



# Results of Open Reduction and V-Y Triceps Plasty of Old Unreduced Elbow Dislocations in 38 Patients with Severe Extension Deformity

Nuradeen Altine Aliyu <sup>a\*</sup> and Ahmad Kamaluddeen <sup>b</sup>

<sup>a</sup> Department of Orthopaedics and Trauma, Usmanu Dan Fodio University Teaching Hospital, Sokoto, Nigeria.

<sup>b</sup> Arthroplasty/Arthroscopy Unit, National Orthopaedic Hospital, Dala, Kano, Nigeria.

## **Authors' contributions**

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## **ABSTRACT**

**Introduction:** Old unreduced posterior elbow dislocation is fairly common in developing countries due to delay in presentation after initial intervention by the traditional bone setters. This poses a huge management challenge for orthopaedic surgeons because of the accompanying triceps retraction. In this article, we report outcome of treatment of old unreduced elbow dislocations with severe extension deformities using open reduction with V-Y tricepsplasty through the posterior approach.

**Methodology:** This was a retrospective study of/involving 38 patients operated with old unreduced posterior elbow dislocations from August 2015 to March 2023. The presentation was within 3 to 18 months from the injury time at the orthopaedic hospital Wamakko, Sokoto, Nigeria. There were

\*Corresponding author: Email: [nuralast@yahoo.co.uk](mailto:nuralast@yahoo.co.uk);

31 males, and 7 females with mean age of 32 (range 18 to 64years). The mean elbow flexion was 11° (range was 5° to 45°) before the procedure. Our management protocol was the use of posterior elbow joint approach and Speed Technique of V-Y plasty for triceps lengthening and stabilizing the reduced joint with kirschner (K) wire.

**Results:** The mean patients' follow up was 21 (range 16 to 26 months). The average Mayo elbow performance index (MEPI) score on admission was 54, while the average MEPI score after the procedure was 88, with 29 (76 %) patients having excellent result, 3 (8%) with good result, 5 (13%) with fair, and 1 (3)% with poor results. On the scale of pain, the mean score was 42; the mean elbow flexion was 11° (range 5° to 45°) before the procedure, and after surgery the mean score was 118° (range 45° to 135°). Complications were 5 cases of ulnar nerve neuropraxia that all resolved within first 3 months postoperatively. Two cases of heterotopic ossifications and 1 postoperative elbow stiffness all significantly improved following rehabilitation therapy.

**Conclusion:** The functional outcome of old unreduced elbow dislocations presenting with severe extension deformity can be satisfactory following open reduction and V-Y Tricepsplasty.

*Keywords: Old unreduced elbow dislocation; open reduction; V-Y plasty; K wire.*

## 1. INTRODUCTION

Old unreduced elbow dislocation is defined as dislocation that has occurred more than 3 weeks before presentation [1-3]. Elbow dislocation is a common orthopaedic joint injury with an incidence of approximately 20% of all articular dislocations [4]. The elbow is the second most frequently dislocated major joint following shoulder in adults [5]. Most patients in developing countries would initially go to local bone setters for initial manipulation intended to heal the injury, this usually compounds the problem leading to high frequency of neglected dislocations of the elbow [2]. The elbow dislocation is either posterior, posterolateral or anterior, and about 80% of them are posterior or posterolateral [6-8]. It can also be classified as either simple or complex in the presence of an associated fracture of any of the bony structures around the elbow area [9]. The dislocation usually results from a fall on the outstretched hand with the forearm pronated in most cases. It's a huge challenge for treatment to orthopaedic surgeons because of the misconceptions associated in addition to the less compliance with rehabilitation. These patients present late with very limited range of elbow motion for activity of daily living and hence their treatment becomes mandatory for any desired future functional outcomes [8,10]. The time since injury and age of patient determine type of treatment [11]. Most authors recommend open reduction for the old unreduced elbow dislocation of up to 3 months following injury [2,12,13]. Functional outcome of open reduction is inversely proportional to the time since injury [13]. Various treatment methods have been described and these include closed reduction; open reduction and stabilization with

