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Case Report

Surgical Management of an Unusual Elbow dislocation with radial shaft fracture and annular ligament disruption: A Case Report

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Abstract

Study design: A report of a rare case of transverse dislocation of the elbow (both ulna and radius) associated with fracture of the shaft of the ipsilateral radius and description of annular ligament plasty performed.

Objective: Describe and identify a rare pattern of elbow dislocation associated with radial shaft fracture using an alphanumeric code, which avoid confusion in forearm fracture–dislocations nomenclature and help surgeons with detection of lesions and guiding surgical treatment.

Introduction: Transverse dislocation of the elbow is a rare injury and most of the cases have been described in paediatric patients. Association of this injury with fracture of forearm bones is rare and has been also unknown since the new locker-classification system of forearm fracture-dislocation has been presented in 2020.According to this classification is possible to distinguish between simple dislocations and complex dislocations (fracture–dislocations) of the forearm joint and furthermore to identify every pattern possibility of fracture-dislocations. In this case, report a complex dislocation of the forearm and its surgical management is described.

Presentation of case: A 36-year-old male patient sustained trauma to his left upper limb during sport activity. Radiographic evaluation revealed transverse dislocation of the elbow and fracture of the shaft of the ipsilateral radius. Open fixation of the fracture with closed reduction of the elbow was carried out followed by annular ligament plasty with triceps tendon to treat the residual radial head dislocation.

Conclusion: The aim of this case report is to illustrate an alternative technique, not well described in literature to treat cases of severe elbow instability, because of elbow fractures. The use of a lateral string of triceps tendon for annular ligament reconstruction avoids triceps tendon weakening and provides a better clinical outcome. It is also important, as described in literature; the use of the appropriate classification system to avoids misdiagnosis and heal delay because of a complex forearm injury.

Keywords: Elbow dislocation; Fracture; Annular ligament plasty; Trauma

Introduction

The forearm has to be considered as a single functional unit [1,2] made of radius and ulna, distal radioulnar joint (DRUJ), middle radioulnar joint (MRUJ) and proximal radioulnar joint (PRUJ), respectively stabilized by the triangular fibrocartilage complex, the interosseus membrane (IOM) and the annular ligament [3] . The three joints of the forearm are classified in two groups: anatomical joints and functional joints. The anatomical ones are the distal radioulnar joint (DRUJ) and proximal radioulnar joint (PRUJ), the functional one is the middle radioulnar joint (MRUJ) made of forearm bones and IOM [1,4]. These structures are also known as forearm "lockers" that allow the forearm stability. According to Elzinga K. et al the forearm unit acts like a ring distributing the mechanical stress along the arc [3,5]. If one component of the forearm ring results, injured, other associated lesions need to be excluded in order to avoid a destabilization of the forearm. The IOM itself is formed by distal membranous portion, central band (which is the most functionally important component), dorsal oblique accessory cord and finally proximal oblique cord [6,7]. The use of new classification systems allows identifying different patterns of fracture-dislocation avoiding the misdiagnosis of a forearm injury. Herein we present a case of forearm fracture-dislocation misdiagnosis treated by a two-step approach.

