP and lateral views of the elbow joint on image intensifier.

There is a diagnostic challenge when it comes to low supracondylar fractures [Figure 8 a]. Distinguishing them from intercondylar fractures, lateral condyle fractures, and medial condyle fractures is important [37]. The probability of patients getting avascular necrosis (AVN) of the trochlea in the low supracondylar humerus is higher [21, 22]. Therefore, these fractures have to be adequately reduced under an image intensifier and fixed percutaneously with K wire [Figure 8 c and d]. Serial radiographs have to be obtained to watch out for the AVN of the trochlea, seen radiographically as a "fishtail deformity" [Figure 9 a, b, and c] [38].

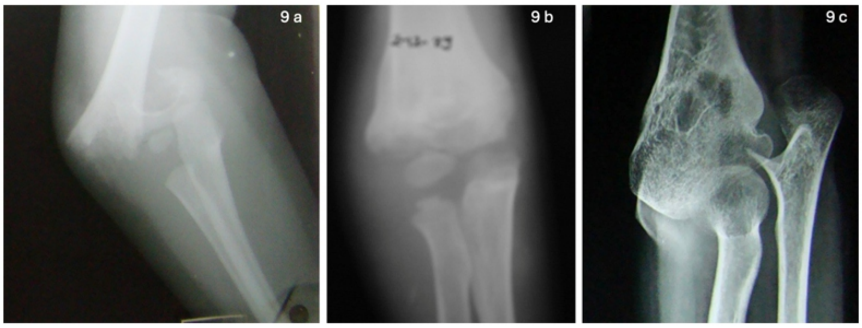

Figure 9:

a,b,c) Serial X Rays of a patient with low supracondylar humerus fracture showing a severe "fishtail deformity.

CASE SCENARIO 6:

Metadiaphyseal type of high supracondylar fractures.

This rare pattern of supracondylar fracture can only be possible if a rotational strain is added to the axial transmitted impact force [Figure 10 a]. If the impact forces are axially transmitted, the fracture can occur more proximally in the distal diaphyseal region or the proximal metaphyseal area of the distal humerus. Three fracture patterns are identified in this region: transverse, oblique, and comminuted type [23, 24]. The high supracondylar fractures are easy to reduce and difficult to fix [23]. We recommend reduction under image intensifier and intramedullary fixation with the K wire reaching up to the proximal third of the humerus [Figures 10 b and c]. [25]

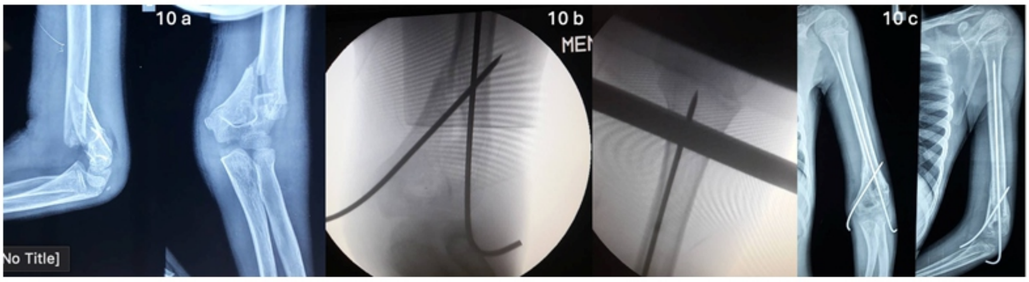

Figure 10:

a) AP and Lateral X – Ray of the elbow joint showing a Metadiaphyseal type of high supracondylar fracture.

b) Intraoperative images showing the position of the intramedullary wire that is used for reduction of these fractures.

c) Post operative radiograph showing a healed Metadiaphyseal type of high supracondylar fracture.

CASE SCENARIO 7:

Oblique supracondylar humerus fractures

Bahk et al. identified four coronal (typical transverse, medial oblique, lateral oblique, and high fractures) and two sagittal (low sagittal and high sagittal) configurations. In typical transverse fractures with a coronal obliquity of < 10° the fracture line enters and exits near the epicondyles. Fractures with an obliquity of ≥ 10° in the coronal plane originate at either the medial or lateral epicondyle and extend proximally through the opposite cortices. High fractures with varying degrees of coronal obliquity start and exit near or above the olecranon fossa but stay within the distal humerus metaphysis.

Whereas in sagittal fracture patterns, low sagittal oblique fractures with an obliquity angle of < 20° start anteriorly and exit posteriorly at nearly the same level. Fractures that have a high sagittal obliquity of ≥ 20° begin at the anterior coretx and extend upwards and exit through the posterior cortex . [13] Fractures with more than 10 degrees of obliquity in the coronal plane and over 20 degrees of sagittal obliquity were associated with a significantly higher incidence of additional injuries and were more likely to result in extension malunion [11, 13].

For a transverse stable fracture, we recommend putting 2–3 lateral K wires from anterior to posterior [Figure 11 a], whereas for oblique rotationally unstable fractures, we recommend cross-pinning from posterior to anterior [Figure 11 b].

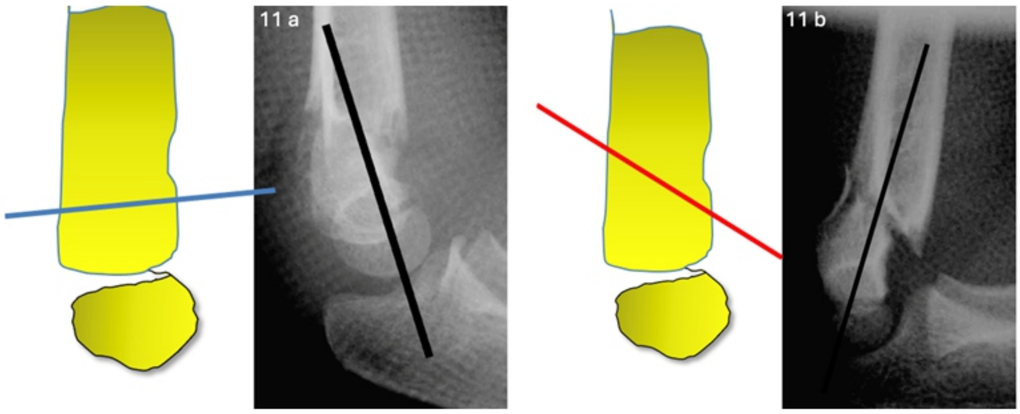

Figure 11:

a) Transverse stable fracture, diagram showing the position of K wires directed anterior to posterior.
b) Oblique rotationally unstable fractures, cross-pinning with the direction being posterior to anterior.

CONCLUSION

There are outliers in the classification of supracondylar humerus fractures, and the management of these fractures has to be done with vigilance to avoid mismanagement. The treatment algorithm for the seven variants of supracondylar humerus fractures described above can be summarised as follows:

Type 1 supracondylar fracture with medial comminution with varus: closed reduction with percutaneous K wire fixation and immobilization with cast.

Type 2 supracondylar fracture with rotational malalignment: closed reduction with percutaneous K wire fixation and immobilization with cast to prevent varus collapse.

Flexion-type Supracondylar Fracture: Closed reduction using a trans olecranon pin, fixation with K wires, and immobilization with a cast.

Type 4 - Multi-directionally Unstable: Closed reduction using the “Arm Board Technique” with percutaneous K wire fixation and immobilization with cast.

Low supracondylar humerus fractures: closed reduction with percutaneous K wire fixation and immobilization; with cast and to watch out for signs of trochlear avascular necrosis.

Metadiaphyseal type of high supracondylar fractures: closed reduction and intramedullary internal fixation with K wire till the proximal humerus and immobilization with cast.

Oblique supracondylar humerus fractures: for transverse stable fractures, lateral K wires from anterior to posterior direction, whereas for oblique rotationally unstable fractures, cross-pinning from posterior to anterior.

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ROLE OF PRP THERAPY FOR CHRONIC ELBOW TENDINOPATHY ('Biological Solutions for Biological Problems')

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ABSTRACT

In recent years, orthobiologics have been of increasing clinical interest in the treatment of elbow pathology. In some conditions, such as lateral epicondylitis, there have been high-quality trials that support the use of platelet-rich plasma (PRP) in reducing pain, restoring functionality, and improving clinical outcomes. However, as the numbers of both cellular-based biologics and the conditions being augmented by biologics continue to expand, there is a substantial need for high-quality investigations to support their routine use in most elbow conditions. The purpose of this review is to summarize the current evidence of PRP therapy as orthobiologics in the management of elbow tendinopathy, as nonoperative treatment and as to avoid operative treatment.

As defined by the American Academy of Orthopedic Surgeons, orthobiologics are products made from substances found naturally in the body utilized to improve the healing of broken bones and injured muscles, tendons, Chief consultant @ Deliwala Arthroscopy, Joint Preservation & Sports Injury Center, Bhavnagar, Gujarat – 364001., India. www.arthroscopyclinic.in
Corresponding Email : dr.uhdeliwala@gmail.com and ligaments.In recent years, the utility of biologics as adjuncts to both conservative and operative therapies for elbow pathologies has been of increasing clinical interest. Owing to their convenience, safety in use, and their high concentrations of growth factors and mesenchymal stem cells (MSCs) thought to improve healing, biologics have been introduced in the treatment of many soft tissue and tendinous injuries despite a paucity of evidence as to their efficacy. The purpose of this review is to provide an overview of commonly utilized injectable orthobiologics, commonly PRP and to summarize the available evidence on the use of orthobiologics for the management of elbow tendinopathy.

Keyword: platelet-rich plasma (PRP); tennis elbow; lateral epicondylitis; tendinopathy; platelet

INTRODUCTION

Pain with resisted wrist extension and local elbow tendernessare the characteristic complaints of patients who presentwith chronic lateral epicondylar tendinopathy (tenniselbow). This pain has been ascribed to microtears withinthe extensor carpi radialis brevis muscle and the subsequentdevelopment of angiofibroblastic dysplasia. Othertheories about the source of the pain include altered neurogenicpathways and up-regulation of substance P.

Recently, an association with an abnormal vascularresponse within the extensor carpi radialis brevis musclehas also been reported.

Since this common disorder was first described in 1883,a wide variety of treatments has been proposed. Rest, activityor equipment modification, nonsteroidal anti-inflammatorymedication, bracing, and physical therapy have all beendescribed as initial interventions. If these treatments fail toimprove the pain and tenderness, second-line treatmentssuch as cortisone injections, prolotherapy, autologous bloodinjections, platelet-rich plasma (PRP) injections, and needlingof the extensor tendon origin have been recommended.If patients continue to report pain and dysfunction despitethese measures, surgery is then considered. Only 10% to15% of patients with chronic lateral epicondylar tendinopathyconsider surgery. Surgical options include open tendondebridement and repair, percutaneous or open tendon release,and arthroscopic debridement. Reviews of the surgical literaturenote few differences in the outcomes of these approachesoverall, with a success rate of approximately 85%.Platelets are, in part, mediators of the coagulation process,but they also contain more than 300 bioactive cytokinesand growth factors that act via autocrine andparacrine mechanisms to help coordinate cellular communication. Platelets also release vasoactive substancessuch as serotonin, calcium, histamine, and adenosine viatheir dense granules. Importantly, several preclinicalstudies suggest that PRP enhances human tendon cell proliferation,differentiation, and maturation.

It is crucial to note that not all PRPs are the same. Somepreparations contain only concentrated platelets in a smallvolume of plasma. Others contain various concentrationsof platelets and white blood cells. Equally important is theinfluence of platelets on the behavior and function of whiteblood cells. Activation of the platelets with thrombin and/or calcium to initiate release of the contents of the granulesex vivo has been recommended in the wound healing literature. Recent information, however, strongly suggests thatPRP without activation promotes a better healingresponse. All these different formulations of PRP makecomparison between studies difficult and have led to thedevelopment of a PRP classification system (Table 1).