k-wire; open reduction with triceps lengthening and medial and lateral collateral ligament release, creation of an intra-articular "cruciate" ligament to stabilize the joint; hinged external fixator; excisional arthroplasty; arthrodesis; and total elbow arthroplasty. There have been many reported cases of old unreduced elbow dislocations in the literature, but to the best of our knowledge there have not been reported cases with exclusive maximum elbow flexion of less than 45°. The aim of this study was to report 38 patients who presented with old unreduced posterior elbow dislocation associated with severe extension deformity of less than 45°, who were treated with open reduction and use of V-Y triceps plasty and stabilisation with Kirschner (K) wire fixation.

## 2. MATERIALS AND METHODS

This is a retrospective study of 38 patients who presented with old unreduced elbow dislocation and were treated with open reduction and V-Y plasty at orthopaedic hospital Wamakko, Sokoto, Nigeria between the periods August 2015 and October 2022. This followed formal ethical clearance. The inclusion criteria were: (1) Neglected posterior elbow dislocation of more than 3 weeks, (2) Associated simple fracture and/or nerve injury, (3) Patient's age more than 18 years. The exclusion criteria were: (1) Open Elbow dislocation, (2) Elbow dislocation with elbow flexion of more than 90°, (3) Anterior elbow dislocation, (4) Associated severe fracture and/or nerve injuries, (5) Patients' age less than 18yrs. Sixty three cases of old unreduced elbow dislocations' folders were retrieved and only 38 patients met the inclusion criteria and among them, 31 (82%) were male, and 7 (18%) were

females. The average age was 32 (range 18 to 64years), and the mean duration of presentation was 7 months (range 2 to 18 Months). Fourteen (37%) cases were on the right side while 22 (63%) were on the left side. Non-dominant hands were the most affected. In 21(55%) patients, the dislocation occurred due to road traffic accident; 13 (34%) due to fall from height, 3 (8%) from sports injury and 1 (3%) from an assault. Ten (24%) patients presented less than 3 months from the injury time, 18 (50%) presented within 3 to 6 months, 6 (16%) presented within 6 to 12 months, and 3 (8%) presented within 12 to 18 months (Table 1). There was history of initial treatment by traditional bone setters (TBS) in all patients prior to presentation. The main reason for presentation to our hospital was largely due to pain, stiffness and gross limitation of functions of the affected limb. Examination findings revealed prominent anterior distal humerus with prominent olecranon posteriorly, and shortened biceps. There was distortion of three point elbow relationship, and ulnar nerve palsies with partial

clawing of fingers were present in two patients (Table 1). The elbow joints were mainly in extended position similar to position of splintage by the TBS who were the first point of contact of all the patients (Fig. 1). The degree of active elbow range of motion was measured by goniometer and the mean elbow flexion at presentation was 11° (range was 5° to 45°) as summarised in Table 2. All patients had preoperative evaluation using Mayo Elbow performance index (MEPI) as shown in Table 3. Nerve involvement assessment was done, and elbow radiographs (Fig. 1C) were taken for each patient to assess the anatomy of the dislocated elbow joint and to rule out presence of concomitant fractures which occurred in 2 patients as a complex dislocation (Table 1). All the 38 patients were preoperatively optimised and had open reduction through posterior elbow joint approach and use of Speed Technique of V-Y plasty for triceps lengthening and fixing the reduced joint with k wire (Figs. 2 and 1D).

