Research Square

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Comparison of Functional Outcomes of Para-tricipital Approach Versus Olecranon Osteotomy Approach in Distal Humerus Intra-Articular Fractures: A Retrospective Study

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Abstract

Background

Distal humerus fractures account for approximately 0.5–7% of all fractures and nearly 30% of elbow fractures. Due to the complex anatomy of the elbow joint, articular involvement, and frequent metaphyseal comminution, these injuries remain challenging to manage. Open reduction and internal fixation (ORIF) is the standard treatment for most intra-articular distal humerus fractures. Among the surgical approaches, the paratricipital (PT) approach and the olecranon osteotomy (OO) approach are commonly used.

Methods

This retrospective comparative study included 47 patients with intra-articular distal humerus fractures treated with ORIF between February 2021 and January 2023. Twenty-four patients underwent fixation using the paratricipital approach and twenty-three patients using the olecranon osteotomy approach. Functional outcomes were assessed using the Mayo Elbow Performance Score (MEPS) at 3, 6, 12, and 24 months.

Results

The mean MEPS score was 87.58 in the PT group and 86.23 in the OO group, showing no statistically significant difference. The PT approach demonstrated a greater mean arc of motion and shorter operative time, whereas the OO approach provided improved exposure and slightly better outcomes in complex AO type C3 fractures.

Conclusion

Both the paratricipital and olecranon osteotomy approaches provide satisfactory functional outcomes in intra-articular distal humerus fractures. The paratricipital approach offers shorter operative time and better postoperative range of motion, whereas the olecranon osteotomy approach provides superior visualization in complex AO type C3 fractures

Highlights

- Comparison of paratricipital and olecranon osteotomy approaches in intra-articular distal humerus fractures.
- Both surgical approaches achieved comparable functional outcomes using the Mayo Elbow Performance Score.
- Paratricipital approach demonstrated shorter operative time and better postoperative range of motion.
- Olecranon osteotomy provided improved articular visualization in complex AO type C3 fractures.
- Choice of surgical approach should be individualized according to fracture morphology

Introduction

Distal humerus fractures are relatively uncommon injuries but present significant treatment challenges due to the complex anatomy of the elbow joint and frequent intra-articular involvement. These fractures demonstrate a bimodal age distribution, occurring in younger individuals following high-energy trauma and in elderly patients following low-energy falls.Adult population represent about 0.5-7% of all fractures and 33% of all humerus fractures [1–3].

Achieving anatomical reduction of the articular surface and stable fixation of both humeral columns is essential to restore elbow function and minimize complications such as stiffness, post-traumatic arthritis, and nerve injury [4]. AO/OTA, Jupiter and riseborough and radin classification have high reliability and reproducibility with their system [5–6]. Anatomic reduction of the articular surface is paramount in keeping the chances of developing post-traumatic arthritis as low as possible [7]. Treatment

option includes conservative management, ORIF & Total Elbow Arthroplasty. This often requires surgical intervention to achieve, with specific rehabilitation protocols set in place for successful recovery and to avoid certain complications, such as elbow stiffness, heterotopic ossification, and nerve injury. These fractures are treated more often with Healing by primary intention by Open reduction and internal fixation. Restoring the elbow anatomy and stable bicolumnar fixation is utmost important and well described [8]. Among ORIF, Para-Tricipital (PT) and Olecranon Osteotomy (OO) approach are commonly used for management.

The olecranon osteotomy approach provides excellent visualization of the articular surface but may be associated with complications related to osteotomy healing and hardware irritation. In contrast, the paratricipital approach preserves the extensor mechanism and avoids osteotomy but may limit visualization in highly comminuted fractures. Comparison of functional outcome is utmost importance for determining superior approach.

Materials and Methods

This retrospective study was conducted at tertiary level hospital between April 2022 and March 2024 after institutional ethical approval. We initially identified 70 patients who had undergone open reduction internal fixation for distal humerus fracture with either approach, among which 20 patients were excluded from the study which resulted in malunion of fracture (step-off >2mm or malalignment of >5degree in any plane) and 3 patient were excluded because of demise of the patient. Forty-seven patients were included in the study with age group ranging from 19 to 60 years. All of them were classified as type C fractures based on the AO classification and subclassified in to c1, c2, c3 types (fig.1).

Among these patients, 24 underwent surgery through the paratricipital approach and 23 through the olecranon osteotomy approach. Patients ranged in age from 19 to 60 years with a mean age of approximately 41 years.

Surgical fixation was done under general anesthesia in the lateral decubitus position with arm support and hemostasis achieved using tourniquet in all patients. Prophylactic antibiotic (cefuroxime 1.5 g) was given in all cases. Signed informed consent was taken from all patients about fracture type, approach used, and possible complications.