This system has 4 types and incorporates white blood cellconcentration, activation status, and platelet concentration(A: .5 times the baseline platelets; B:\5 times the baselineplatelets). Such classification now permits investigators andclinicians to replicate research results and standardize theuse of different formulations of PRP for various conditions.In 2006, Mishra and Pavelko published a pilot studysuggesting that inactivated concentrated platelets withconcentrated white blood cells may be effective for patientswho had failed nonoperative treatment for lateral epicondylartendinopathy and who were considering surgery.

That specific formulation of PRP consisted of unactivatedplatelets concentrated at about 5 times the baseline withconcentrated white blood cells (type 1 PRP). In a smallgroup of patients (n = 15), there were statistically significantimprovements compared with an active control group(bupivacaine with epinephrine, n = 5) at 8 weeks and a 93%reduction in pain scores for the PRP-treated patients at anaverage of 25.6 months.

That investigation was followed by a study by Gosenset al and Peer booms et al using the same techniquesand indications in a prospective, randomized trial of PRP versuscortisone in 100 patients. The results were published in 2separate works. At 2 years, the PRP-treated patientsreported an improvement of 69% in pain scores comparedwith only 36% for patients treated with corticosteroid injections(P\.0001). When the patients were evaluated via theDisabilities of the Arm, Shoulder and Hand (DASH) scoresat 2 years, the PRP group had an improvement of 67.6% comparedwith 15.7% in the cortisone group (P\.0001).

The pilot study of Mishra and Pavelko was underpoweredand only suggested some value for inactivatedPRP inpatients with chronic lateral epicondylar tendinopathywho were considering surgery when all other nonoperativemeasures had failed. The studies of Gosens et al and Peerbooms et al had excellent methodology and executionbut have been criticized for using cortisone as a controlgroup because of its potential negative effects. Overall,however, these 2 controlled studies reported no safetyissues and supported the use of unactivated PRP with leukocytesas an alternative to surgery. The second set ofstudies also clearly showed that cortisone has little or nolong-term value in the treatment of chronic tennis elbow.

TABLE 1

Platelet-Rich Plasma Classification System

Type	White Blood Cells	Activated?
1	Increased over baseline	No
2	Increased over baseline	Yes
3	Minimal or no white blood cells	No
4	Minimal or no white blood cells	Yes
	A: Platelets >53× baseline	
	B: Platelets <53× baseline	

TABLE 2

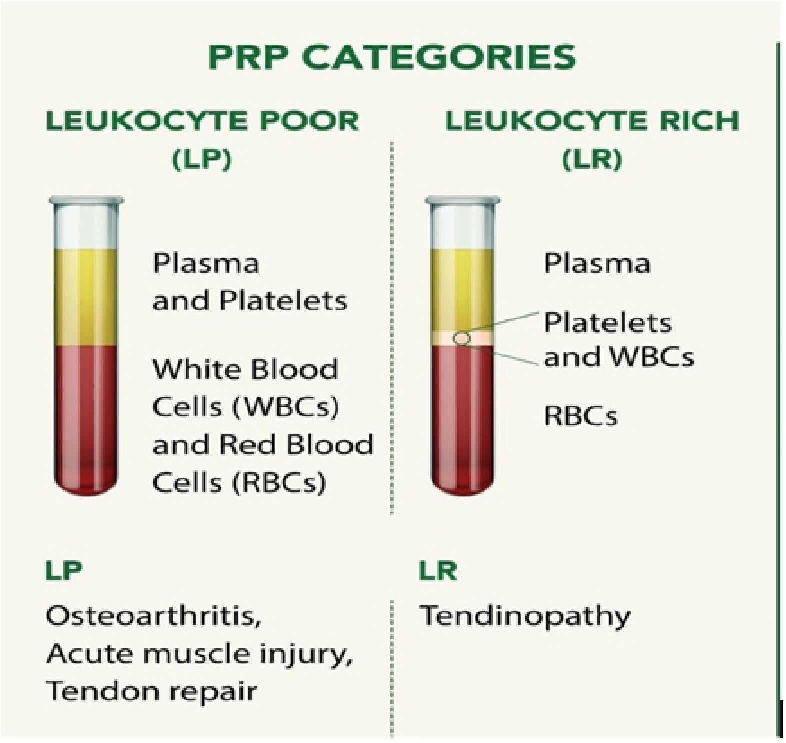
Classification :Different PRP kitsby Dohan Ehrenfest et al. (2009)

· 1. P-PRP (Pure) –Cell separator, Antigua's PRGF

· 2. L-PRP –Cursan, SmartPRep, Plateltex,Regen

· 3. Pure Platelet –rich fibrin (P –PRF) Fibrinet

· 4. Platelet and leukocyte-rich fibrin (L-PRF) : Choukrun'sPRF



Needling of the extensor tendon under a local anesthetichas been described in the literature as an effective treatmentfor chronic tennis elbow. The objective of the presentinvestigation was to evaluate the efficacy of needlingwith and without a specific type of PRP as a treatmentfor chronic lateral epicondylar tendinopathy. We hypothesizedthat the addition of PRP would result in moreimprovement in pain and lower levels of tenderness atthe elbow compared with needling alone.

MATERIALS AND METHODS

- 2015 to 2022
- 42 patients
- Age:14-56 (average : 35.6 y/o)
- Sex: M : 22 , F :20
- Duration of symptoms: 13.2 months (average)
- Tennis Elbow around 80 % prior taken Steroid Injections

  (50 % taken >2 injections chronic tendinopathy)

Sr.		TENNIS ELBOW	GOLFER ELBOW
	NO OF PATIENT	36	6
1	Duration of system	14	16
2	Brace orthotics	15	1
3	ICE	19	2
4	Electrotherapy-US	22	2
5	Physio exercise	25	2
6	NSAIDS	26	2
7	Tapping	5	1
8	Steroid Injection	23	2

Inclusion Criteria :

- Tendinopathies with failure of conservative treatment > 6 months
- NSAID stopped 7 days before and 2 weeks after PRP treatment (as may inhibit GF role)
- Tennis elbow - Lateral Epicondilities
- Golfers elbow – Medial Epicondilities

SURGICAL TECHNIQUE

Approximately 30 mL of whole blood was drawn froma peripheral vein of each patient. In the PRP group, theblood was mixed with an anticoagulant (ACD-A) andplaced into a sterile separator canister (GPS, Biomet Biologics,Warsaw, Indiana). The canister was then placedin a desktop-sized centrifuge and processed for 15 minutesat 3200 rpm (Figure 2). This method of preparation producestype 1A PRP (leukocyte-enriched PRP with platelets5 3 baseline used in an inactivatedmanner). The PRPwas then removed and buffered to physiological pH using8.4% sodium bicarbonate to neutralize the acidic ACD-Ain the PRP. The injection site was blocked using 0.5% bupivacainewith epinephrine, and then, 2 to 3 mL of the preparedPRP was injected into the extensor carpi radialisbrevis tendon and surrounding area using a pepperingtechnique. This technique consisted of 5 penetrations ofthe tendon as the PRP was injected via a single skin penetration.The active control group was injected with 2 to 3mL of bupivacaine using the same peppering techniqueas the PRP group. To maintain blinding in both groups,the entire 10-mL syringe including the needle hub waswrapped in black tape to obscure its contents. The patient's arm was also draped to prevent inadvertent unblinding ofthe patient during the injection.

PRP Therapy

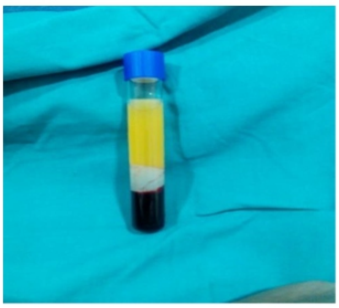
(8 ml blood - 4 ml - Total 20 min procedure)

Centrifugation machine

PRP AMBULATORY THERAPY

Done OPD basis :- Total 20 minutes of duration

Needs : 1o ml syringe, 18 G Spinal needle & 20G needle



METHODS OF PRP INJECTION

- Identifypainfularea(s)bypalpation
- Marktargetarea
- Inject3/4mlofL-PRPwith18gaugeneedle
- Directintocommonextensor/flexortendonaswellasinsertionsintobone
- USGguided:helpfulinbroadarea

Post injection Management

- Rest (sling) for a few days to a week
- Complications –Minimal as Autologous –Minor redness, swelling
- ICE application : immediate and one day after
- NO NSAID'S for at least 2 weeks
- PT –Eccentric physio
- Slow stretching program
- Low weight pain free move
- Effect starts afte2 months
- No high loading activities until criteria met
    - No rest pain
    - Minimal tenderness
    - Full motion
    - Normal strength

RESULTS

All patients evaluated with VAS score at preinjection, 6 weeks,3 months,6 months & 1 year. 2 patients lost follow-up after 6 weeks followup. Around 58% (24/42) improved by VAS at 6 wks. 88% (36/42) improved by VAS by 6 months & 1year but Only 40 % (2/5) of Bloodbank (2 steps) PRP at 1 year . Complications in term of minor redness, swelling in some patient treated with ICE & resolves within 24 hours . Mostly safe as Autologous. Two stage therapy – Bloodbank type has more tissue reactions. Almost none adverse reactions apart form this redness in Ambulatory Daycare therapy compare to more in Blood bank type

DISCUSSION

Overall, the primary finding of the our study demonstrate that PRP when compared to a variety of other treatment modalities, including placebo, physiotherapy, injections containing corticosteroid, shows significant improvement in pain or functional outcomes in the management of TE at end of 6 months & 1 year. Literature says that the most common treatment group that PRP was compared with was corticosteroid injections. Gosens et al. reported superior relief of pain and restoration of function more effectively with PRP than steroid injections in patients with chronic TE. Yadav et al. reported both PRP and steroids to be effective at pain relief and improving functional outcomes but the PRP group enjoyed significantly better improvements at the 3 months follow up period. . Gupta et al. reported greater short-term pain management and performance scores at 6 weeks with steroid injections, but patients receiving PRP injections enjoyed superior results in the longer term. . However, PRP enabled biological healing for patients with chronic symptomatic TE, whereas patients treated with corticosteroids are at increased risk of tendon degeneration.

In the past, steroid injections were popular and even considered to be the gold standard treatment for TE. However, recent studies have recommended against steroid therapy due to the short-lived efficacy as well as potential detrimental effects including high recurrence rates, dermal depigmentation and subcutaneous atrophy.″

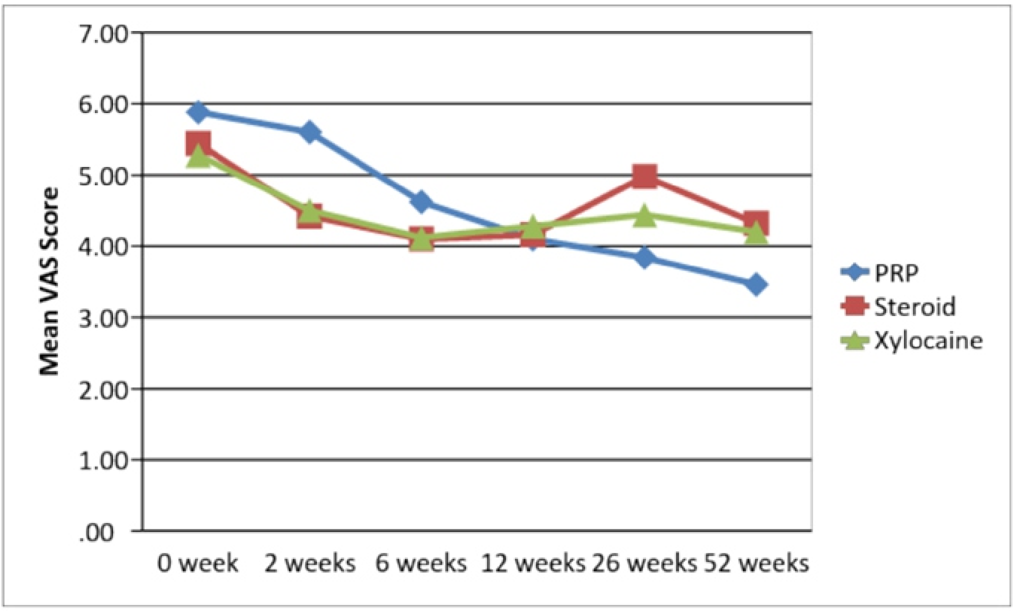
Surgical release or debridement of the damaged extensor tendon is typically considered after a failed trial of conservative treatment. Previous studies have documented high success rates of up to 97.7% however, only 2 RCTs were found to have directly compared surgical intervention with PRP. Our findings show that patients found surgery to be superior in terms of pain relief compared to PRP, the RCTs included were at high risk of bias especially because it was technically impossible to blind both patients and researchers. Merolla et al. compared the effects of PRP with arthroscopic debridement. They found that both were effective at improving both pain and performance initially. Conversely, surgical debridement was superior in the long-term. Watts et al. compared PRP with surgical release for refractory TE. They reported no statistical difference functionally however, surgical patients reported superior pain scores compared to the PRP group.