**Table 1. Demographic characteristics of the patients**

Demographic characteristics of the patients	Number (%)
Age: 15-20	9(24%)
21-40	19(50%)
41-50	6(16%)
51-65	4(10%)
Sex: Male	31(82%)
Female	7(18%)
Duration of symptoms	
<3 months	10(26%)
3 month to 6 months	19(50%)
6 months to 12 months	6(16%)
12 months to 18 months	3(8%)
Road traffic accident (RTA)	21(55%)
Fall from height	13(34%)
Sports Injury	3(8%)
Assault	1(3%)
Side: Right	18(47%)
Left	20(53%)
Types of dislocation	
Simple	36(95%)
Complex	2(5%)
Associated nerve injuries at presentation	
Present	35(92%)
Absent	2(8%)

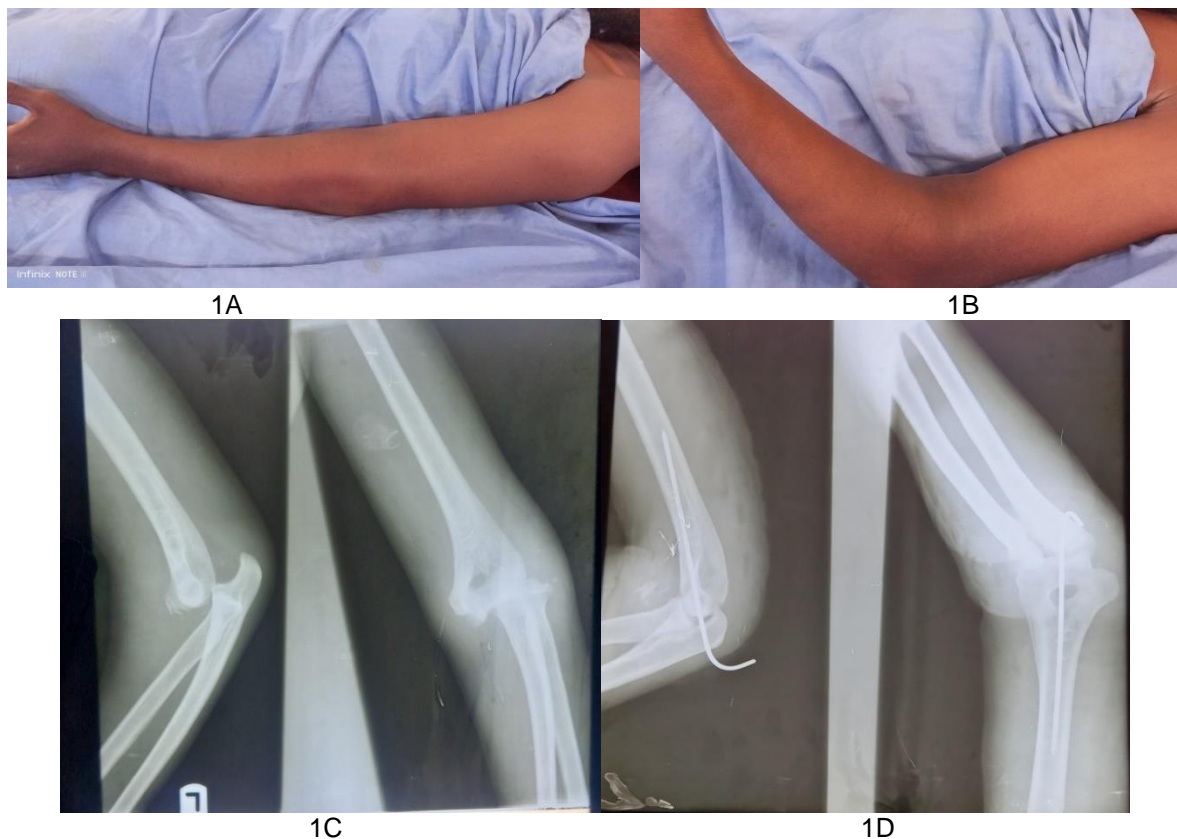
**Table 2. Maximum flexion angle of dislocated elbow at presentation**

Maximum elbow flexion	<11°	11°-20°	21°-30°	31°-45°
Number	26	5	3	4
Percentage	68%	13%	8%	11%%