Fractures were classified according to the AO/OTA classification system. Functional outcome was assessed using the Mayo Elbow Performance Score (MEPS) and range of motion measurements obtained with a goniometer during follow-up visits at 3, 6, 12, and 24 months.

Statistical analysis was performed using IBM SPSS Statistics version XX (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, and categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using Chi-square test and independent t-test where appropriate. A p-value <0.05 was considered statistically significant.

Study design

- Study design: Retrospective study
- Study period: 2 years
- Place of study: tertiary care hospital; outpatient basis
- Sample size: 47

INCLUSION CRITERIA:

Patients with intercondylar fractures of distal humerus (intraarticular) type c fractures according to AO Classification and operated with open reduction internal fixation with either para-tricipital or olecranon osteotomy in 15-60 year of age group will be selected for this study.

EXCLUSION CRITERIA:

- Patient below 15 and above the age of 60
- Patients with malunited fracture (step-off >2mm or malalignment of >5degree in any plane).
- Patient with immunocompromise disorders.

RESULTS

A total of **47 patients** with intra-articular distal humerus fractures were included in the study and managed with open reduction and internal fixation using either the **paratricipital (PT) approach** or the **olecranon osteotomy (OO) approach**. Among them, **24 patients were treated with the PT approach (fig.2) and 23 patients with the OO approach**. (fig.3)

The mean age of the study population was **40.9 ± 11.14 years**, with an age range between **19 and 60 years**. The age distribution of the patients is shown in **Table 1**. The highest proportion of patients was observed in the **41–50 years age group (29.7%)**, followed by the **31–40 years age group (25.53%)**, **51–60 years (23.4%)**, and **≤30 years (21.27%)**. There was **no statistically significant difference in age distribution between the two surgical groups (p = 0.1893)**.

With regard to gender distribution, **32 patients (68%) were male and 15 patients (32%) were female**. The distribution of males and females between the two groups was comparable (**Table 2**) and the difference was **not statistically significant (p = 0.7576)**.

Fractures were classified according to the **AO classification system**. As shown in **Table 3 and chart-1**, the most common fracture type was **C3 (36.1%)**, followed by **C2 (34.2%)** and **C1 (29.7%)**. In the PT group, **8 patients had C1 fractures, 10 had C2 fractures and 6 had C3 fractures**, whereas in the OO group **6 patients had C1 fractures, 6 had C2 fractures and 11 had C3 fractures**.

This distribution indicates that a relatively larger proportion of **complex fracture patterns (C3)** were managed with the **olecranon osteotomy approach**, likely due to the improved articular visualization provided by this technique.

The mean operative time was **longer in the olecranon osteotomy group compared with the paratricipital group**. The overall mean surgical duration was **157 minutes in the OO group and 139.6 minutes in the PT group** (**Table 4**). When analyzed according to fracture type, the operative time remained significantly higher in the OO group for **C1, C2, and C3 fractures (p < 0.001)**.

The longer surgical time with OO approach may be attributed to additional procedural steps including **creation of the osteotomy, fixation of the olecranon fragment, and increased surgical exposure**.

Postoperative elbow range was assessed using a **goniometer**, and the mean arc of motion was calculated for both groups (**Table 5**). The **PT approach demonstrated a higher mean functional arc of motion (99.34°)** compared with the **OO approach (88.1°)**.

When stratified by fracture type:

- **C1 fractures:** PT group had a mean arc of **113.12°**, compared with **91.42°** in the OO group.
- **C2 fractures:** PT group had **103.5°**, compared with **88.57°** in the OO group.
- **C3 fractures:** The arc of motion was similar between the two groups.

Despite these differences, the **overall difference in mean arc of motion between the two groups was not statistically significant**.

Functional outcome was evaluated using the **Mayo Elbow Performance Score (MEPS)** during follow-up visits at **3, 6, 12, and 24 months postoperatively**. (Table-6)

Overall functional outcomes were highly satisfactory:

- **Excellent:** 28 patients
- **Good:** 15 patients
- **Fair:** 3 patients
- **Poor:** 1 patient

The **mean MEPS score was 87.58 in the PT group and 86.23 in the OO group**, demonstrating **no statistically significant difference between the two surgical approaches**.

However, when fracture types were analysed separately, **patients with AO type C3 fractures tended to have slightly better functional outcomes when treated with the OO approach**, likely due to improved visualization and more accurate articular reduction.