Physiotherapy for the treatment of tennis elbow typically includes eccentric strengthening exercises for the wrist extensors and static stretching of the ECRB. While only up to 10% of TE patients eventually opt for surgical management, majority if not all patients would be offered a course of physiotherapy. Needle tenotomy can be performed as a standalone procedure (“dry needling”) or part of a combined intervention such as with local anaesthetic agents. Theoretically, tenotomy in itself may induce healing via microtrauma.

However, a microtear will ensue if this force exceeds the tendon's elastic threshold. Repetitive stress and overuse may result in multiple microtears leading to degenerative changes also known as tendinosis. Eventually, a full-thickness tendon tear may ensue with gradual degradation of the tendon. In general, there are 4 distinct grades of tendinopathy as succinctly summarised by Bhabra et al. Using basic science principles, they proposed a treatment algorithm to help clinicians manage TE appropriately depending on severity of tendinopathy. Briefly, grade 1 tendinopathy only requires rest and activity modification to avoid further damage. Grade 2 tendinopathy is classified according to the presence of immature vascular hyperplasia hence indicating PRP. In grade 3 tendinopathy, the loss of cells due to apoptosis and autophagy indicates replacing with autologous cell therapy. Finally, in grade 4 tendinopathy, surgical repair may be required to mechanically restore the collagen matrix.

Interestingly, a recent systematic review published in 2021 concluded that PRP therapy provided similar improvements to surgical interventions in terms of functional scores and pain relief for TE patients in the initial phase. Another meta-analysis found PRP to be only minimally effective when compared to other forms of minimally invasive therapies for TE such as steroids, Bone marrow injections, local anesthetics, dry needle and even saline injections. The insufficient long term evidence of PRP therapy coupled with the relatively high costs of PRP and its accompanying preparational equipment makes it difficult to justify PRP therapy for TE currently as sure shot therapy ,but definitely better than Invasive Physiotherapy methods such as Dry needling as well as compare to Steroid injections & surgical debridement.

Graph - 1 : Graph showing mean VAS score at different follow up visits in the three groups.



According to VAS score in comparison to PRP therapy effect of steroid remains for shorter duration whereas PRP therapy remains till 52 weeks.

LIMITATION

- An optimal dose range of PRP has yet to be defined
- Although application of the PRP may enhance mesenchymal stem cell migration and proliferation, overexposure of cells to PRP may also limit differentiation of those cells into the appropriate cell lines

- Lack of standardization in the preparation of PRP
- Clinical outcome controversial in certain tendon pathology
- Which Method is ideal, Time will say, long term randomized study required for our population

FUTURE OF PRP THERAPY :

· Expanding role in the treatment of many conditions and an adjunct to healing in the care of connective and musculoskeletal tissues.

· As use of Orthobiologics use in Orthopaedics , we have only scratched the surface

· The future is bright but uncertain until more clinical randomized series are completed.

CONCLUSION

Overall, our primary finding is that there is abundant Level 1 & 2 evidences supporting for use of PRP for Lateral & Medial epicondylitis, but moderate supports for use of PRP for other Tendinopathies. Further research with larger number of patients and longer duration of follow up are required to establish the optimal formulation methods and administration of PRP injections for various Tendinopathies. Additionally, proper documentation of Tennis Elbow patients and the chronicity of their symptoms, pain and functional evaluation scores need to be standardized use of PRP for Tendinopathy pathologies of Elbow.

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Role of Arthroscopy in Traumatic Elbow Injuries

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Introduction

It is often challenging to treat the fractures in and around the elbow joint because they sometimes require extended approaches and pose a risk to the neurovascular structures. In most of the cases, conventional open approach is required to carry out anatomical reduction of the fractured fragments and to fix them using implants or for ligament repair or reconstruction. On the other hand, there are few cases that benefit from arthroscopy to help in achieving an anatomical reduction of articular surface and to perform a percutaneous fixation after reduction. Arthroscopy also allows for an evaluation of other pathologies such as loose bodies and chondral lesions and also decreases chances of heterotrophic ossification.

Arthroscopic procedures, if done properly, would cause less soft tissue injury and allow an earlier mobilization and potentially less stiffness. However, elbow arthroscopy is a demanding technique with steep learning curve that requires a thorough knowledge of the normal anatomy and nerve distribution. Also good trauma sk

ills are needed to safely perform percutaneous fixation of the fracture.

Arthroscopic setup

Elbow arthroscopy is usually performed in the lateral decubitus position with the elbow placed on a padded holder at 90º. The procedure is carried out under regional anaesthesia which also helps to maintain good post surgical analgesia.

It is very important to position and check under the C arm, proper visualisation of the elbow joint as it will aid in percutaneous fixation of the fracture (Fig. 1). A tourniquet is always used for the surgery.

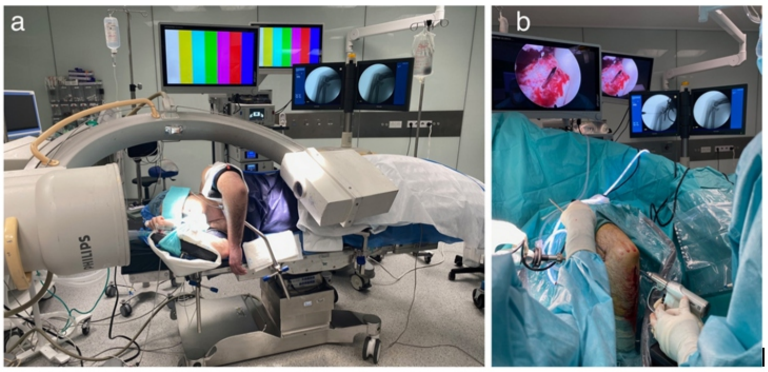

Figure 1
A Fluoroscopy is brought to the field from the head of the patient, with the arc tilted 40–60 degrees above the patient for screen visualization, and the thicker x-ray beam detector near the patient´s head. This disposition allows to work in the reduction and fixation at the same time the images are obtained. **B** The field is then prepared in a sterile fashion over the patient and the radioscopy device

(Image courtesy - Valencia, M., Foruria, A. The role of arthroscopy in the management of adult elbow trauma. *J EXP ORTOP* **10**, 144 (2023). https://doi.org/10.1186/s40634-023-00710-z)

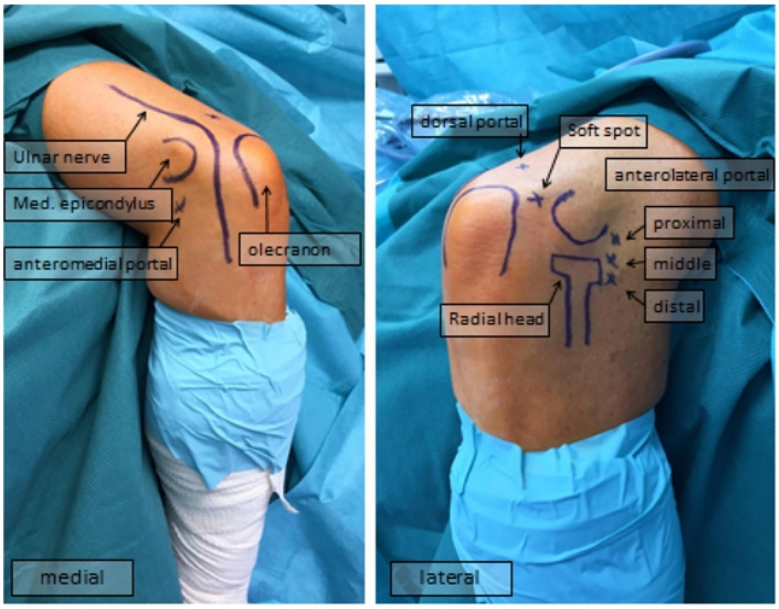

Figure 2 (Portals)

Surgical technique

In addition to the routine portals used for elbow arthroscopy, additional portals might be needed to either visualise, reduce or assist in the fixation of the fracture.

Marking of all the portals should be done before starting the procedure as the anatomical landmarks might be difficult to identify due to the swelling and the distorted bony references. Entrance to the joint is usually straightforward as it is distended by hematoma in acute fractures and so the injection of saline is not needed. A standard 4 mm 30º arthroscope is routinely used, but a 70º scope could be useful for coronoid and capitellar fractures. Arthro-pump should not be used to avoid risk of overdistention and compartment syndrome because of the extravasation of the saline due to the damaged capsule.

After thoroughly cleaning the joint of hematoma and fracture debris, debridement of the fracture site is performed in order to allow anatomical reduction and a correct visualization of the wires used for percutaneous fixation. Wissinger rods are particularly useful for capsular retraction and fracture manipulation. Small periosteal elevators are very useful in assisting reduction and holding fracture fragments in place. A grasper is also used for fragment management and holding provisional wires in place.

First, percutaneous K-wires are introduced through the affected bone perpendicular to the fracture plane.These wires should aim the fracture bed and exit in the desired locations for fixation. Then, the wires are pulled back flush to the fracture bed to allow fracture reduction with the aid of blunt instruments and graspers, with both visual and radioscopic confirmation. Pressing the fracture fragment towards the fracture bed is usually enough to allow provisional k-wires to be further introduced to maintain the reduction. When performing screw fixation it is recommended to introduce multiple K-wires to maintain the reduction of the fragment and to allow cannulated drilling. A grasper on the tip of the wire at its exit point from the bone is useful to avoid both wire or fragment migration while drilling and screwing phases. The length of the screw is then measured with the aid of another wire of the same length, subtracting the length of the proximal part of the wire outside the bone. Finally, a cannulated screw is introduced. This technique can be reproduced with as many screws as needed (Figs. 2 and 3).

Indications and results

1. Coronoid fractures

The most commonly reported treatment of elbow fractures assisted by arthroscopy is the coronoid fracture [–1,–2,–3,–4].

Indications for fixation of coronoid fractures - Morrey type II and III, and O´Driscoll anteromedial facet fractures associated to a posteromedial instability pattern that also require a repair of the LCL.

In coronoid fractures standard anteromedial viewing portal is performed, as well as the anterolateral and proximal anterolateral portals for the use of retractors and reduction tools. Introducing the camera from one of the lateral portals allows a wider visualization of the coronoid and the lateral fracture bed. The percutaneous fixation is performed from the subcutaneous border of the proximal ulna in a posterior to anterior direction ['–21]. Multiple techniques have been described: screws, suture lasso technique or indirect capsular sutures. Some authors use an anterior cruciate ligament guide in order to position the k wires but it can also be performed freehand under direct arthroscopic visualization [–1]. Carefully measure the screw length so that the length is enough to fix the fragment but the tip does not penetrate excessively in the joint interfering with elbow flexion.