Case Report

A 36-year-old male was admitted to our Emergency Unit reporting accidental trauma to his left upper limb during sport activity complaining of forearm and elbow pain. The medical history was collected. No other comorbidities or previous surgeries were reported. At physical examination, there were swelling, and deformity of the elbow associated with tenderness over the radial shaft. Movements at the elbow were limited and painful. There were no associated injuries or distal neurovascular deficit. X-ray evaluation revealed dislocation of the radio-humeral, ulno-humeral and the proximal radioulnar joint with fracture of the radial shaft. The distal radioulnar joint (DRUJ) was not injured (Figure1). Closed reduction of the elbow dislocation was attempted without success in the emergency room. Immediately the patient underwent surgery to manage the radial shaft fracture and dislocation of the elbow. The reduction of the dislocation was carried out, and it was apparently found to be stable during the intraoperative X-ray control. Open reduction and internal fixation of the radial shaft fracture was performed using Synthes DCP plate and six screws .The standard Henry approach was used to expose the fracture preserving the interosseous nerve. Then, a long arm plaster valve was applied. On the first post-operative day the X-ray control showed a residual anterior radial head dislocation (Figure 2). A 3D TC of the left arm was performed in order to assess alterations in the synthesized radius of either shortening or lengthening which could lead to residual elbow dislocation (Figure 3). Considering the residual radial head dislocation, there was a clear injury of the forearm lockers (the annular ligament and the IOM). The fracture-dislocation has been classified as 1.2I according to the locker-based classification proposed by Artiaco [1]. Two days after surgery the patient was re-operated in order to reduce the dislocation by repairing the annular ligament. The Kocher approach was used to expose the radiohumeral articulation. A lesion of the Lateral Collateral Ligament and an unrepairable break of the annular ligament were observed. Furthermore the instability of the proximal radioulnar joint (PRUJ) was confirmed during pronosupination manouver. A strip from distal triceps tendon was isolated and used for the reconstruction of the annular ligament. It was detached from the lateral side (Figure 4), with care to preserve its attachment to the olecranon. The strip was transposed under the anconeus muscle and kept around the radial head. Pronosupination manouver, keeping a tension on triceps tendon strip loop was performed to assess the stability of the PRUJ (Figure 5). Then the loop was fixed by a corkscrew on the supinatory crest of the ulna. Then, the repair of the LCL by the fixation on the humeral epicondyle by one corkscrew was performed (Figure 6). At the end, a long arm plaster valve was applied and retained for two weeks, followed by a month of articulated brace with free flexion and extension.The post-operative x-ray control after one month showed PRUJ stability underlined by the evidence of an engrave under the radial head which represents the tensioning work done by the annular ligament (Figure 7). On clinical follow up one month and six months after surgery pronosupination, flexion and extension of the elbow were restored (Figure 9-10). No post-operative complications occurred and the fracture healing was assessed (Figure 8).

Pattern	1 (PRUJ)	2 (MRUJ)			3 (DRUJ)	Description
Two-locker injuries						
1.2I	X	X				Isolated radial head fracture
1.2IU	X	X	X			Monteggia fracture-dislocation
1.2IR	X	X		X		
1.2IRU	X	X	X	X		
2I.3		X			X	Isolated dislocation of ulnar head
2IR.3		X		X	X	Galeazzi injury
2IU.3		X	X		X	Never described
2IRU.3		X	X	X	X	
1.3	X				X	Leung crisscross injury
Three-lockers injuries						
12I.3	X	X			X	Essex-Lopresti injury
1.2IRU.3	X	X	X	X	X	
1.2IR.3	X	X		X	X	
1.2IU.3	X	X	X		X	

Table 1: Description of possible combinations of forearm fracture–dislocation patterns. Each lesion is described based on the anatomical structures involved in each type of forearm fracture–dislocation.

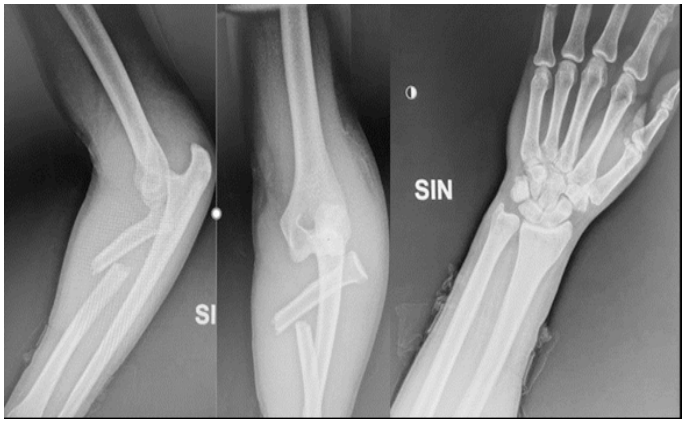

Figure 1: Left elbow, forearm and wrist X-rays.

Figure 2: Post-operative X-rays of the left forearm.

Figure 3: Post-operative CT of the left forearm.

Figure 4: Strip from the lateral side of distal triceps tendon was isolated and detached.