Overall, both approaches resulted in **excellent to good outcomes in the majority of patients**, suggesting that **either surgical technique can achieve satisfactory functional recovery when stable fixation and anatomical reduction are achieved**.

Table 1: Distribution of Study Subjects according to the Age

(N = 47)

Age (Years)	PT	OO	Total No.	Percent	P value
≤ 30	5	5	10	21.27	P value= 0.1893
31-40	3	9	12	25.53	Chi square value= 4.86
41-50	11	3	14	29.7	Degree of freedom=3
51-60	5	6	11	23.4	
Mean (SD)			40.90 (11.14)		
Range	23-60	19-59	19-60		

Table 2: Gender distribution according to the approach

Gender	OO	PT	Total	P value
Female	7	8	15	P value=0.7576
Male	16	16	32	Chi square=0.0952
				Degree of freedom=1

Table 3: Distribution of Study Subjects according to fracture type based on AO Classification (N=47)

			Total
	OO	PT	
c1	6	8	14
c2	6	10	16
c3	11	6	17
Total	23	24	47

Table 4: Distribution of Study Subjects according to surgical approach and surgical time (mean in mins):

			Mean	P value
	OO	PT		
c1	145	117.5	131.25	<0.001
c2	160	138.5	149.25	<0.001
c3	168	162.8	165.4	<0.001
Mean	157	139.6		
Range	135-190	100-180		

Table 5: Distribution of Study Subjects according to functional arc of motion post op (Mean arc of motion):

	OO	PT	P value
c1	91.42	113.12	<0.001
c2	88.57	103.5	0.0341
c3	84.5	81.4	0.0651
Mean	88.1	99.34	0.3428

Table 6: Distribution of Study Subjects according to MEPS outcome (N=47):

		Excellent	**Good**	**Fair**	**Poor**	**Total**	**P- value**
C1	OO	03	03	00	00	06	0.5623
	PT	06	02	00	00	08	
C2	OO	04	02	00	00	06	0.6732
	PT	07	03	00	00	10	
C3	OO	06	03	02	00	11	0.7832
	PT	02	02	01	01	06	
Total		28	15	03	01	47	

DISCUSSION

Distal humerus fractures involving the articular surface remain one of the most challenging injuries encountered in orthopaedic trauma surgery. The complexity of the elbow joint, the presence of thin cortical bone, and frequent articular comminution make

surgical management demanding. The primary goal of treatment is **anatomical reduction of the articular surface and stable fixation of both humeral columns**, which allows for **early mobilization and restoration of elbow function**.

In the present study, we compared the **functional outcomes of the paratricipital approach and the olecranon osteotomy approach** in the management of intra-articular distal humerus fractures. Both techniques are widely used surgical approaches and each has its own advantages and limitations.

The mean age of the patients in our study was **40.9 years**, which is consistent with previously reported epidemiological data. A study conducted by Charles M. Robinson [9] reported an incidence of approximately **5.7 cases per 100,000 population annually**, with a bimodal age distribution involving younger patients sustaining high-energy trauma and elderly patients sustaining low-energy falls.

Similarly, epidemiological analyses by Jean-Luc Charissoux [10] demonstrated that distal humerus fractures frequently occur in active adults due to high-energy injuries such as motor vehicle accidents, which corresponds with the mechanism of injury observed in many of our patients.

Historically, treatment of distal humerus fractures has evolved significantly. Early authors such as William J. Eastwood [11] advocated conservative treatment with closed reduction and immobilization, reporting acceptable outcomes in selected cases. However, subsequent studies demonstrated that non-operative treatment often resulted in **poor functional outcomes and elbow stiffness**, particularly in younger active individuals.

Later studies by Edward J. Riseborough and Eugene L. Radin [6] highlighted the unpredictable outcomes associated with conservative management of intercondylar fractures and emphasized the importance of **operative fixation**.

Modern principles of fracture management were further refined by Orvar Lansinger [12], who emphasized that **stable internal fixation and anatomical reduction are essential to achieve good functional outcomes** in intra-articular distal humerus fractures.

The **olecranon osteotomy approach** has traditionally been considered the **gold standard** for exposure of distal humerus fractures because it allows **excellent visualization of the articular surface**. This facilitates accurate reduction and fixation, particularly in **complex fracture patterns**.

However, this approach is associated with potential complications including **osteotomy non-union, hardware irritation, and need for secondary implant removal**. A study by Christopher P. Coles [13] reported that a significant proportion of patients undergoing olecranon osteotomy required removal of hardware due to irritation or prominence.

In contrast, **triceps-sparing techniques such as the paratricipital approach preserve the extensor mechanism** and avoid osteotomy-related complications. These techniques have gained increasing popularity in recent years.