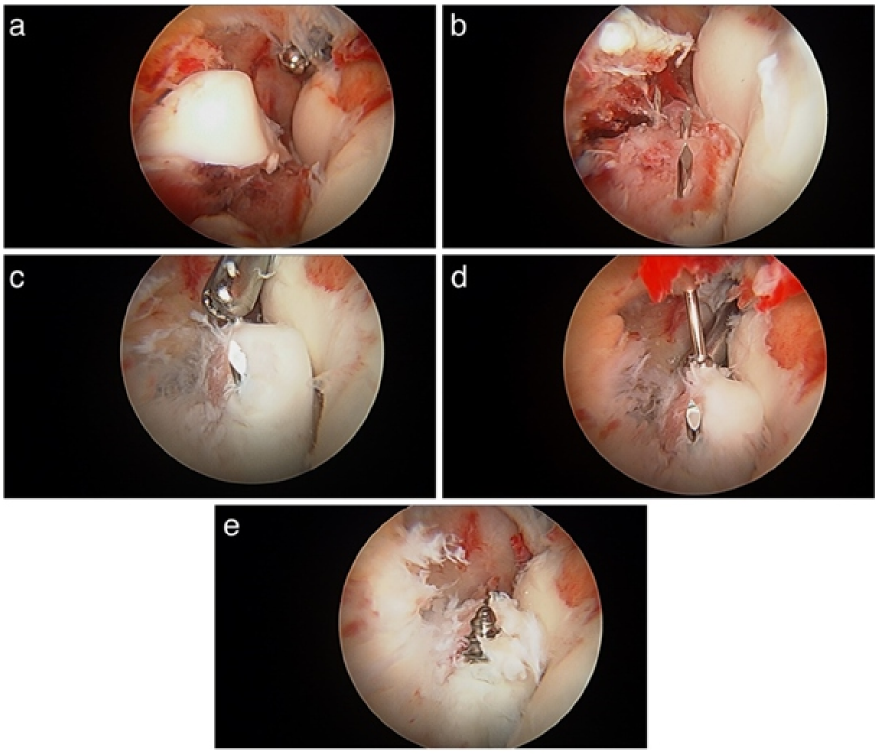

Figure 3

Arthroscopic coronoid fixation **A** Fracture bed is cleaned. **B** Provisional wires are introduced trough the fracture bed, perpendicular to the fracture plane. **C** The fragment is reduced and the wires are passed through it. **D** Cannulated drilling. **E** Screw placement

(Image courtesy - Valencia, M., Foruria, A. The role of arthroscopy in the management of adult elbow trauma. *J EXP ORTOP* **10**, 144 (2023). https://doi.org/10.1186/s40634-023-00710-z)

Figure 4

This image shows an exterior view during coronoid fixation. The surgeon takes the camera with the left hand and proceeds with screw length measurement with the right hand. An assistant, in the left side of the surgeon, maintains the capsule pushed anteriorly with an elevator introduced in the proximal anterolateral portal. Another assistant, in the right side of the surgeon, holds the reduction with a grasper.

(Image courtesy - Valencia, M., Foruria, A. The role of arthroscopy in the management of adult elbow trauma. *J EXP ORTOP* **10**, 144 (2023). https://doi.org/10.1186/s40634-023-00710-z)

Adams et al. published good results in their 7 cases series of isolated coronoid fracture arthroscopic fixation [–1]. Colozza et al. [–4] also reported excellent results of anteromedial fractures. Of 36 cases, 27 required a repair of the LCL and 8 of them were performed arthroscopically. However, literature comparing both open and arthroscopic techniques is scarce.

2. Radial head fracture

Indications for arthroscopy includes resection of less than 30% of radial head and fixation of simple non comminuted fractures of the radial head [–20,'–21,–22,–23,–24,–25].

A posterolateral viewing portal and the soft spot working portal are established. If the fragment is anteriorly located, an anteromedial portal could be useful for viewing and fracture reduction and fixation can be performed from the lateral side.

Pronation and supination can help in identifying and defining the fragments of the fracture. A probe or a k wire can be percutaneously inserted and used as a joystick to help in reduction. A small stab incision is used to introduce the screws. Care should be taken when performing a percutaneous fixation, as posterior interosseous nerve is close in this location. The fixation can be performed with cannulated screws in a similar fashion to the open technique and the size of the screws can be checked under fluoroscopy.

The results of this technique have been published in two case series by Rolla et al. [–25] and Michels et al. [–20]. Michels et al. obtained excellent results for a series of 16 Mason Type II fractures without reporting any complications.

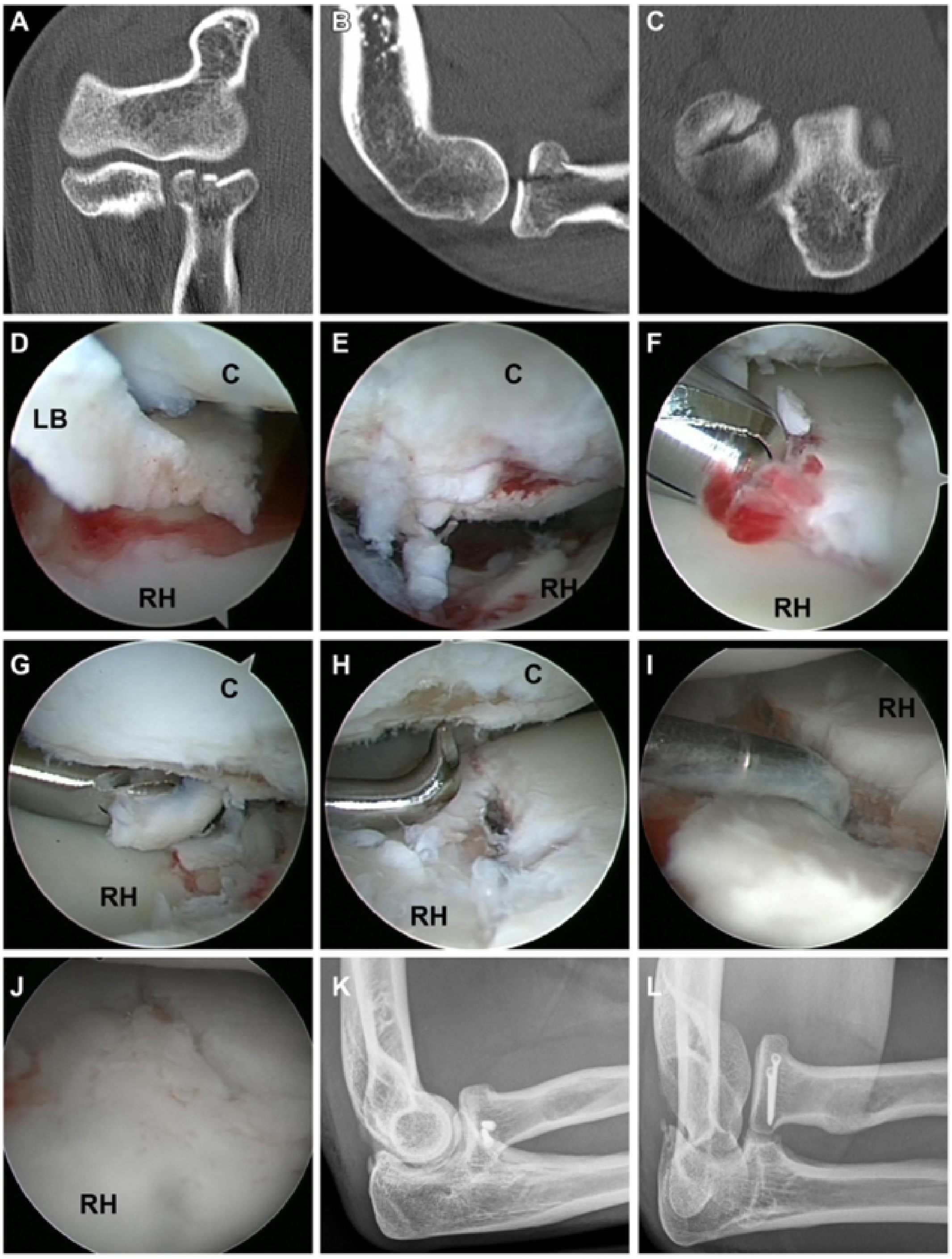

Figure 5

Mason Type II radial head fracture with traumatic capitellar chondral lesion und intraarticular loose bodies. **a**-**c** CT scan showed an articular step of 3 mm in coronal view. Loose bodies and capitellar injury were not identified (**d**) Arthroscopy revealed a large chondral loose body [LB] entrapped between the capitellum [C] and the radial head [RH]. **e** grade IV chondral lesion to the capitellum. **f** After removal of fracture hematoma, (**g**) chondroplasty and (**h**) microfracturing was performed at the capitellum humeri. **i** Fracture reduction was carried out with a sharp hook and (**j**) anatomic restoration of the radial head was achieved by screw osteosynthesis over the anterolateral portal. **k,l** Postoperative x-rays demonstrate anatomic reduction and correct screw placement

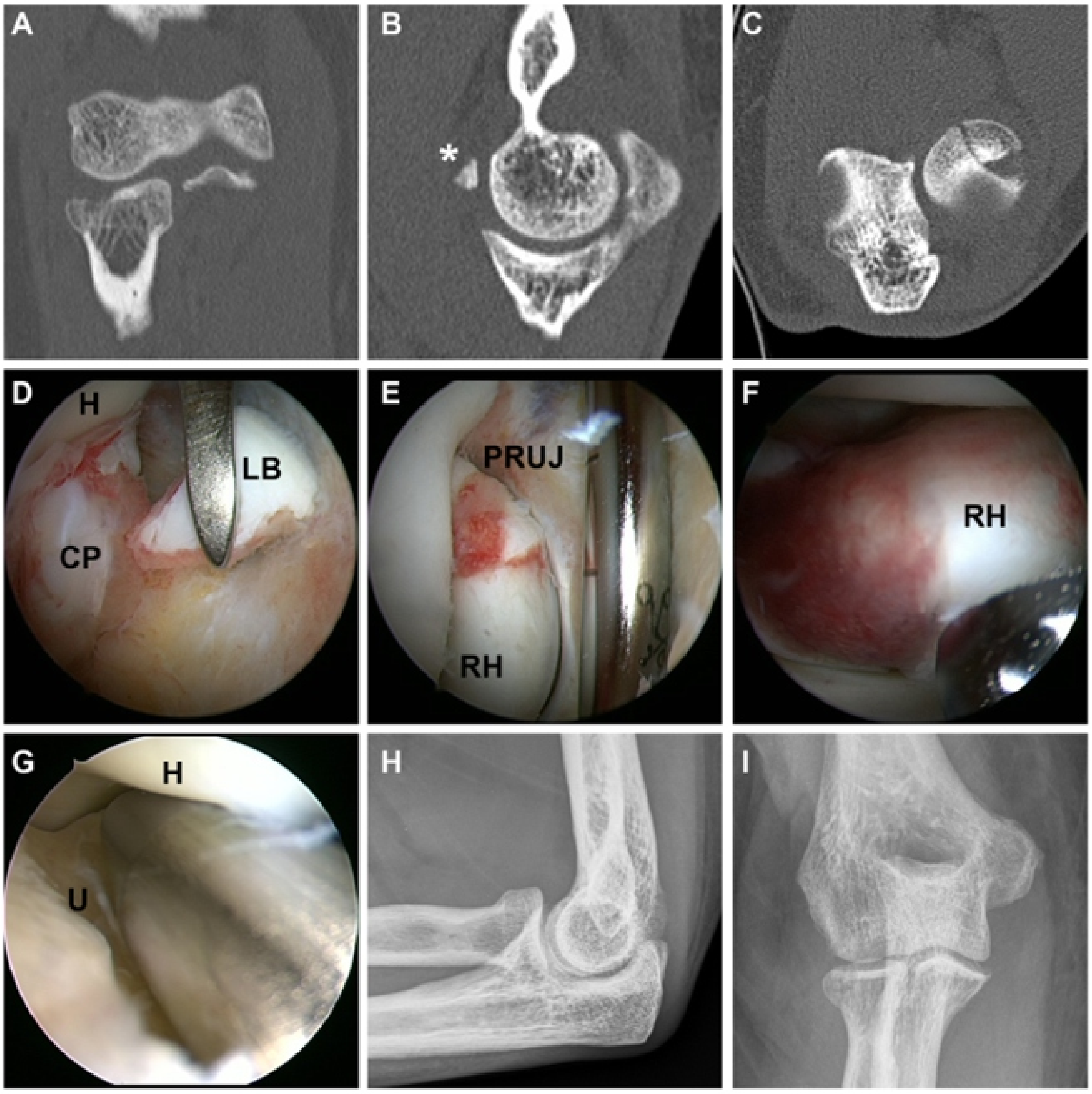

Figure 6

Mason Type I Fracture with loose joint body in the anterior compartment. **a**-**c** CT scan showed a mildly (< 2 mm) displaced radial head fracture without blocking of motion and an osteochondral fracture fragment in the anterior elbow compartment. **d** The loose joint body [LB] was arthroscopically removed after identification between humerus [H] and coronoid process [CP]. **e** Dynamic evaluation of unimpaired motion in the proximal radioulnar joint [PRUJ] was arthroscopically confirmed. **f** Exploration of the radial head in full supination. **g** Posterolateral rotational instability was ruled out with a modified "drive through test" with a switching stick from the soft spot portal between ulnar [U] and humerus [H]. **h, i** Postoperative x-rays demonstrated correct alignment of the elbow joint and complete removal of loose bodies

(Image courtesy - Haasters, F., Helfen, T., Böcker, W. *et al.* The value of elbow arthroscopy in diagnosing and treatment of radial head fractures. *BMC MusculoskeletDisord* **20**, 343 (2019). https://doi.org/10.1186/s12891-019-2726-6)

3. Capitellar fractures

Isolated capitellar fractures are infrequent and represent 1% of all elbow fractures and in more than 60% of the cases are associated to fractures of the radial head or LCL injuries.