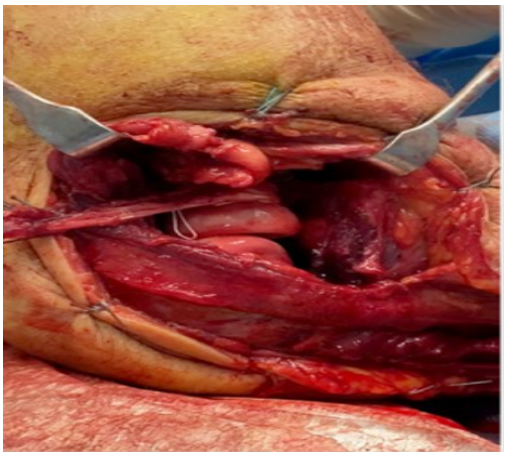

Figure 5: Tensioning of the triceps tendon strip loop during pronosupination manouver performed to assess the stability of the PRUJ.

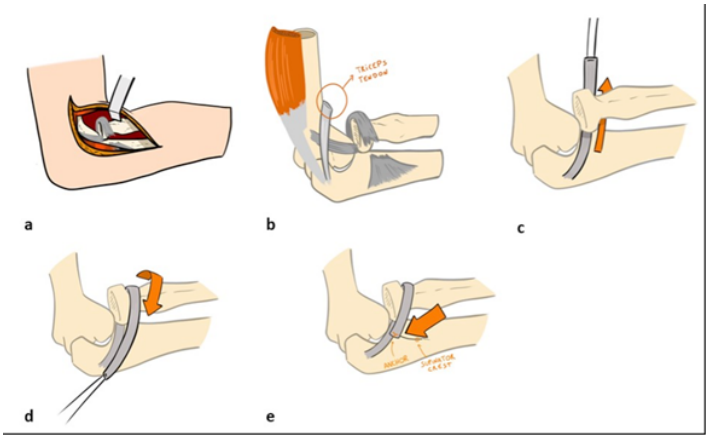

Figure 6: Surgical steps performed drawings: a) Kocher approach, b) strip of lateral distal triceps tendon isolated and detached, c) transposition of the tendon, d) tendon strip looped around the radial neck and e) fixation of the neo annular ligament on the supinatory crest of the ulna.

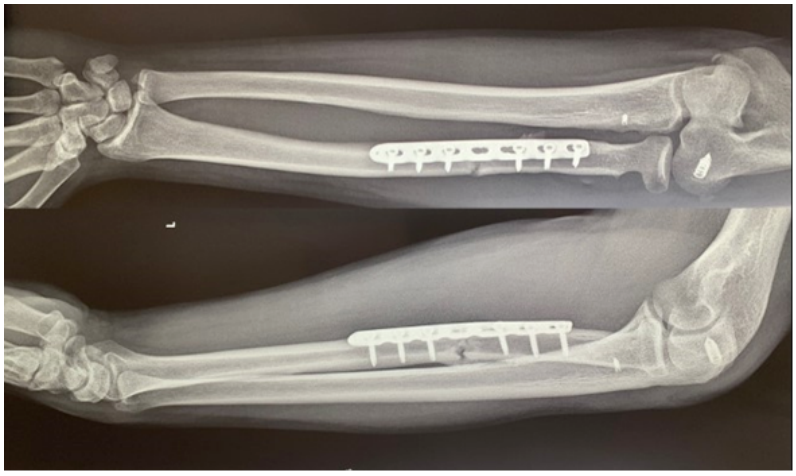

Figure 7: One month post-operative x-ray control of the left forearm.

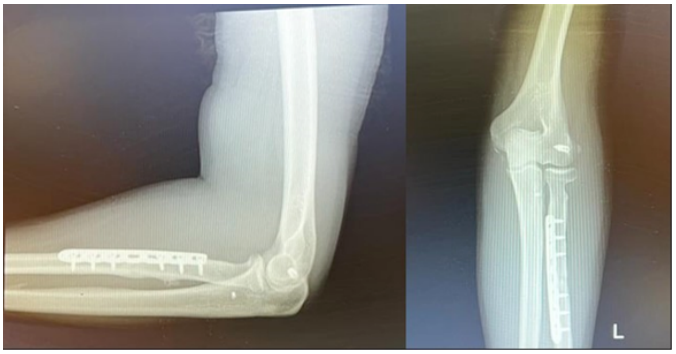

Figure 8: Six months post-operative x-ray control of the left forearm.