A clinical study by Chi Zhang [14] demonstrated that triceps-sparing approaches can achieve **excellent functional outcomes in AO type C1 and C2 fractures**, with reduced surgical morbidity compared with olecranon osteotomy.

Our findings are consistent with these observations. In the present study, **patients treated with the PT approach demonstrated slightly better postoperative range of motion and shorter operative time**, suggesting that preservation of the triceps mechanism may facilitate earlier rehabilitation and improved mobility.

The mean operative time was significantly longer in the OO group compared with the PT group. This finding is consistent with previous studies, Hongwei Chen [15] conducted a systematic review comparing surgical approaches and reported that **olecranon osteotomy procedures are associated with longer operative times and increased surgical complexity**.

Similarly, meta-analysis conducted by Shuai Lu [16] demonstrated that triceps-sparing approaches often result in **shorter surgical duration and reduced intraoperative blood loss**.

In our study, the **mean MEPS score was comparable between the two surgical approaches**, indicating that both techniques provide satisfactory functional outcomes when appropriate fracture reduction and fixation are achieved.

These findings are consistent with previous clinical studies. A prospective comparative study by Rahul Singh [17] demonstrated that **both PT and OO approaches produced similar outcomes in C1 and C2 fractures**, while OO provided better exposure for **C3 fractures**.

Another retrospective study by Mehmet Kose [18] also reported **no significant difference in overall functional outcome between the two approaches**, suggesting that surgeon experience and fracture pattern may play a greater role in determining results.

One important observation in our study was that **patients with AO type C3 fractures tended to have better outcomes when treated with the olecranon osteotomy approach**. This is likely due to the improved visualization of the articular surface provided by osteotomy, which facilitates **accurate reduction of highly comminuted fragments**.

Cadaveric studies conducted by Jae-Woo Cho [19] have demonstrated that the paratricipital approach may leave **approximately 30% of the central articular surface inaccessible**, which can make fixation of complex fractures more difficult.

Recent literature continues to emphasize that **open reduction and internal fixation (ORIF)** remain the gold standard for the management of intra-articular distal humerus fractures, with the primary objective being anatomical reduction of the articular surface and stable fixation of both columns to allow early mobilization of the elbow joint. A systematic review and meta-analysis by Ho-Seung Jeong et al. [20] (2022) comparing the **olecranon osteotomy and paratricipital approaches** concluded that both approaches yield **comparable functional outcomes**, particularly when evaluated using the Mayo Elbow Performance Score (MEPS). However, the study highlighted that the olecranon osteotomy approach provides superior visualization of the articular surface, which may facilitate accurate reduction in complex fracture patterns. Similarly, clinical investigations evaluating triceps-sparing techniques have reported satisfactory functional outcomes with reduced surgical morbidity and preservation of the extensor mechanism.

Similarly, a prospective observational study by **Selvan et al. [21]** comparing olecranon osteotomy with triceps-reflecting approaches demonstrated that although olecranon osteotomy may provide slightly better early postoperative range of motion and functional scores, long-term outcomes between the two approaches tend to become comparable. However, the osteotomy approach was associated with higher complication rates, including implant irritation and osteotomy-related problems, suggesting that extensor-preserving approaches may reduce surgical morbidity. (Table-7)

The findings of the present study are consistent with these observations. Both the Para tricipital and olecranon osteotomy approaches produced **comparable functional outcomes**, as reflected by similar mean MEPS scores between the two groups. However, the Para tricipital approach demonstrated **shorter operative time and slightly improved postoperative range of motion**, whereas the olecranon osteotomy approach provided better visualization in more complex fracture patterns, particularly AO type C3 fractures. These results support the growing consensus in recent literature that the choice of surgical approach should be **individualized based on fracture morphology, surgeon experience, and the need for adequate articular visualization**, rather than relying on a single universal approach.

Therefore, although the PT approach offers several advantages, surgeons should be prepared to convert to **olecranon osteotomy in cases where adequate visualization cannot be achieved**.