## 2.1 Technique

All our patients had general anaesthesia and were positioned in lateral decubitus with the affected arm placed outward on a pad and the posterior aspect of the elbow exposed with the forearm hanging. Tourniquet was applied on the proximal arm. Posterior approach and a triceps tongue raising method were employed to gain access to the elbow joint (Fig. 2A). Following routine superficial and deep dissection, the ulnar nerve was identified and protected with use of elastic band. Following capsulotomy to expose the joint, ligaments adhesions and fibrosis mainly in the olecranon fossa were noted, and appropriate release and fibrolysis were done (Fig. 2B). Heterotopic ossifications were present in four patients and one patient had healed minimally displaced radial head fracture, while the second patient had medial epicondyle avulsion fracture. The non-united avulsion fracture was fixed successfully with a screw following fracture edges preparation for

revascularisation before achieving adequate reduction. Before attempt was made to completely release and mobilise the joint, Speed V-Y plasty of the triceps [14] was firstly done in all our patients irrespective of the time of presentation as the degree of stiffness (<40) was high (Table 2). Thereafter, continuous gentle elbow flexion was attempted while at the same time ligamentous and capsular releases were simultaneously done in most of our patients (Fig. 2B). Most of the collateral ligaments were detached because of the degree of contracture and this aided joint motion during reduction after the triceps procedure. The detached ligaments were not reconstructed but reattached to the adjoining fibrous tissues to avoid excessive tension. The elbow joint was held at 90° flexion after passing single 2.5mm thickness k wire through the Olecrano-Humerus, and haemostasis was achieved after release of tourniquet. The wounds were closed in layers (Fig. 2C) over a drain and the limb supported with a plaster of Paris (P.O.P) backslab in the



**Fig. 1. Preoperative clinical picture (A & B) and Radiograph (C); immediate postoperative radiograph (D)**



**Fig. 2. Intraoperative pictures**

majority of our patients. Then postoperative X-ray was taken to evaluate the elbow joint alignment and confirm the K wire position (Fig. 1D). The K wires were left in situ for an average of 4 weeks (range 3 to 6 weeks). Thereafter, rehabilitation was commenced for elbow range of motion with an aim to achieve near or full elbow motion. In addition to the other postoperative medications, oral Indomethacin was routinely given to all our patients for heterotopic ossification prevention. During the postoperative period before the k wire removal, patients were also encouraged to actively mobilise the elbow joint to facilitate subsequent joint motion exercises. Patients were followed up on clinic visits with continuous active and passive elbow movement, and Mayo elbow performance index (MEPI) score [15] was used to assess the outcome of surgery at a regular interval while on follow up appointments at 6 weeks, 12 weeks, 6 months, 1 year and subsequently for those selected patients that require extended rehabilitations (Fig. 3).