Figure 9: Clinical evaluation of pronosupination and flexion of the left elbow one month after surgery.

Figure 10: Clinical evaluation of extension of the left elbow one month after surgery.

Discussion

The surgical management of forearms lesion is challenging and several techniques have been proposed to give stability to this complex functional unit [1]. In fact, the forearm stability derives from a system of "lockers", and it is not compromised if one locker is injured but when two or three lockers are involved, in which case surgery is required [1]. Despite several patterns of forearm injuries have been described, the classification by Monteggia, Galeazzi and Essex-Lopresti are still widely used in the clinical practice. In a study by Lendemans et al., Galeazzi, Monteggia and Essex-Lopresti were included in a group of injuries involving the instability of the distal or proximal radioulnar joint combined with forearm fracture [8,9]. Recently, Artiaco et al. developed a new alphanumeric classification considering the forearm joint concept and three-locker system [1,2,10]. According to this new classification, every pattern of fracture-dislocation involving two- and three-locker injures can be distinguished and identified. This locker-based classification system consists of numbers and letters, which refer respectively to: (1) PRUJ, (2) MRUJ, (3) DRUJ, (I) interosseus membrane, (U) ulnar fracture and (R) radial fracture. Therefore, nine different patterns of fracture-dislocation involving two-lockers and further four patterns of fracture-dislocation involving three-lockers injury have been described (Table1). As demonstrated in our case report this classification could be helpful for surgeons for the choice of the best treatment to perform. The fracture-dislocation of our case was classified as "radial shaft fracture with a coexistent dislocation of the elbow". This diagnosis led to perform the open fixation of the fracture and the elbow closed reduction without verifying any locker lesions. The residual elbow dislocation, more precisely anterior radial head dislocation, after radial fracture fixation suggested two-locker damage: IOM and annular ligament. In literature, it has been stated that the annular ligament is the most important structure in maintaining the anatomical position of the radial head and so the stability of the PRUJ and any surgical attempt at reduction of the radial head without annular ligament reconstruction is doomed to failure and recurrent dislocations [11]. In reconstructive surgery for chronic dislocation of the radial head, have been described loss of elbow function, redislocations and complications (osteolytic changes, narrowing or growth disturbance of the radial neck in children, and restricted pronation and supination) [12-14] . Despite these complications may occur after surgery, the impairment of the joint due to persistent dislocation of the radial head, may be more troublesome [15]. Aware that a misdiagnosis of the fracture-dislocation occurred before the use of the new classification system, the correct pattern of the lesion was identified, and a second-step surgery was needed in order to obtain radial head reduction and PRUJ stability. During the first step of the surgery, the fixation of the radius fracture was carried out, while during the second step the repair annular ligament was obtained performing the annular ligament plasty with a strip of triceps tendon. Nowadays there are different possibilities of annular ligament reconstruction by using nylon or silk thread, free tendon or free fascia graft, a strip from the triceps tendon and the fascia from forearm [11,15-23]. Reviewing the literature, several authors, using any form of annular ligament reconstruction, have reported good results in most of their cases [11,16,17,20,21]. According to Goyal et al, palmaris longus tendon graft is another option that has been considered for the annular ligament plasty [24] and it requires smaller surgical incision, a shorter duration of surgery, and consequently led to a lower infection rate compared with the triceps fascia harvest [25]. Ghinea et al described the technique of annular ligament plasty using the extensor carpi radialis longus (ECRL) tendon to reduce the risk of reabsorption of the neoligament and to avoid an excessive limitation of the pronation and supination [26]. Lloyd-Roberts et al. preferred reconstruction with the triceps tendon because of the use of one surgical field for the isolation of the strip and the performance of the ligament plasty [22]. In 1977 Bucknill also described the surgical annular ligament reconstruction technique using triceps tendon which had been sutured itself after passing it around the radial neck. He's paper underlines how suitable is a lateral strip of triceps tendon for annular ligament reconstruction rather than a central triceps tendon strip as described by Bell Tawse [12,27]. In fact the use of a lateral strip of triceps tendon is more suitable because avoids triceps tendon weakening and also provides a better clinical outcome. To prove this, Bucknil [27] published a case series of 8 children affected by unilateral radial head dislocation treated with open reduction and reconstruction of the annular ligament with a strip of triceps tendon mobilized from the lateral border. Unlike our case Bucknill performed a posterolateral approach (described by Boyd) and the tendon strip was passed round the medial side of the radial neck and back through a hole drilled in the ulna [27]. All data collected by reviewing literature about surgical approach,