Table-7 Related Research work

Author	Year	Study Design	Sample Size	Surgical Approaches Compared	Key Findings
Riseborough & Radin [6]	1969	Retrospective study	29	Various operative methods	Emphasized need for anatomical reduction and stable fixation in distal humerus fractures
Lansinger et al. [12]	1986	Clinical study	50	Internal fixation techniques	Demonstrated better functional outcomes with rigid internal fixation and early mobilization
Robinson et al. [9]	2003	Epidemiological study	80+	Not approach specific	Reported bimodal age distribution and incidence of distal humerus fractures
Coles et al. [13]	2006	Cadaveric comparative study	—	Olecranon osteotomy vs triceps-sparing	Olecranon osteotomy provided superior articular visualization
Zhang et al. [14]	2014	Retrospective comparative study	62	Paratricipital vs Olecranon osteotomy	Similar functional outcomes between both approaches
Chen et al. [15]	2017	Systematic review	9	Multiple approaches	No significant difference in MEPS scores between approaches
Singh et al. [17]	2018	Comparative clinical study	40	PT vs OO	PT approach associated with shorter operative time
Kose et al. [18]	2019	Retrospective study	48	PT vs OO	Comparable functional outcomes but fewer complications with PT
Jeong et al. [20]	2020	Meta-analysis	700+ patients	PT vs OO	Both approaches provide similar functional results
Lu et al.[16]	2021	Meta-analysis	Multiple studies	Triceps sparing vs OO	PT associated with shorter operative duration
Cho et al. [19]	2022	Cadaveric study	—	PT exposure analysis	PT approach limits visualization of central articular surface
Selvan P et al [21]	2025	Prospective observational		OO vs TRAP	OO offers better early results, more complications, while TRAP provides similar long-term outcomes with fewer risks.
Present Study	**2025**	Retrospective comparative study	**47**	**Paratricipital vs Olecranon Osteotomy**	**Both approaches produced comparable MEPS scores; PT had shorter operative time and better arc of motion, while OO provided better exposure for C3 fractures**

Complications

Postoperative complications following distal humerus fracture fixation may include **ulnar nerve neuropathy, elbow stiffness, heterotopic ossification, and implant irritation**. Previous studies have reported a postoperative ulnar neuropathy incidence ranging from **7–17%**, as reported by James K. Wiggers and colleagues.

Fortunately, in our study, the overall complication rate was low and the majority of patients achieved **excellent or good functional outcomes**.

Conclusion

Overall, the findings of the present study suggest that:

- Both PT and OO approaches provide **excellent functional outcomes**.
- PT approach results in **shorter surgical time and slightly better range of motion**.
- OO approach provides **better visualization for complex fractures (C3)**.
- The **choice of surgical approach should be individualized** based on fracture pattern and surgeon experience.

Strengths of the Study

The present study compares two commonly used surgical approaches for intra-articular distal humerus fractures with standardized functional evaluation using the Mayo Elbow Performance Score. Additionally, patients were followed for a minimum duration of 18–24 months, allowing for meaningful assessment of functional recovery and fracture union.

Limitations of the Study

The present study has several limitations. First, the retrospective design introduces the possibility of selection bias. Second, the sample size is relatively small, which may limit the statistical power of the analysis. Third, the study was conducted at a single tertiary care center and the results may therefore not be generalizable to other populations. Finally, the choice of approach depended on surgeon preference and fracture characteristics. Future prospective randomized studies with larger sample sizes are required to further validate these findings.

Declarations

There is no Conflict of interest, acknowledgement and or source of funding

Informed Consent has been obtained from patient or guardian for the study's participation and publication

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval

The study was approved by the Institutional Ethics Committee. The study was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Author Contribution

Dr. YNT: Conceptualization, Methodology, Data curation, Investigation, Formal analysis, Writing – original draft preparation, Visualization.Dr. SSB: Supervision, Conceptualization, Methodology, ValidationDr. RP: Methodology, Investigation, Data interpretationDr. HS: Data collection, Data curation, Statistical assistance, Manuscript preparation.Dr. YV: Investigation, Literature review, Data collection, Manuscript editing.Dr. NP: Data curation, Literature review, Manuscript proofreading and editing.Dr. HH: Data curation, Literature review, Manuscript proofreading and editing.

References

1. Amir S, Jannis S, Daniel R. Distal humerus fractures: a review of current therapy concepts. Curr Rev Musculoskelet Med [Internet]. 2016 [cited 2023 Aug 10];9(2):199–206. Available from: http://dx.doi.org/10.1007/s12178-016-9341-z
2. Charissoux J-L, Vergnenegre G, Pelissier M, Fabre T, Mansat P. Epidemiology of distal humerus fractures in the elderly. Orthop Traumatol Surg Res [Internet]. 2013;99(7):765–9. Available from: https://www.sciencedirect.com/science/article/pii/S1877056813001886