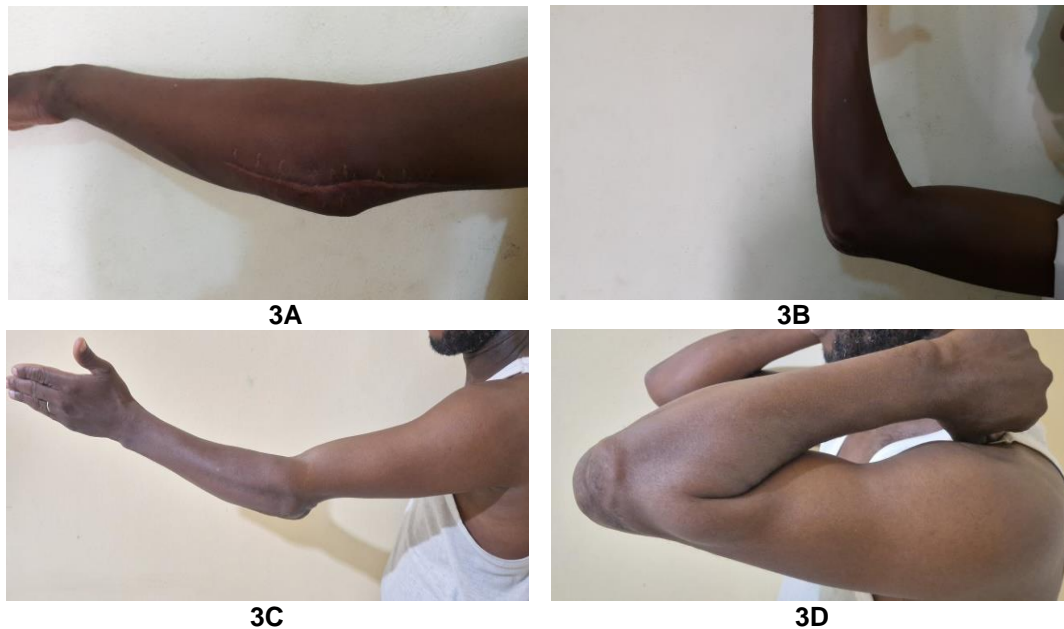
### 3. RESULTS

The patients' mean follow up was 21 months (16 to 26 months). At the final follow up, MEPI score

was used to assess the outcome of all the 38 operated patients in our study, with 29 (76%) patients having excellent results, 3 (8%) with good results, 5 (13%) with fair results, and 1 (3%) with poor result. The overall mean MEPI score before operation was 54 and was 88 after the operation (Table 4). On the scale of pain, the mean score was 42; for the flexion the mean score was 118° (Table 5), with the lowest (45° to 95°) among 5 patients (13%), and highest (135°) among 26 patients (68%); for the stability score, all except 1 patient achieved anatomical congruency of both Ulna-humeral and radio-capitella joints. The mild instability on the non-dominant hand was well tolerated. Three patients had postoperative wound infection which was treated with antibiotics and wound dressings. One patient among the three with wound infection had debridement before the wound healed. Two patients developed heterotopic ossification around the affected elbow which was detected early and was treated with physiotherapy and continuous reassurance. The maximum flexion angle attained in these patients was 95°. The 2 patients that presented with ulnar nerve deficit preoperatively improved with physiotherapy on follow up; however, there were 5 patients that developed neuropraxia

**Table 3. Mayo Elbow Performance Index (MEPI) Score**

Assessment	Scores
PAIN (Max.,45 points)	<ul style="list-style-type: none"> <li>• None (45 points)</li> <li>• Mild (30 points)</li> <li>• Moderate (15 points)</li> <li>• Severe (0 points)</li> </ul>
Range of Motion (Max.,20 points)	<ul style="list-style-type: none"> <li>• Arc &gt;100 degrees (20 points)</li> <li>• Arc 50 to 100 degrees (15 points)</li> <li>• Arc &lt; 50 degrees (5 points)</li> </ul>
Stability (Max.,10 points)	<ul style="list-style-type: none"> <li>• Stable (10 points)</li> <li>• Moderately unstable (5 points)</li> <li>• Grossly unstable (10 points)</li> </ul>
Function (Max.,25 points)	<ul style="list-style-type: none"> <li>• Able to comb hair (5 points)</li> <li>• Able to feed oneself (5 points)</li> <li>• Able to perform personal hygiene task (5 points)</li> <li>• Able to put on shirt (5 points)</li> <li>• Able to put on shoes (5 points)</li> </ul>



**Fig. 3. Postoperative 34 year old male patient at 1 year follow up (3A & 3B); at 3 year follow up (3C & 3D)**

**Table 4. Patients' outcome based on MEPI Scores**

Score	90-100 (Excellent)	75-89 (Good)	60-74 (Fair)	<60 (Poor)
Patient number	29	3	5	1
Percentage	76%	8%	13	3%

**Table 5. Elbow flexion angle achieved during follow up on the scale of MEPI flexion score**

Maximum elbow flexion	>100°	50°-100°	<50°
Number	32	5	1
Percentage	84%	13%	3%%

postoperatively that resolved within the first 3 months of postoperative management including regular physiotherapy. Twelve patients (32%) had persistent postoperative elbow fixed extension deformity of less than 5°; only one patient did not achieve flexion beyond 40° due to poor compliance with postoperative physiotherapy. Table 6 lists all the postoperative complications.