Capitellar fractures can be reduced in a closed fashion before starting arthroscopy or once the scope is located inside the joint. The fractures typically reduce with full extension of the elbow and the forearm supinated. Then, the elbow should be flexed gently and maintaining the traction so that the radial head does not displace the fragment again [–22]. Once the fragment is reduced, the elbow should be flexed more than 90º to keep the fragment in place. Conventional portals can be used but in cases of plastic deformity of the distal humerus, or comminuted fractures, posterolateral portals can be useful to debride. Bryan- Morrey type I fractures (large osseous piece of the capitellum involved) can be fixed with 3.5 mm screws from posterior to anterior through a small incision in the lateral triceps and a minimum of two screws are recommended depending on the fragment size [30]. Bryan-Morrey types II and III fractures can be managed by osteosutures and very small fragments can be excised [–8]. Type IV fractures (McKee modification that includes trochlear extension) are usually fixed with three screws in a tripod fashion, with one screw in the medial trochlea and two in the capitellum.

Zhang et al. included 10 cases, and reported good clinical and radiological results and no complications related to the surgical technique. There were 4 cases of AVN with no clinical impact. It is recommended to wait between 3 to 14 days to undergo the surgery to avoid excessive bleeding during the scopy.

However, comparative series are still lacking in order to determine if the advantages of the arthroscopic technique are substantial.

4. Ligament repair

In order to treat complex coronoid and radial head fractures, more recently, an arthroscopic management of injuries to the LUCL has been reported. In the acute setting, when the ligament is torn, a formal repair with anchors can be performed, usually in the proximal attachment [–5].

The formal repair can be performed arthroscopically viewing primarily the joint from the posterior compartment.

The lateral epicondyle should first be debrided and decorticated in order to expose subchondral bone and enhance healing. Then, the isometric point should be identified in order to place the anchor. Depending on the type of anchor used, a drill guide might be necessary. The third step should be to pass the sutures through the proximal part of the ligament with an indirect suture shuttling device.

Conclusion

Arthroscopic fixation for elbow fractures is indicated in cases in which this technique is going to save an open approach. Although the indications for the use of arthroscopy in elbow trauma is limited to a very few subset of injuries, but in these type of injuries, it really plays a pivotal role in avoiding large incisions and ultimately preventing elbow stiffness post surgery.

Arthroscopy of the elbow has evolved significantly in the last decade, becoming an excellent tool to better understand and visualize some articular fractures of the elbow. Its main advantage is preserving the soft tissue envelope and avoidance of multiple approaches in specific complex elbow instability patterns. However, despite the advances in surgical technique, whether it improves clinical and radiological results is still to be proven.

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Management of Neglected Paediatric Monteggia Fracture Dislocation

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INTRODUCTION

Elbow injuries are common in children and can sometimes be challenging to treat. Monteggia fractures constitute a small percentage of elbow injuries in children, with the injury first described by Italian doctor Giovanni Monteggia in 1814 in his book "Istituzioni Chirurgiche." The classification system, described by Bado in 1967, depends on the direction of translation of the radial head.

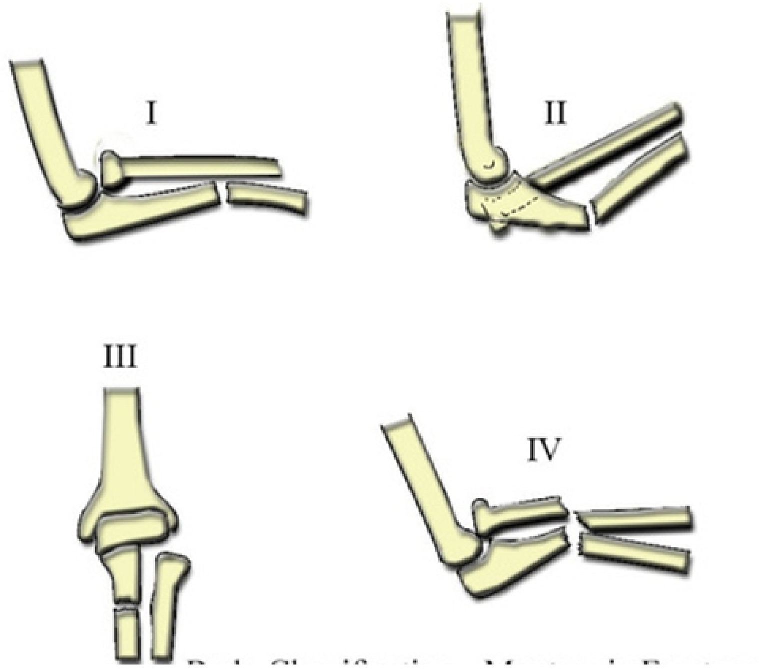

Fig 1 – Bado Classification of Monteggia fracture

Type 1: is the most common type. From my experience, the most common clinical situation where a Monteggia fracture-dislocation is missed is when the radial head dislocation is accompanied only by plastic deformation of the ulna. In such cases, minimal pain and swelling may lead to the oversight of a serious injury.

If a thorough examination of X-rays is not conducted, a radial head dislocation can be missed. It can also be missed when a longitudinally unstable ulna fracture is fixed with an intramedullary nail. The radial head dislocation might not be visible on the image intensifier. Sometimes, the radial head has not yet ossified in a young child, and its dislocation might be missed. Once the ulna unites, the dislocated radial head does not get reduced even with remodeling, leading to chronic instability of the elbow. Additionally, depending on its position, it might affect the range of motion of the elbow joint. Therefore, addressing the radial head dislocation is crucial for the long-term health of the elbow joint

Fig 2– Missed Monteggia in length unstable fractures

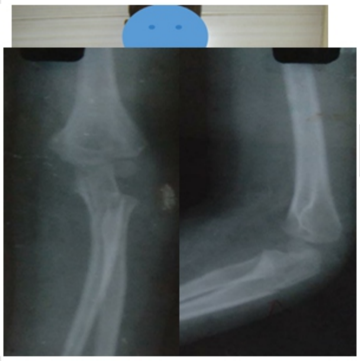

Fig 3– Fixed Pronation in missed Monteggia

Fig 4 – Flexion deficit in missed Monteggia

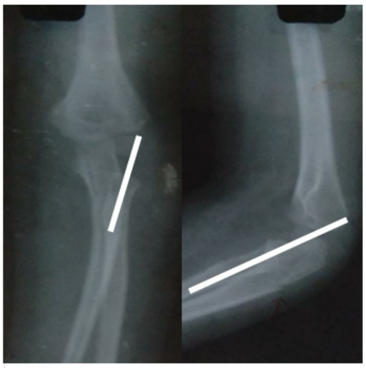

Fig 5 – Missed type 3 monteggia in unossified radial headhead

Fig 5 – Missed type 3 monteggia in unossified radial headhead

ANATOMY AND PATHOANATOMY

Anatomically, the bones of the forearm function as a joint, with the mobility and stability of the elbow and wrist joints depending on the ligaments connecting the radius and ulna. The stability of the radiocapitellar joint depends on the tension in these ligaments. If there is a fracture in the ulna, most commonly with apex volar angulation and/or shortening, the force of injury disrupts the annular ligament, leading to dislocation of the radial head.Restoring the stability of the radiocapitellar joint requires restoring the tension of the interosseous membrane and the radioulnar ligaments. In the case of an acute Monteggia fracture-dislocation, this is achieved by restoring the anatomical length and alignment of the ulna. However, in chronic Monteggia cases, depending on the chronicity, the tension in the interosseous membrane and the radioulnar ligaments change. This necessitates ulna lengthening and overflexion to re-tension the interosseous membrane and restore stability of the radiocapitellar joint. This forms the basis of treatment for chronic Monteggia fractures.[1,2,3,4]

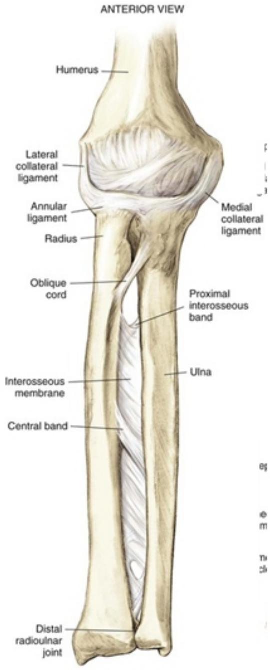

Fig 6 – Ligaments of forearm

HOW TO PICKUP MONTEGGIA INJURIES IN CHILDREN

To effectively manage chronic Monteggia injuries, it is imperative to not only understand their treatment but also how to avoid missing such injuries. The most crucial aspect of diagnosing a Monteggia injury is a meticulous examination of X-rays. The X-ray films must be obtained with proper positioning, considering that the height of the X-ray table might not be suitable for a child and may require adjustments. Two essential lines should be scrutinized in X-rays: the radiocapitellar line, passing through the center of the upper third of the radius in both the anteroposterior (AP) and lateral views, ensuring alignment in all views; and the Mubarak line, drawn on the volar surface of the ulna in the lateral view, indicating the normal posterior bow of the ulna. Drawing this line aids in identifying any plastic deformation of the ulna, often associated with anterior subluxation or dislocation of the radiocapitellar joint.

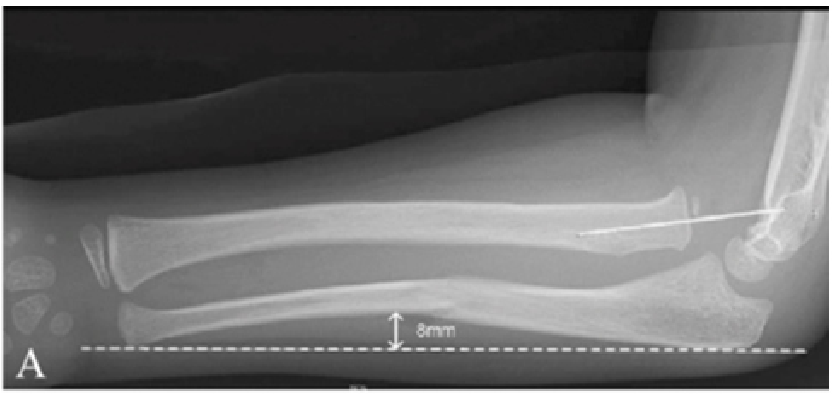

Fig 7 – Mubaraks line and radio capitellar line

Surgical Procedure:

The key to correcting this problem is to restore radiocapitellar stability without inducing stiffness. Various surgical procedures have been described to correct this deformity, with the most commonly performed surgery involving an open reduction of the radiocapitellar joint and a proximal ulna flexion distraction osteotomy. The surgery was first published by Bouyaula et al. in 1988. The site of osteotomy is determined by the fracture location or the metaphysis of the proximal ulna. Many authors believe that the best site of osteotomy is the most proximal site that can accommodate a 4 or 6-hole plate. This is to avoid restriction of forearm rotation as the net tension in the interosseous membrane remains constant.