3. Fernandes Junior JCF, Milan TV, Ribeiro HAMF, Stein HE, Ribas Filho HC, Carula BC. Distal humeral fracture: An epidemiological analysis of orthopedic patients for children. Acta Ortop Bras [Internet]. 2019 [cited 2023 Aug 10];27(5):261–4. Available from: https://www.scielo.br/j/aob/a/PJzTbPLv3MKdzWGpLvCWV6C/
4. Srinivasan K, Agarwal M, Matthews SJE, Giannoudis PV. Fractures of the distal humerus in the elderly: Is internal fixation the treatment of choice? Clin Orthop Relat Res [Internet]. 2005 [cited 2023 Aug 10];NA;(434):222–30. Available from: https://pubmed.ncbi.nlm.nih.gov/15864057/
5. Jupiter JB, Mehne DK. Fractures of the distal humerus. Orthopedics [Internet]. 1992;15(7):825–33. Available from: http://dx.doi.org/10.3928/0147-7447-19920701-07
6. Riseborough EJ, Radin EL. Intercondylar T fractures of the humerus in the adult. A comparison of operative and non-operative treatment in twenty-nine cases. J Bone Joint Surg Am [Internet]. 1969 [cited 2023 Aug 10];51(1). Available from: https://pubmed.ncbi.nlm.nih.gov/5762707/
7. Chammas M. Post-traumatic osteoarthritis of the elbow. Orthop Traumatol Surg Res [Internet]. 2014;100(1):S15–24. Available from: https://www.sciencedirect.com/science/article/pii/S1877056813002612
8. Doornberg JN, van Duijn PJ, Linzel D, Ring DC, Zurakowski D, Marti RK, et al. Surgical treatment of intra-articular fractures of the distal part of the humerus: Functional outcome after twelve to thirty years. J Bone Joint Surg Am [Internet]. 2007 [cited 2023 Aug 10];89(7):1524–32. Available from: https://journals.lww.com/jbjsjournal/Abstract/2007/07000/Surgical_Treatment_of_Intra_Articular_Fractures_of.17.aspx
9. Adult Distal Humeral Metaphyseal Fractures: Epidemiology... : Journal of Orthopaedic Trauma [Internet]. LWW. 2026 [cited 2026 Mar 14]. Available from: https://journals.lww.com/jorthotrauma/abstract/2003/01000/adult_distal_humeral_metaphyseal_fractures_.6.aspx
10. Europe PMC. Europe PMC [Internet]. Europepmc.org. 2016 [cited 2026 Mar 14]. Available from: https://europepmc.org/article/med/18513575
11. Eastwood WJ. The T-shaped fracture of the lower end of the humerus. JBJS. 1937 Apr 1;19(2):364-9.
12. Europe PMC. Europe PMC [Internet]. Europepmc.org. 2016 [cited 2026 Mar 14]. Available from: https://europepmc.org/article/med/7125874
13. The Olecranon Osteotomy: A Six-year Experience in the... : Journal of Orthopaedic Trauma [Internet]. LWW. 2026 [cited 2026 Mar 14]. Available from: https://journals.lww.com/jorthotrauma/abstract/2006/03000/the_olecranon_osteotomy__a_six_year_experience_in.2.aspx
14. Zhang C, Zhong B, Luo C. Comparing approaches to expose type C fractures of the distal humerus for ORIF in elderly patients: six years clinical experience with both the triceps-sparing approach and olecranon osteotomy. Archives of Orthopaedic and Trauma Surgery. 2014 Apr 29;134(6):803–11.
15. Chen H, Li D, Zhang J, Xiong X. Comparison of treatments in patients with distal humerus intercondylar fracture: a systematic review and meta-analysis. Annals of Medicine. 2017 Jun 14;49(7):613–25.
16. Lu S, Zha YJ, Gong MQ, Chen C, Sun WT, Hua KH, et al. Olecranon osteotomy vs. triceps-sparing for open reduction and internal fixation in treatment of distal humerus intercondylar fracture: a systematic review and meta-analysis. Chinese Medical Journal [Internet]. 2021 Jan 27 [cited 2024 Mar 14];134(4):390–7. Available from: https://pubmed.ncbi.nlm.nih.gov/33617182/
17. Singh R, Naman Kanodia, Singh H. Outcome following olecranon osteotomy versus paratricipital approach for complex intra-articular (AO 13-C) fracture of distal humerus: a prospective comparative study. Journal of shoulder and elbow surgery. 2019 Apr 1;28(4):742–50.
18. Kose M, Topal M, Iden G, Yilar S, Engin M. A retrospective comparison of olecranon osteotomy and paratricipital approach in treatment of distal humerus intra-articular fractures. Annals of Medical Research. 2021;28(9):1781.
19. Cho JW, Kim BS, Yeo DH, Kang S hyun, Lim EJ, Sakong S, et al. Clinical outcome of AO/OTA type C fracture of the distal humerus using the expanded paratricipital approach and cadaveric comparison of the exposure of the paratricipital and expanded paratricipital approaches to the distal humerus. Journal of Shoulder and Elbow Surgery [Internet]. 2020 Jun 9;29(8):1554–63. Available from: https://www.sciencedirect.com/science/article/abs/pii/S1058274620302391