#### 4. DISCUSSION

The presentation and management of elbow dislocation may have a different dimension in the developing countries with a delay in presentation due to several factors, largely socio-cultural and financial [16]. The consequence of such delay results in an old unreduced neglected elbow dislocation which is defined as a dislocation presenting after 3 weeks of its occurrence. The

management of this poses a great challenge to an orthopaedic surgeon because of the changes in soft tissue pliability with associated ligament and capsular fibrosis [17]. Thus, giving rise to increasing difficulty in achieving joint congruency due to presentation in an extended forearm with consequence of interference with patient's activities of daily living. Because these patients often sought the expertise of traditional bone setters (TBS) first, it has further added to the difficulty in its management by the orthopaedic surgeon [18]. Our study indicated higher frequency among male gender and the left elbow was more affected than the right, similar to what other previous studies reported [19]. Meanwhile, a study reported by Salihu M.N et al [20], which was similar to our findings with regards to road traffic accident being the most common cause of elbow dislocation injuries in 21(55%) of our cases; most studies, however, showed fall from

height to be the number one cause of elbow dislocation among their study patients. The reason for the difference in cause distribution in our study may be related to non-protective use of motorcycle as one of the major means of transportation in our environment. This is in keeping with the average age of affected patients in our study to be at 32years who happened to be the age group to commonly utilize motorcycle ride [21].

The goal of treatment is to achieve a functional range of elbow joint motion through anatomical reduction to arrive at a stable elbow. Treatment options exist depending on the chronicity and level of soft tissue fibrosis and associated complications. When presented early, simple closed reduction may suffice to achieve desirable outcome in uncomplicated cases. However, an old unreduced elbow dislocation in the presence of significant ligament and capsular fibrosis, open reduction may be the only option and this can be in form of open reduction with or without stabilization with K wire; open reduction with triceps lengthening and soft tissue release; hinged external fixator, excisional arthroplasty; arthrodesis; and total elbow replacement [8,22].

Based on our results and many other studies, open reduction with triceps tendon lengthening was the preferred choice because of the combined chronicity and marked flexion deficit (1). The upper limb attitude presented in these patients indicated the general pattern of delay in presentation and initial management by the TBS. The usual elbow splinting position was in extension which is left unmoved for many weeks. This may lead to inadequate restoration of elbow flexion in the presence of both the joint surface incongruence and marked soft tissue fibrosis and contracture around the dislocated elbow joint after the splint was removed. The extreme limitation of elbow flexion in our patients has clearly differentiates report of our study from other studies on old unreduced elbow dislocation in which varying degree of higher elbow flexion was presented; and their treatment included options other than use of open reduction with triceps lengthening [23,24,25].

Complications following surgery in our patients included postoperative wound infections in 3 patients, ulnar nerve neuropraxia in 5 patients, and heterotopic ossifications in 2 patients. These resolved following instituted management within 3 to 6 months of surgery. The heterotopic ossification developed despite use of

prophylactic dose of oral Indomethacin at immediate postoperative period in accordance with general recommendation for its prevention [26,27]. These complications were also found in most studies with prolonged neglected posterior elbow dislocation even following open reduction [28]. One patient with postoperative elbow stiffness due to poor physiotherapy compliance did not require arthrolysis as suggested in other study [29], but did well on reinstated rehabilitative therapy. The extension lag was found in 12 (32%) patients despite use of vigorous physiotherapy and was generally not a burden on the daily activities of living.