A set of true AP and lateral x-rays of the elbow with forearm views should be obtained to plan the surgery. The surgery is typically performed under regional anesthesia with the patient in a supine position. An incision is made over the elbow, extending onto the dorsal surface of the upper third of the ulna's metaphysis. The plane between the anconeus and extensor carpi ulnaris (ECU) is developed. The radiocapitellar capsule is opened, and fibrosis and entrapped annular ligament in the radiocapitellar joint are cleared. A gentle reduction of the radial head is performed to ensure reducibility and verify the absence of soft tissue interposition.

At the site of the proximal ulnar metaphysis, a transverse osteotomy is performed. Some surgeons may opt for a Z-shaped step-cut osteotomy to accommodate the lengthening of the ulna. The osteotomy is distracted. A contoured 2.7 mm plate is applied at a 20-degree flexion on the osteotomy. It is provisionally fixed with a single screw proximally and clamped distally. This angle has been derived from an excellent study by Nakamura et al., where they operated on 22 cases and found the mean angle of bending of the plate to be 15.8 degrees and the mean distance of distraction to be 8 millimeters. Approximately 1 cm of acute osteotomy distraction is performed to facilitate radial head reduction. Stability is assessed in full extension, pronation, and supination. If stability is confirmed, the plate is secured with additional screws. The joint is closed, and the wound is closed in layers.

There is typically no need for routine annular ligament reconstruction, as the joint is usually stable post-surgery. We also tend to avoid a transcapitellar wire because it is known to damage the cartilage and affect pronation and supination. Moreover, there is an added risk of intra-articular broken K-wires, which might be difficult to retrieve. Immobilization in an above-elbow splint at a 110-degree flexion and supination is recommended for the child. The osteotomy usually unites within one month. Then we initiate gentle range of motion exercises for the elbow. This surgical approach yields favorable outcomes and is widely accepted for treating chronic Monteggia injuries.

Fig 8a – Posterolateral incision in treating missed monteggia

Fig 8b – Exposure of radiocapitellar joint through Kochers interval

Fig 8c – Removal of entrapped fibrous tissue in radiocapitellar

Fig 8d – Proximal ulna metaphyseal osteotomy

Fig 8e – Flexion distraction maneuver, with provisionally fixed plate

Fig 8f – Assesment of stability of radial head in extension

Fig 8g – Final Post Op Xray

RESULTS

In this paper, we report the results and complications of 16 cases of delayed presentation of Monteggia fracture-dislocations. The literature lacks a precise definition of a "chronic" Monteggia lesion. However, conventionally, we assume that any Monteggia fracture where the ulna has united after 4 weeks of injury is considered chronic Monteggia.[5]

We have presented the details of our cases in the table below. The author using the same standardized technique described previously performed all the cases. Notably, we encountered two complications. One child had a redislocation of the radial head after surgery. This was revised, but the ulna osteotomy resulted in non-union. The other complication was a restricted range of motion after treating an 8-year-old radial head dislocation in a 14-year-old boy.

Serial number	Time since injury	Comments	Type	Time till ur	Flexion-extension	Pronation supination	Complication
1	45 days		1		no defect	normal	
2	48 days		1		no defect	normal	
3	52 days		1		no defect	terminal supination deficit	
4	4 month		3	1 mont	none	none	residual lateral subluxation
5	1 month		1		none	none	
6	15 days		1		none	none	
7	36 days		1		none	none	
8	8 years	gradual legnthening of ulna was done	1	6 monts	20 degree ffd	30 degree fixed pronation	pin tract infection, resolved after pin removal and antibiotics
9	1 year		3		none	none	
10	6 month	redislocation on first post op day…revised	1	nonunion	normal	normal	bonegrafting for nonunion
11	62 days		1		normal	pronation limited by 20 deg	
12	7 month		3		normal	terminal supination deficit	
13	2 and half months		1		normal	none	
14	38days		1		normal	pronation limited by 20 deg	
15	5 month		1		normal	none	
16	3 and half months		1		normal	terminal supination deficit	

DISCUSSION :

Our case series demonstrates that this procedure yields good, reliable, and consistent results in well-selected cases. Multiple other procedures are described in the literature as well. Some authors recommend procedures to repair the radiocapitellar joint and reconstruct the annular ligament. Others like to correct the ulnar deformity with an osteotomy.[6,7] The current technique under discussion has been widely accepted and replicated around the world. The main disadvantage of this procedure is the dorsal ulnar prominence that is seen after the osteotomy. This takes a long time to remodel. Combining annular ligament reconstruction intuitively seems essential to maintain radiocapitellar alignment. However, doing this procedure in all patients is controversial because many authors have reported restriction of pronation and supination in cases where this is done. Some authors justify using this procedure in all cases while others completely avoid doing it. In our practice, if the radial head is found to be stable after the ulna osteotomy, we do not perform annular ligament reconstruction. This has also been reported by Bhaskar et al.[12]

Some authors recommend gradual lengthening of the ulna with external fixators.[9] Some have even recommended radial shaft shortening in cases of redislocation.[10]

One of our patients had non-union of the osteotomy. We found literature evidence to modify our practice after this complication. We can do a "sliding"[6] or "Z"[11] osteotomy of the ulna to reduce the gap between the distracted fragments. This helps shorten the time required to achieve the union of the osteotomy.

In our series, the 16-year-old child with an 8-year-old radial head dislocation had changes in the shape of the radial head. After reduction, he had poor results in terms of forearm rotation. This matches the evidence we found in the literature that reports poor results after 12 years of age and/or more than 3 years of injury.

It is essential to counsel parents and explain to them the negative long-term effects of a permanent radial head dislocation on the child. This fracture is one of the situations where the treatment of a neglected condition is far more difficult and painful than in a fresh presentation scenario. Therefore, when treating an ulna fracture, we should be mindful of missing a radial head subluxation or dislocation. Prevention is always better than cure.

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Anterior Transposition of Ulnar nerve

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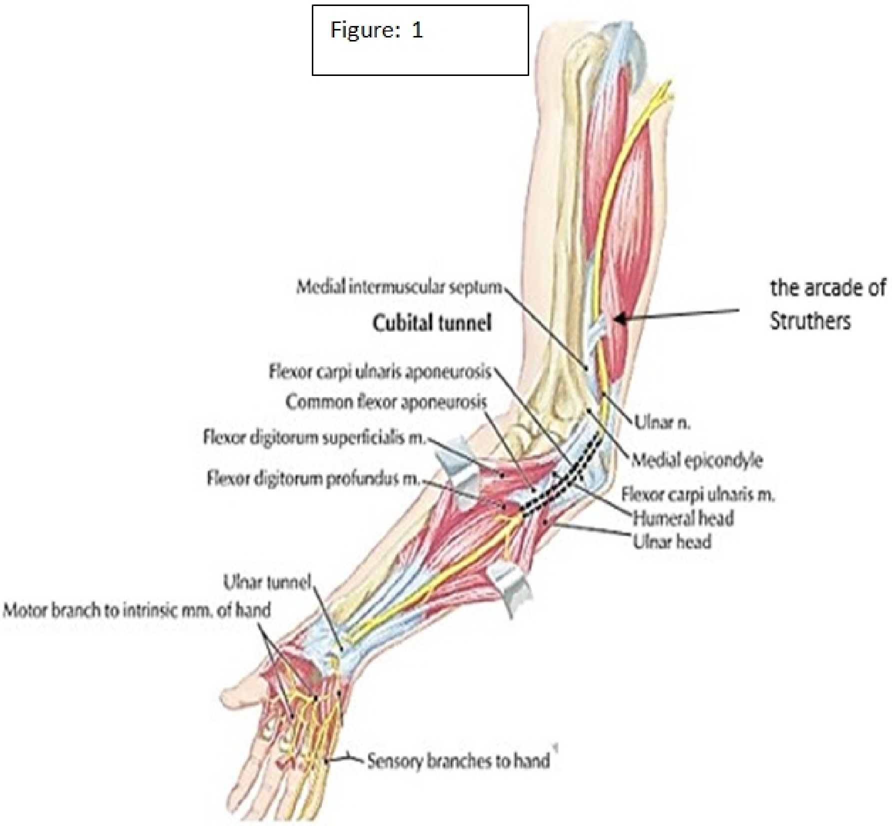
Anatomic considerations

The ulnar nerve is composed of fibers from C8 and IT coming from the medial cord of the brachial plexus.Ulnar nerve supplies following muscles, proximal to the elbow, flexor carpi ulnaris, flexor profundus to the little and ring fingers, the lumbricals of the same fingers, all of the interossei, the adductor of the thumb, and all of the short muscles of the little finger. Rarely when a nerve is completely divided at elbow level, the intrinsic muscles of the hand function normally because of anomalous innervation by median nerve at Middle of forearm (Martin-Gruber anastomosis),after complete transection of the Ulnar nerve around or above elbow only FCL may get palsy rest of hand muscles gets spared because ofMartin-Gruber anastomosis. Similarly, there is anatomic variant connection in palm between Median nerve and Ulnar nerve (Riche-Cannieu anastomosis), leads to motor sparing of intrinsic muscles of hand inspite of complete transection of Ulnar nerve at wrist. These are rare, but important to remember.(Fig 1)

Sensory function, medial 1/3 of forearm,medial /13 of hand (thenar eminence) and little and ring finger(ulnar half)is classical sensory supply but anatomic variations may cause confusing sensory findings, at that time autonomous zone is diagnostic at that time. (middle and distal phalanx of little finger). Figure: 1

Figure: 1



Ulnar nerve Injury/compression

Symptoms:

Well,we all know paresthesia along medial side of forearm and hand with clawing of little and ring finger and sensory symptoms on little finger are common symptoms are classical complains, if sensory symptoms are above elbow, then other disorder (syringomyelia etc) to be thought of.

Signs:

For the Ulnar nerve, for practical purpose only three muscles —**the flexor carpi ulnaris, the abductor digiti quinti, and the first dorsal interosseus muscle** - can be tested accurately. The bellies of these muscles can be easily palpated and seen. One may be tempted to test other muscles by their well-known functions but would be misled by the occasional patient who can by substituting other muscles perfectly perform the actions of paralyzed muscles or rare case of Median Nerve Ulnar nerve communicating fibers may alter clinical findings. (Ref Martin-Gruber anastomosis, Riche-Cannieu anastomosis)

Wasting of hypothenar eminence, interossei wasting, trophic changes Ulnar two digits is classical. Atrophy of the muscles supplied by the ulnar nerve and clawing of the little and ring fingers usually are confirmatory evidence in Tardy Ulnar Palsy. However, if the nerve has been **injured proximal to the elbow, clawing of these two fingers may be absent because the flexor digitorum profundus to the ring and little fingers also is denervated**.

In patients suspected of having cubital tunnel syndrome, a positive percussion test over the ulnar nerve at the level of the medial epicondyle and a positive elbow flexion test are strongly suggestive of a significant compressive neuropathy. With the elbow fully flexed, the patient will complain of numbness and tingling in the small and ring fingers, often within 1 minute.

One needs to examine only the middle and distal phalanges of the little finger, which make up the autonomous zone of the ulnar nerve.The Iodine Starch test can be done to prove de-nervation.

In case of children specially examine for dislocating/subluxating Ulnar nerve (many studies have found approx. 16% incidence)

Diagnosis:

EMG/NCV: Electrical stimulation of the nerve in-situ is easy at the elbow and wrist.Nerveconduction studies are helpful and should demonstrate slowing in the ulnar nerve velocities across the elbow, in case of chronic compression normal velocities may be maintained during early involvement,but electromyography may demonstrate fibrillations in the ulnar innervated intrinsic muscles.