type of graft used, patient's mean age and number of cases has been reported in Table 2. The technique used for this case it's different and new from the other reported. Forty-five days after surgery, the left elbow showed static and dynamic stability and the ROM was successfully restored. In fact, 3 months after surgery, the X-ray showed the notching of the radial neck caused by the neo annular ligament tensioning.

Author	N. Of cases	Mean age (years)	Surgical approach	Annular ligament reconstruction
Bucknil [27]	28	7,5	Boyd	A lateral strip of triceps tendon
Gyr et al. [11]	15	6,1	Boyd	A central strip of triceps tendon
Lloyd et al [22]	8	5,5	Boyd	2 Palmar tendon and Kirschner wire 6 Triceps sling and Kirschner wire
Wang et al. [16]	13	8,3	Boyd	Free fascia lata graft
Marinello et al [28]	2	19	Kocher	A lateral strip of triceps tendon detached form his origin (sutured on the ulnar shaft)
Hatta et al [29]	1	13	Kocher	Palmaris lungus

Table 2: Data collected by reviewing literature regarding fracture-dislocation of the forearm.

Conclusions

The correct use of a complete classification system of locker-based forearm fracture-dislocation allows identify the correct pattern of fracture-dislocation avoiding misdiagnosis, avoiding heal delay and performing the best surgical treatment for patients. This type of injuries could be surgically approached in different ways and there is no consensus in literature. With this case, report we want to show a new successful technique performed in a 36 years old man. 45 days after surgery the ROM of the elbow was completely restored with an acceptable static and dynamic joint stability. The patient has underwent to closer clinical and radiological check up and 3 months after surgery the X-rays has showed a notching of the radial head as a sign of a suitable tensioning of the annular ligament.

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References

1. Artiaco S, Fusini F, Sard A, Dutto E, Masse A, et al (2020) Fracture-dislocations of the forearm joint: a systematic review of the literature and a comprehensive locker-based classification system. J Orthop Traumatol, 21: 21.
2. Soubeyrand M, Wassermann V, Hirch C, Gagey O, Dumontier C (2011) The middle radioulnar joint and triarticular forearm complex. J Hand Surg Eur Vol, 36: 447-454.
3. Adams JE (2017) Forearm Instability: Anatomy, Biomechanics, and Treatment Options. J Hand Surg Am, 42: 47-52.
4. LaStayo PC and M.J Lee (2006) The forearm complex: anatomy, biomechanics and clinical considerations. J Hand Ther, 19: 137-144.
5. Elzinga, K. and Chung K (2019) Evolution of the Ring Concept for the Forearm and Its Implication on Treatment: From Galeazzi, Monteggia, Essex-Lopresti, and Darrach to the Current Era. J Hand Surg Asian Pac 24: 251-257.
6. Adams, JE, W Culp, and Osterman AL (2016) Central Band Interosseous Membrane Reconstruction For Forearm Longitudinal Instability. J Wrist Surg, 5: 184-187.
7. Noda, K, Goto A, Murase T, Sugamoto K, Yoshikawa H, et al (2009) Interosseous membrane of the forearm: an anatomical study of ligament attachment locations. J Hand Surg Am, 34: 415-122.
8. Soubeyrand, M, Lafont C, Georges R, Dumontier C (2007) [Traumatic pathology of antibrachial interosseous membrane of forearm]. Chir Main, 26: 255-277.
9. Lendemans, S, Taeger G, and Nast-Kolb D (2008) [Dislocation fractures of the forearm. Galeazzi, Monteggia, and Essex-Lopresti injuries]. Unfallchirurg, 111: 1005-14; quiz 1015-6.
10. Artiaco S (2021) Combined simple elbow dislocation and forearm joint injuries. A systematic review of the literature with injury patterns and current treatment rationale. Eur J Orthop Surg Traumatol, 2021.
11. Gyr, B.M, P.M. Stevens, and Smith JT (2004) Chronic Monteggia fractures in children: outcome after treatment with the Bell-Tawse procedure. J Pediatr Orthop B, 13: 402-406.
12. Bell Tawse, A.J (1965) The treatment of malunited anterior Monteggia fractures in children. J Bone Joint Surg Br, 47: 718-723.