The average MEPI score in our study was 88 indicating overall excellent to good outcomes and this was closely related to many other studies with use of operative reduction procedure for the old unreduced elbow dislocations [30,31]. In most cases the open treatment to elbow dislocation was through posterior approach. However, in a recent study by T. Sumarwoto et al used double approaches (medial and lateral incisions) to treat nine patients with posterior elbow dislocations following an average delay of 3.44 Months. The MEPI scores were excellent in 4 patients and good in 5 patients indicating a favourable study outcome [32].

**Table 6. Summary of complications after surgery**

Postoperative Complications	Frequency	Outcome
Postoperative wound infections	3	Treated
Ulnar nerve neuropraxia	5	Resolved
Heterotopic ossifications	2	Improved
Elbow stiffness	1	Improved
Elbow instability (Non-dominant hand)	1	Mild & Tolerated
Extension lag (<5°)	12	Mild and Tolerated

## 5. CONCLUSION

The functional outcome of the old unreduced elbow dislocations with severe extension deformity can be satisfactory following open reduction and V-Y Tricepsplasty. The less than 45° elbow flexion presentation warranted the need for V-Y tricepsplasty in our entire patients. This has yielded desired and satisfactory outcomes in the majority of our patients.

## ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

## CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Naidoo KS. Unreduced posterior dislocations of the elbow. *J Bone Joint Surg Br.* 1982;64:603–606.
2. Freeman III BL. Old unreduced dislocations. In: AH Crenshaw, ed. *Campbell's Operative Orthopaedics*, 9th edn. St. Louis: Mosby. 1998;2673–2674.
3. Mehta S, Sud A, Tiwari A, et al. Open reduction for late-presenting posterior dislocation of the elbow. *J Orthop Surg.* 2007;15:15–21.
4. Jupiter JB. Trauma to the adult elbow fractures of the distal humerus. In: BD Browner, AM Levine, PG Trafton, eds. *Skeletal Trauma*. Philadelphia: Saunders. 1992;1141.
5. King GJW. The complex dislocations of the elbow. In: A Celli, L Celli, BF Morrey, eds. *Treatment of Elbow Lesions*. Milan: Springer. 2007;1033.
6. DeLee JC, Green DP, Wilkins KE. Fractures and dislocations of the elbow. In: CA Rockwood, DP Green, eds. *Fractures in Adults*, 2nd edn. Philadelphia: Lippincott, 1984;559.
7. Linscheid RL, Wheeler DK. Elbow dislocations. *JAMA.* 1965;194:1171–1176.
8. Rockwood CA. Treatment of old unreduced posterior dislocation of elbow. In: Rockwood CA, editor. *Rockwood and Green's fracture in adults*. 4th ed. Philadelphia: Lippincott-Raven. 1996;1:975–6.
9. Islam S, Jahangir J, Manzur RM, Chowdury AAA, Tripura N, das A. Management of neglected elbow dislocations in a setting with low clinical resources. *Orthop Surg.* 2012;4(3):177-181.
10. Morrey BF, Askew LJ, Chao EY. A biomechanical study of normal function of elbow motion. *J Bone Joint Surg Am.* 1981;63:872-7.
11. Naidoo KS. Unreduced posterior dislocation of the elbow. *J Bone Joint Surg Br.* 1982;64:603-6.
12. Bruce C, Laing P, Dorang J, Kleneman L. Unreduced dislocation of the elbow: Case report and review of literature. *J Trauma.* 1993;35:962-5.
13. Allende G, Freyetes M. Old dislocation of the elbow. *J Bone Joint Surg.* 1944; 26:691-706.
14. Longo UG, Franceschi F, Loppini M, Maffulli N, Denaro V. Rating systems for evaluation of the elbow. *British Medical Bulletin.* 2008;87(1):131-61.
15. Coulibaly NF, Tiemdjo H, Sane AD, Sarr YF, Ndiaye A, Seye S. Posterior approach for surgical treatment of neglected elbow dislocation. *Orthopaedics & Traumatology: Surgery & Research.* 2012;98(5):552-8.
16. Panteli M, Pountos I, Kanakaris NK, Tosounidis TH, Giannoudis PV. Cost analysis and outcomes of simple elbow dislocations. *World Journal of Orthopedics.* 2015;6(7):513.
17. Morrey B, Sanchez-Sotelo J, Morrey M. Elbow Stiffness: Basic Science and Overview dislocations. In: *The Elbow and Its Disorders*. 5th éd. Philadelphia: Elsevier Inc. 2018;529-34.
18. Ekere AU, Echem RC. Complications of fracture and dislocation treatment by traditional bone setters: a private practice experience. *Nigerian Health Journal.* 2011;11(2):59-66.
19. Matelenok YM. Treatment of neglected complex dislocations in the elbow joint (clinical case). *Orthopaedics, Traumatology & Prosthetics/Ortopediia, Traumatologija i Protezirovanije.* 2023;(3).
20. Salihu MN, Arojuraye SA, Alabi AI, Mustapha IU, Okoh N, Ayeni FB. Old unreduced elbow dislocation: Patients' perspectives on outcome of open reduction. *The Surgeon.* 2021;19(2):87-92.
21. Clarke DD, Ward P, Bartle C, Truman W. In-depth study of motorcycle accidents. *Road Safety Research Rep.* 2004;54.
22. Pal CP, Mittal V, Dinkar KS, Kapoor R, Gupta M. Neglected posterior dislocation of elbow: A review. *Journal of Clinical Orthopaedics and Trauma.* 2021;18:100-4.