Anterior transposition of ulnar nerve is not a routine procedure but its useful procedure for various indications.

1. In acute transaction when gap is significant (above 8cm) anterior transposition is very important to appose cut ends of the nerve and do tension free repair.

2. In complex lower end humerus fracture malunion or bony prominence can lead to chronic irritation and Tardy Ulnar nerve palsy.

3. Cubitus Valgus following lateral condyle injury in childhood.

4. Atrophic medial condyle, shallow ulnar groove, or an inadequate fibrous arch that normally keeps the nerve in the groove, resulting in recurrent subluxation or dislocation of the nerve.

5. Repeated manipulations of the osseous injury, or by excessive scar formation developing sometime lead to chronic compression.

6. **Cubital Tunnel syndrome**: (Figure - 2,3) Entrapment or compression of the ulnar nerve may occur at the supracondylar region, at the arcade of Struthers near the medial inter- muscular septum, between the heads of origin of the flexor carpi ulnaris. In 1958 Feindel and Stratford coined the term **cubital tunnel syndrome** to describe a compression neuropathy with no antecedent trauma. As the ulnar nerve enters the cubital tunnel it is first bordered by the medial epicondyle anteriorly, then by the elbow joint laterally, and finally by the two heads of the flexor carpi ulnaris medially.

7. The ulnar nerve is especially vulnerable to compression when the forearm is allowed to rest in pronation and flexion in cast.

Other than gap closure in nerve repair, Tardy Ulnar palsy is the main cause of ulnar nerve transposition.

Figure - 2

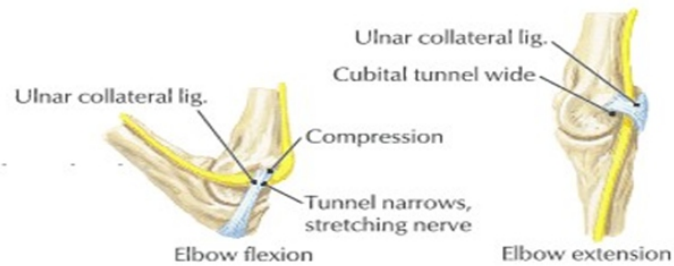


Figure - 3

Figure 2 & 3: Relation of UCL and Cubital tunnel

I

Treatment of Tardy Ulnar nerve palsy:
Conservative treatment for this syndrome should be attempted for a period of 3 months before surgical treatment is considered. Patients are instructed to avoid prolonged elbow flexion. Towels or pillows secured about the elbow may adequately limit elbow flexion during sleep. Paediatric patients and few adults may be given elbow extension splints for sleeping. The splint should not be fitted with the forearm held in pronation as this may aggravate the symptoms.

Operative treatment:
The surgical treatment of cubital tunnel syndrome includes simple decompression, medial epicondylectomy, and anterior transposition of the ulnar nerve either into a subcutaneous, intramuscular, or submuscular bed.
Only decompression is inadequate in most the cases (various studies have proved this). Anterior transpositions with or without medial epicondylectomy of Humerus is required. The greatest number of excellent results and fewest recurrences were obtained with the release and submuscular transposition technique. Whichever the techniques is used, **the medial intermuscular septum must be excised from the insertion of the coracobrachialis muscle to the medial epicondyle to prevent kinking of the ulnar nerve** after anterior transposition.

Transposition of Ulnar Nerve

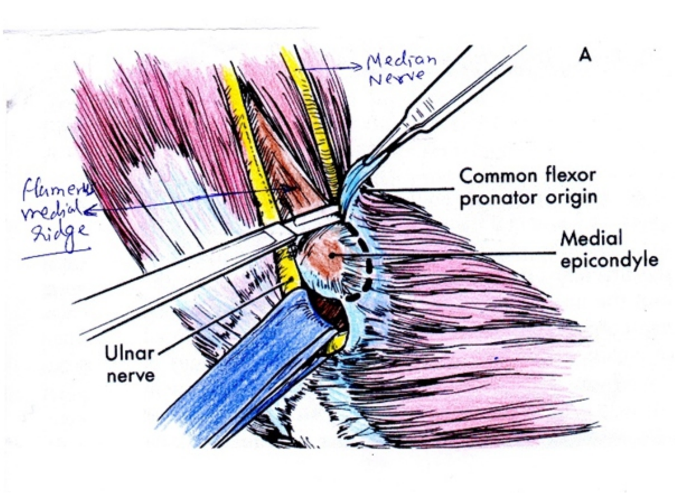
TECHNIQUE: With the arm abducted and externally rotated, make an incision on the posteromedial surface of the elbow beginning 7 cm proximal to the epicondyle, passing distally anterior to the epicondyle, and proceeding farther distally in line with the course of the nerve. Reflect the anterior skin flap to expose the common origin of the flexor muscles. Take care to avoid damaging the medial antebrachial cutaneous nerve. Identify the ulnar nerve in its groove, posterior to the medial epicondyle and free it of soft tissues. Free the flexor carpi ulnaris from its humeral origin on the epicondyle to further expose the nerve. Identify its branches to the flexor profundus and flexor carpi ulnaris and carefully dissect them intraneurally up the nerve. Dissect any fibrous tissue or callus from the area adjacent to the groove and remove the nerve. Carry out a neurolysis or endoneurolysis as indicated if there is extensive scarring. Now draw the nerve over the epicondyle to the anterior surface of the elbow and place it on the surface of the fascia of the flexor-pronator group beneath the thick fat in this region. Excise the medial intermuscular septum and any other tendinous bands that may constrict or otherwise injure the transposed nerve. Be certain that the intermuscular septum is excised as far proximally as the arcade of Struthers, where the ulnar nerve passes from the anterior to posterior compartment. Place a few interrupted sutures through the fascia and subcutaneous fat medial to the nerve to keep the nerve from slipping back posterior to the epicondyle.

For Submuscular transfer: place a hemostat beneath the superficial head of the pronator teres, the flexor carpi radialis, the palmaris longus, and the superficial head of the flexor carpi ulnaris, being certain not to include the median nerve. Sharply divide the tendinous origin off the medial epicondyle and retract the flexor mass distally, carefully protecting the small motor branches from the median and ulnar nerves. After placing the ulnar nerve deep to the flexor mass, near median nerve repair the tendinous origin to the medial epicondyle with a nonabsorbable suture. As an alternative, divide the medial epicondyle, transpose the ulnar nerve anterior to the elbow near the median nerve, and reattach the epicondyle. The tourniquet should be deflated and hemostasis achieved before closure because postoperative hematoma may be significant in this area. The elbow is immobilized at a right angle for 3 weeks. Physical therapy is then started and continued to prevent secondary changes in the muscles of the hand.

Medial Epicondylectomy:

It's bit easy to do osteotomy of medial epicondyle with Common Flexor Origin then cutting common flexors of the bone and re-attach it. Then doing anterior transposition of nerve only. Many prefer this procedure for ease of doing it.

TECHNIQUE: (Fig 4, Fig 5) Make an 8 cm skin incision along the course of the ulnar nerve centered over the posterior aspect of the medial epicondyle. Carry the incision to the deep fascia, carefully protecting the medial brachial and antebrachial cutaneous nerves. Expose the medial epicondyle subperiostally, incising the common flexor-pronator origin but protecting the ulnar collateral ligament. Identify and retract the ulnar nerve posteriorly during exposure of the medial epicondyle being careful to protect the mesoneurium. With osteotome or rongeur remove the entire medial epicondyle and a portion of the supracondylar ridge to release the insertion of the medial intermuscular septum. Expose and excise the medial intermuscular septum proximally to the insertion of the coracobrachialis muscle, releasing the arcade of Struthers as a potential area of compression. Using a bone rasp makes certain that no bony ridges remain in the area of the osteotomy. Reattach the periosteum to the common flexor-pronator tendon to separate the raw cancellous surface from the ulnar nerve. Allow the ulnar nerve to seek its own position adjacent to the medial humeral condyle. Deflate the tourniquet to allow adequate hemostasis before routine closure of the subcutaneous tissues and skin. Protect the wound in a soft bulky dressing, allowing early range of motion as tolerated.



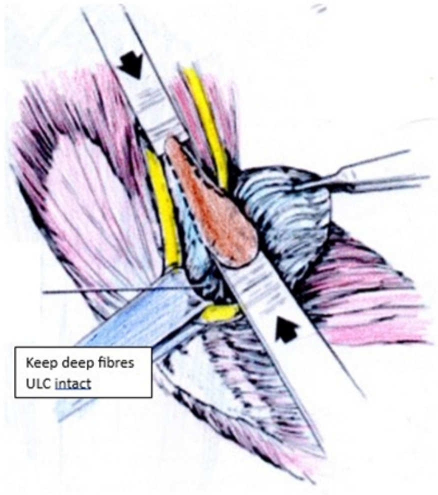


Fig 4 & 5 : Median Nerve is very near keep it protected, Keep deep Fires of UCL intact

Note :operative procedure are copied form Campbell's text book. (highlighted part)

Different Surgical Techniques in Management of Distal Humerus Fracture Nonunion

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Abstract

Background

Open reduction and internal fixation of distal humerus fractures is standard of care with good to excellent outcome for most patients. However, nonunions of the distal humerus fracturesstill occur. These are severely disabling problems for the patient and a challenge for the treating surgeon. Fortunately, a combination of standard nonunion techniques with new plate designs and fixation methods allow even the most challenging distal humeral nonunion to be treated successfully.

Objective
The purpose of this article is to describe our Various technique in treating distal humerus fracture nonunion.

Methods
A few key steps are essential to obtain bone healing while regaining or preserving elbow motion. These include careful planning, extensile exposure, release of the ulnar nerve, capsular release and mobilization of the distal fragment, debridement, and finally stable fixation after alignment with application of bone graft, if required.**Total 22 patients** were selected for the study with fracture duration of more than 2 months without intervention or 6 months minimum after fixation with no signs of healing.

Results
The distal humerus fracture nonunions can be treated successfully with need based surgical techniques, ranges from External devices to Internal fixation after eradication of infection.

Conclusion
Important components of the treatment plan are careful preoperative planning, extensile approach, debridement, and fixation is ranges from External devices like LRS to Internal fixation- Locked Plates)and use of Bone Graft, after eradication of infection

Introduction
Most often, a distal humerus fracture nonunion is located at the supracondylar level with the articular fragments having healed in a near-anatomic position. Motion at the nonunion site causes pain, limited elbow function, and disability . Hardware will ultimately fail or loosen with often a windshield wiper effect of the screws in the bone, further compromising bone stock . The increased motion at the supracondylar level, excessive scar formation, and inflammation around the ulnar nerve can lead to nerve symptoms including pain, numbness, and/or paresthesias. Use of the arm for loaded activities and positioning the forearm and hand against gravity will be severely compromised.

A nonunion of the distal humerus is often oligotrophic, being a combination of decreased biological activity and insufficient stability. They can be sub-classified based on location being supracondylar, transcondylar, intercondylar, unicondylar (medial or lateral), or osteochondral . The size of the distal fragment can be underestimated as it is often flexed on the AP-radiograph. It is always important to consider an associated infection, even if there are no clear symptoms as fever, drainage, or wound problems.

Elbow arthrodesis, open reduction and internal fixation and the Ilizarov technique have all been used in the management of distal humeral nonunion. Each of these treatment options has limitations and complications, including difficult bone fusion (due to restricted bone stock), inconsistent outcomes, instability, weakness and loss of function of the elbow joint, neuropathic joints, and infection.

Our experience is that most nonunion of the distal humerus can be treated surgically to obtain bone healing with a functional range of motion of the elbow. Distal humeral nonunion treated with internal fixation have become reliable since new anatomic locking plates have been introduced allowing better fixation of small osteopenic nonunion fragments. However, other modalities like LRS and TBW are also equally effective.The aim of this manuscript is to describe our current treatment of a distal humeral nonunion using a standardized treatment plan that includes careful planning, extensile exposure, release of the ulnar nerve, capsular release and mobilization of the distal fragment, debridement, and finally need based stable fixation after alignment with or without use of bone graft.