13. Oner, F.C. and Diepstraten AF (1993) Treatment of chronic post-traumatic dislocation of the radial head in children. J Bone Joint Surg Br, 75: 577-581.

14. Best, T.N (1994) Management of old unreduced Monteggia fracture dislocations of the elbow in children. J Pediatr Orthop, 14: 193-199.

15. Eygendaal, D. and Hillen RJ (2007) Open reduction and corrective ulnar osteotomy for missed radial head dislocations in children. Strategies Trauma Limb Reconstr, 2: 31-34.

16. Wang, M.N. and Chang WN (2006) Chronic posttraumatic anterior dislocation of the radial head in children: thirteen cases treated by open reduction, ulnar osteotomy, and annular ligament reconstruction through a Boyd incision. J Orthop Trauma, 20: 1-5.

17. Cappellino, A, S.W. Wolfe, and Marsh JS (1998) Use of a modified Bell Tawse procedure for chronic acquired dislocation of the radial head. J Pediatr Orthop, 18: 410-414.

18. Attarian D.E (1993) Annular ligament reconstruction in chronic posttraumatic radial head dislocation in children. Contemp Orthop, 27: 259-264.

19. Fowles J.V, N Sliman, and Kassab MT (1983) The Monteggia lesion in children. Fracture of the ulna and dislocation of the radial head. J Bone Joint Surg Am, 65: 1276-1282.

20. Papandrea R. and P.M. Waters (2000) Posttraumatic reconstruction of the elbow in the pediatric patient. Clin Orthop Relat Res, 2000: 115-126.

21. Thompson J.D and A.B. Lipscomb (1989) Recurrent radial head subluxation treated with annular ligament reconstruction. A case report and follow-up study. Clin Orthop Relat Res, 1989: 131-135.

22. Lloyd-Roberts, G.C. and T.M. Bucknill, (1957)Anterior dislocation of the radial head in children: aetiology, natural history and management. J Bone Joint Surg Br, 59-B: 402-407.

23. Seel M.J. and H.A. Peterson (1999) Management of chronic posttraumatic radial head dislocation in children. J Pediatr Orthop, 19: 306-312.

24. Goyal T (2015) Neglected Monteggia fracture dislocations in children: a systematic review. J Pediatr Orthop B, 24: 191-199.

25. Garg, R, Fung KK, Chow SP, Ip WY (2007) Surgical management of radial head dislocation in quadriplegic cerebral palsy -- a 5 year follow-up. J Hand Surg Eur 32: 725-726.

26. Ghinea, CA, Gavriliu S, Vlad C, Japie E, Parvan A, et al (2013) Burnei's technique in the treatment of radial head displacement; innovative surgery. Study on two cases. J Med Life, 6: 26-33.

27. Bucknill, T.M (1977) Anterior dislocation of the radial head in children. Proc R Soc Med, 70: 620-624.

28. Marinello, P.G, Wagner T, Styron J, Maschke S, Evans PJ (2016) Annular Ligament Reconstruction With Triceps Autograft for Chronic Radial Head Instability. Tech Hand Up Extrem Surg, 20: 21-25.

29. Hatta, T, Shinagawa K, Hayashi K, Hasegawa K, Miyasaka Y, et al (2019) Ligament Reconstruction for Recurrent Anterior Dislocation of the Radial Head. Case Rep Orthop, 2019: 6067312.