20. Jeong HS, Jae Young Yang, Seung Jun Jeon, Shon HC, Oh JK, Eic Ju Lim. Comparison of olecranon osteotomy and paratricipital approach in distal humerus intra-articular fracture: A systematic review and meta-analysis. Medicine. 2022 Aug 26;101(34):e30216–6.
21. Selvan P, Krishnan M, Pandian T, Periasamy P. Functional Outcomes and Complications of Olecranon Osteotomy Versus Triceps-Reflecting Approach for Intra-Articular Distal Humerus Fractures in Adults: A Prospective Observational Study from South India. Journal of Pharmacy and Bioallied Sciences [Internet]. 2025 Oct [cited 2026 Mar 14];17(4):254–6. Available from: https://journals.lww.com/jpbs/fulltext/2025/10000/functional_outcomes_and_complications_of_olecranon.18.aspx?context=latestarticles

Chart

Chart 1 is available in the Supplementary Files section.

Figures

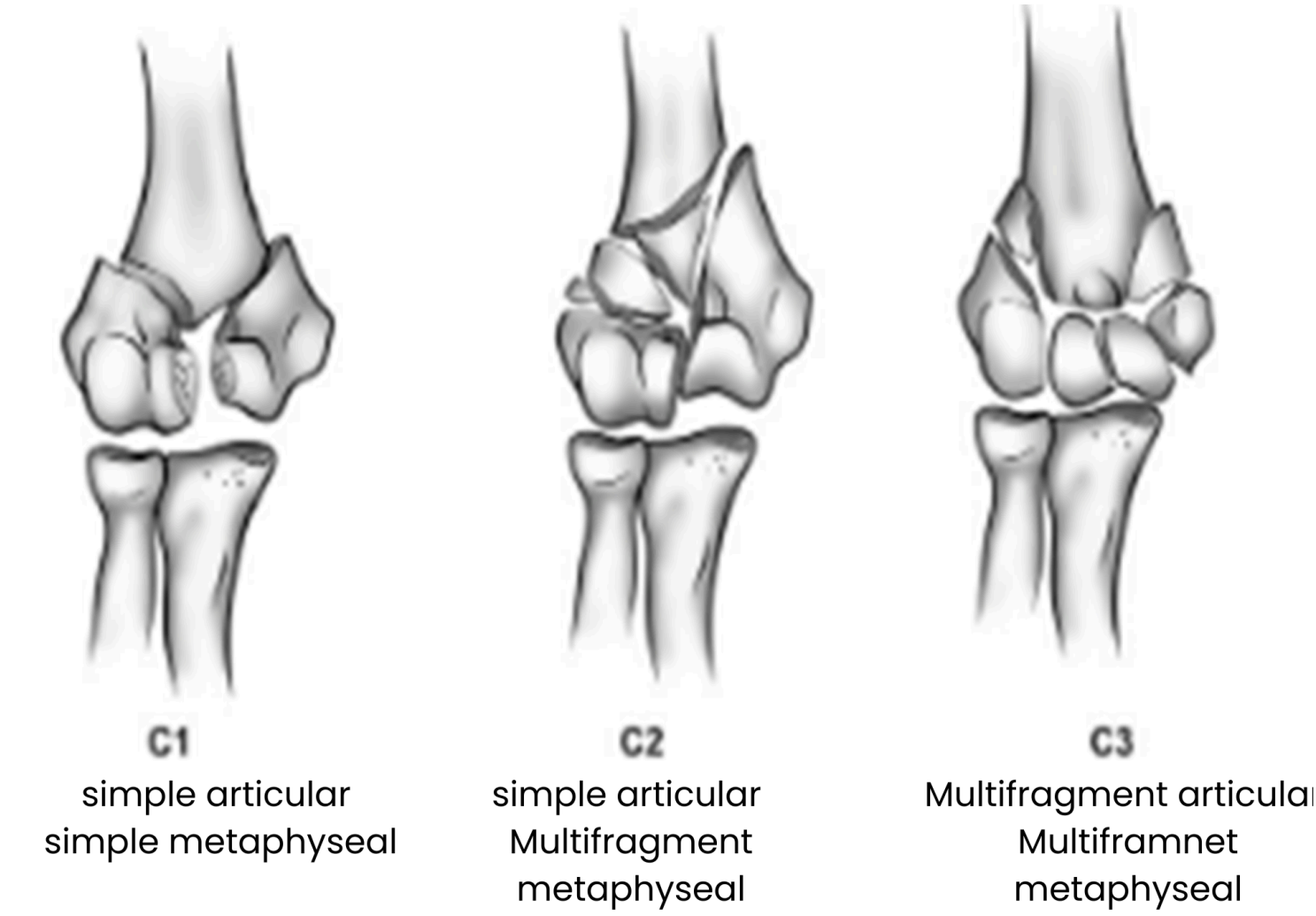


Figure 1

AO type C Fractures



Figure 2

Para-tricipital approach

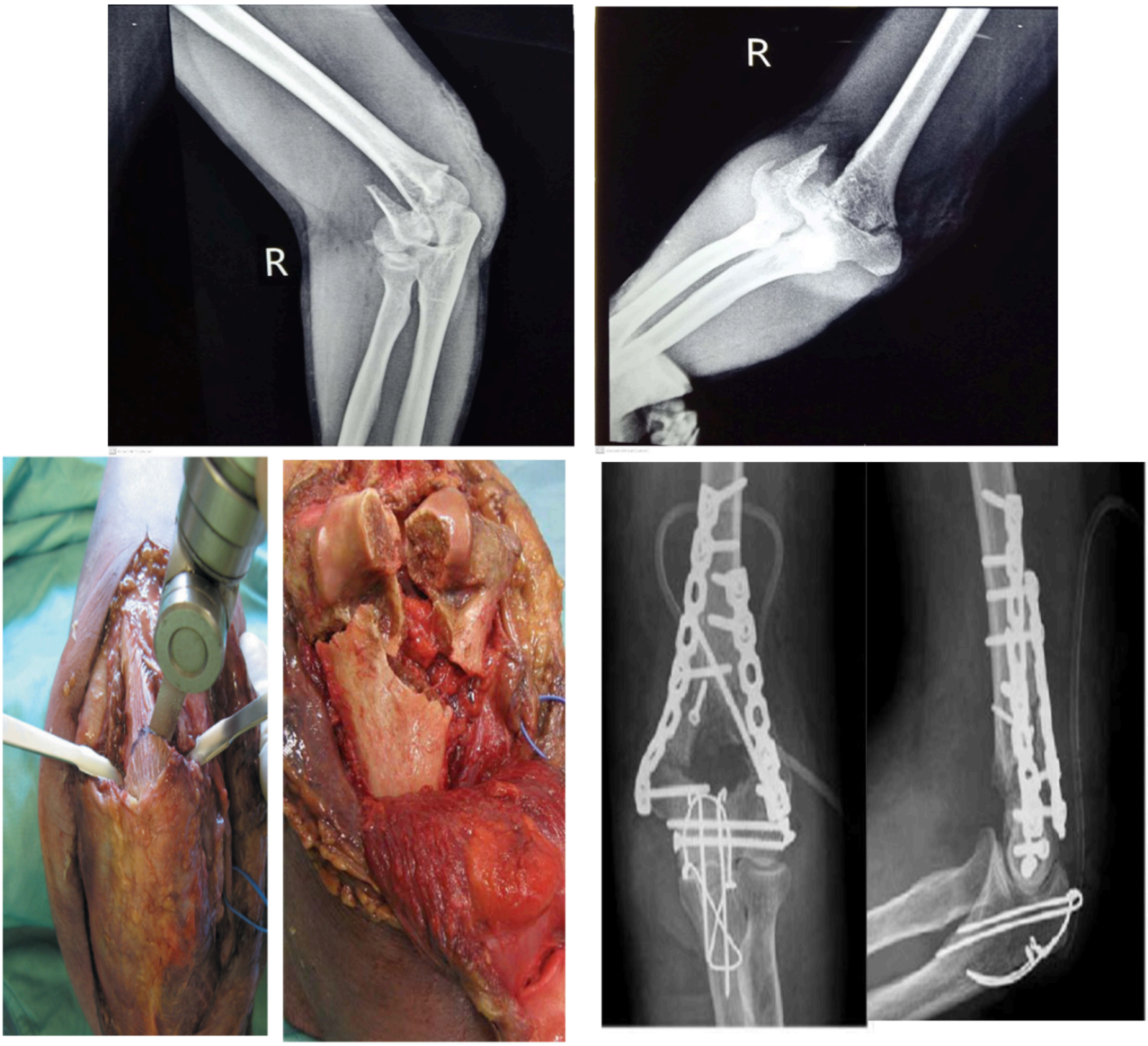


Figure 3

Olecranon osteotomy approach

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Chart1.docx