Methods

Total 22 patients were selected for the study with fracture distal humerus with duration of more than 2 months without intervention or 6 months minimum after fixation with no signs of union.

Surgical Technique

Preparation and Positioning - The patient is positioned prone or in the lateral decubitus position. A preoperative drawing outlining the surgical tactic helps to anticipate and prevent intraoperative problems. Good preoperative planning will greatly facilitate the surgical procedure. Preoperative anteroposterior (AP) and lateral radiographs are taken

Surgical Exposure - The posterior approach allows elevation of medial and lateral skin flaps and an olecranon osteotomy. The ulnar nerve is identified proximally and traced towards the elbow. If ulnar nerve symptoms are present preoperatively, external neurolysis is performed. The olecranon osteotomy for an intra-articular, transcondylar, or a low distal humeral nonunion provides superb exposure and ability for extensile release. For a supracondylar distal humeral nonunion, a triceps splitting or paratricipital approach can be used.

For a unicondylar nonunion, a medial or lateral approach is often sufficient. Alternatively, one can start with a paratricipital approach and add an olecranon osteotomy as needed. The chevron olecranon osteotomy is done at the semilunar notch where the cartilage is thinnest. Careful elevation of the proximal fragment prevents articular separation that can be the result of adherence of the olecranon cartilage to the trochlea. The triceps is elevated off the bone with a rasp of by finger dissection. All unstable hardware is removed. Nonunion tissue is debrided sharply. After clearing scar tissue and posterior capsule, the anterior capsule and scar can be released allowing increased joint mobilization. If motion remains limited, the lateral collateral ligament can be osteotomized, allowing the joint to be hinged open on the medial ligamentous structures for further release.

Results

We evaluated all 22 patients with a delayed or nonunion of the distal humerus. All patients were treated using the protocol as outlined above. Over the years, fixation devices have been modified and improved. The concepts of debridement, alignment, rigid fixation, bone grafting, and early motion have remained current.Out of the 22 patients, 10 got the pre injury status with good physiotherapy, 8 were with terminal flexion or extension deformity and 2 patients movements were restricted more with occasional pain,2 were arthrodesed.

Discussion, Drawbacks and advantages of procedures

A distal humeral nonunion often leads to a flail and painful arm. There are very few contraindications for surgical treatment. In the literature, since the early 1980s, 24 publications have been published specifically on the treatment of distal humeral nonunions. Most series describe the results after internal fixation.In series of Ring and Jupiter (2006), Total 35 cases(Age range 18Years–47Years), Operated with ORIF, had given 100% UNION with Average ROM arc was 30®-130°;Average Mayo score is 85 (80–95); Average DASH is 19.5 (4–35).Success rates of formal open reduction and internal fixation of a distal humeral nonunion is highly dependent on careful preoperative planning, extensile exposure includes olecranon osteotomy, meticulous debridement of scar tissue, release and if required anterior transposition of the ulnar nerve, capsular release and mobilization of the distal fragment, and finally stable fixation with Bicolumnar plates.

CASE 1

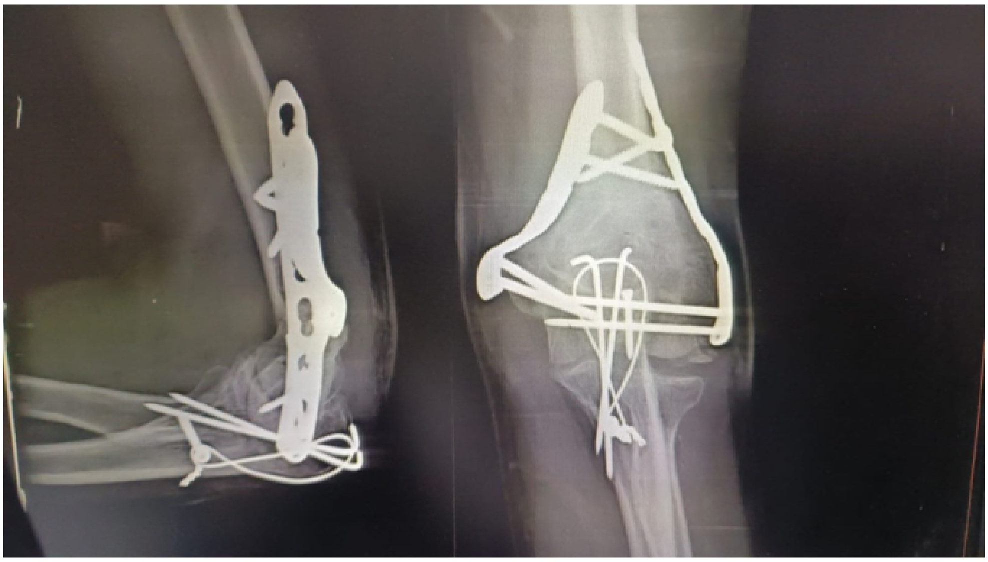

Figure 1 - Use of Olecranon osteotomy to get good exposure to the joint

But other surgical procedures like, CR & K wires and External Fixation devices like LRS are also equally effective, provided right indication. Union rate when treated with open reduction and internal or thin wire fixation in these studies ranged between 80 and 100% (average 93%) with a total range of flexion-extension motion arc at latest follow-up reported between 71 and 102° (average 91°). Brinker et al. (2007), Total 6 infected distal humerus nonunion treated with Debridement, shortening via Ilizarov technique and bone graft had union rate of 100% with Average ROM arc is 81° (range 70–100°); Average DASH is 77 (50–93).

For infected distal humerus nonunions or those with compromised soft tissues, the Ilizarov technique or LRS fixation is a good—but difficult—alternative There is a steep learning curve and patients need to be motivated as the frame is cumbersome.

CASE 2

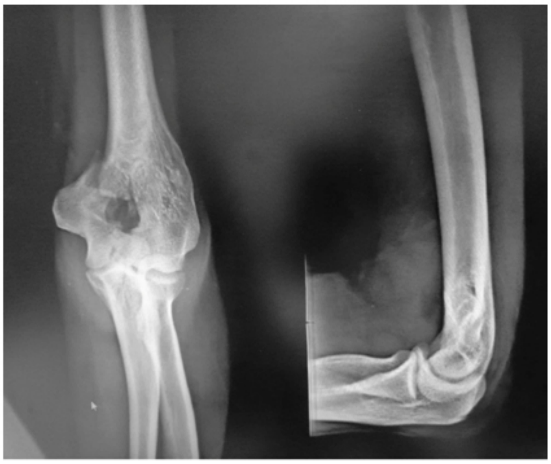

Figure 2a
Figure 2a - 2 months old neglected Medial column fracture treated with plaster cast.

Figure 2b
Figure 2b - Final x rays - 1 year after the osteosynthesis

CASE 3

Figure 3a
Figure 3a - female of 65 treated by bone setter 2 months after the fracture with nonunion.

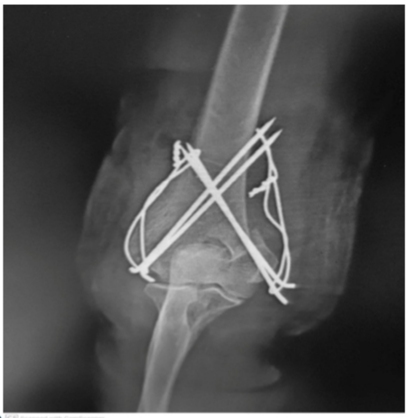

Figure 3b

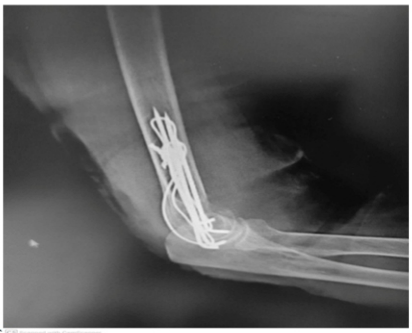

Figure 3c

Figure 3b&3c - 3 months after x rays of treatment done with the usage of TBW principle with k wires and SS wire loop and holding both the columns.

CASE 4

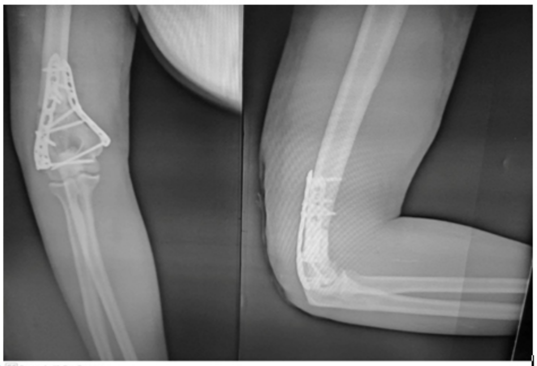

Figure 4a

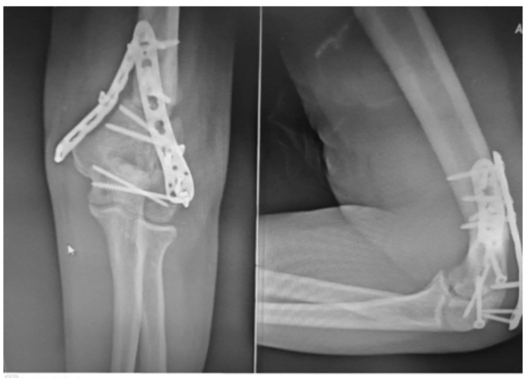

Figure 4b

Figure 4a &4b - A 64-year-old male presents 5 months following ORIF of a right-sided distal humeral fracture with complaints of pain at the fracture site and limited range of motion of the elbow. Radiographs reveal a nonunion, and loss of fixation,screw breakage medial side,.

Figure 4c

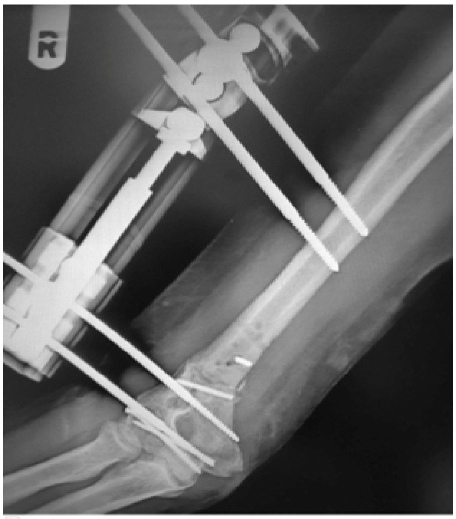

Figure 4d

figure 4c &4d - treated with plate and screw removal, debridement, freshening of the edges and removal of necrotic tissue and then Limb Reconstruction system placement done.

In conclusion, internal fixation and bone grafting remains the treatment of choice for a nonunion of the distal humerus. Our results and those of others have shown careful preoperative planning, extensile approach, thorough debridement, and release of scarred soft tissues are essential to a successful reduction and optimal realignment. Rigid fixation with versatile locking plates and liberal use of bone graft will maximize the union rates and the reestablishment of a functional elbow in most patients. However, External devices like LRS also equally effective in infected cases.

Upcoming Orthopaedic Conferences

Pune Trauma Operative Course 2024 Pune   12-04-2024

Post Graduate Course DOA MAMC, DELHI   13-04-2024

6th Annual Conference of AOPAS, 2024, Kochi   19-04-2024

Central Zone IOA National Mid Term Symposium, BHOPAL- MP   20-04-2024

2nd IORA Hand CME and Workshop 2024 Cuttack   21-04-2024

AOS Nailscon 2024 Ahmedabad   21-04-2024

Arthro Shoulder 2024 Mumbai   26-04-2024

Adult Hip Reconstruction Cadaveric Advance Course Dehradun   05-05-2024

Orthobiologics live techniques Course DOA, DELHI   05-05-2024

PAC 2024 4th Pune Arthroplasty Course, PUNE   31-05-2024

Humour in Orthopaedics