23. Kachnerkar NI, Lakde N, Salokhe S. Neglected old posterior dislocation of elbow: treatment and results of open reduction. *Int J Orthop Sci.* 2017;3(3o):1062-6.
24. Nicola L, Birhanu A, Aselefech G, Giovanni M. Outcome of open reduction for the neglected posterior dislocation of the elbow in a low-to-middle income country. *Tropical Doctor.* 2016;46(2):96-100.
25. Islam MS, Jahangir J, Manzur RM, Chowdury AA, Tripura N, das A. Management of neglected elbow dislocations in a setting with low clinical resources. *Orthopaedic Surgery.* 2012;4(3):177-81.
26. Atwan Y, Abdulla I, Grewal R, Faber KJ, King GJ, Athwal GS. Indomethacin for heterotopic ossification prophylaxis following surgical treatment of elbow trauma: A randomized controlled trial. *Journal of Shoulder and Elbow Surgery.* 2023;32(6):1242-8.
27. Tangtiphaiboontana J, Agel J, Beingsner D, Hébert-Davies J. Prolonged dislocation and delay to surgery are associated with higher rates of heterotopic ossification in operatively treated terrible triad injuries. *JSES international.* 2020;4(2):238-41.
28. Potini VC, Ogunro S, Henry PD, Ahmed I, Tan V. Complications associated with hinged external fixation for chronic elbow dislocations. *The Journal of Hand Surgery.* 2015;40(4):730-7.
29. AyADi D, ETiEnnE P, Burny F, SCHuinD F. Results of open arthrolysis for elbow stiffness. A series of 22 cases. *Acta Orthop Belg.* 2011;77(4):453-7.
30. Kapukaya A, Ucar BY, Gem M. Open reduction and Kirschner wire fixation with triceps lengthening for neglected elbow dislocations. *Journal of Orthopaedic Surgery.* 2013;21(2):178-81.
31. Iordens GI, Den Hartog D, Van Lieshout EM, Tuinebreijer WE, De Haan J, Patka P, Verhofstad MH, Schep NW, Collaborative DE. Good functional recovery of complex elbow dislocations treated with hinged external fixation: a multicenter prospective study. *Clinical Orthopaedics and Related Research®.* 2015;473(4):1451-61.
32. Sumarwoto T, Hadinoto SA, Aprilya D, Bayudono S, Siswanto T. Functional outcomes of neglected elbow dislocation treated with double approach surgery. *Orthopedic Research and Reviews.* 2023:175-81.

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