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The Radial Nerve Entrapment in Pediatric Extension-Type Supracondylar Humeral Fractures. About Two Cases Reports

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Abstract

Radial nerve injuries in displaced extension-type supracondylar humeral fractures in children are well known. Entrapment in fracture of radial nerve is uncommon and rarely evocated in literature. We report two similar cases in the mechanism of injury, the clinical findings and the treatment and propose therapeutic guidelines.

Keywords

Entrapment, Radial Nerve, Exploration, Supracondylar Humeral Fractures

1. Introduction

Nervous and vascular injuries of supracondylar humeral fractures (SHF) in children are well-known [1]-[3]. In the extension-type fracture, it is more often the median nerve and the radial nerve (RN) than the ulnar nerve [1] [4]. Nervous injuries are commonly neurapraxia with spontaneous recovery by indirect trauma [5] [6]. The radial nerve entrapment in the fracture site is rarely reported [5] [7] [8]. We report two cases of RN entrapments in Rigault and Lagrange [9] type 4SHF and we discuss the anatomo-pathological patterns and the practical approach in emergency.

2. Cases Presentation

Two similar cases were observed in three years in our department.

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It was two eight years old school-boys, right-handed, who sustained closed traumas of a right elbow, for the one, and a left elbow, for the orther, after wrestling games. They felt on palms of theirhands with elbows in extension. At admission, examination found difformed swelling elbow with no vascular and nervous lesion. Radiographs of elbows showed posterolateral displaced supracondylar humeralfractures (SHF) classified type IV according Rigault and Lagrange Classification [9] (**Figure 1**). In order to soften elbows for closed reduction, members were suspended.

The next day, a reevaluation was made. Radial and ulnar pulses were present and symmetrical. It was a falling hand and a loss of active extension of thumbs. We found also a hypoesthesia of the dorsal side of hands. It was no deficit of median and ulnar nerves. The nervous lesion and the importance of fractures displacements motivated an open reduction and internal fixation (ORIF). The third day, under general anesthesia, a surgical exploration was performed by a medial approach. We found a musculoaponeurotic breach of the brachialis and lateral epicondylar muscles (**Figure 2**). A continuous radial nerve (RN) was found entrapped in fracture site (**Figure 3**). RNwereextricated softly with help of external maneuvers such as supination and flexion of elbows. Liberated nerves were contused with an intact perineurium (**Figure 4**). Fractures were reduced and fixed by two crossed K-Wires (**Figure 5**). The post-operative period was uneventful. Sensitivity recovered at seven months and motricity at 11 months. No electromyography was done by indisponibility. K-Wires were removed at three months.

The follow-up after 12 and 48 months showed good functional results according to the Flynn [10] criteria and complete neurologic recovery.

Figure 1. Anteroposterior view (a) and lateral view (b) radiographs of the elbow showing a posteromedial displaced type 4 supracondylar humeral fracture.

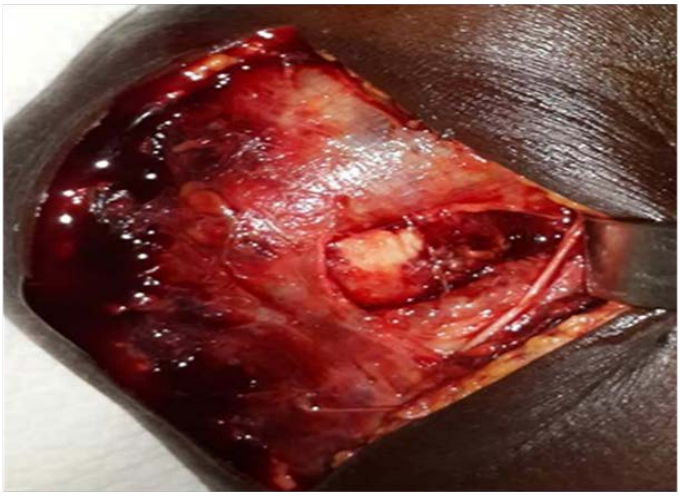

Figure 2. Medial approach of the elbow showing a brachialis musculo-aponeurotic breach.

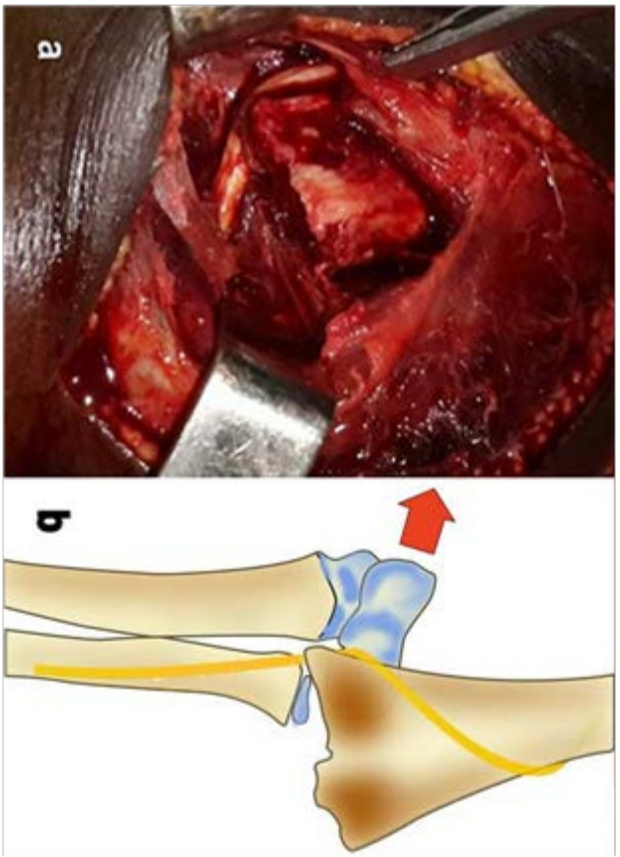

Figure 3. Per-operative (a) and illustration (b) images showing the radial nerve entrapment.

3. Discussion

Radial nerve (RN) lesions in the extension-type supracondylar humeral fractures (SHF) are rare (**Table 1**).

Delayed or missed diagnoses may explain this rare occurrence. In our cases, neurological lesions were found later. The primary neurological lesions are often misdiagnosed and missed [2] [3] [5] [7]. This is due to the

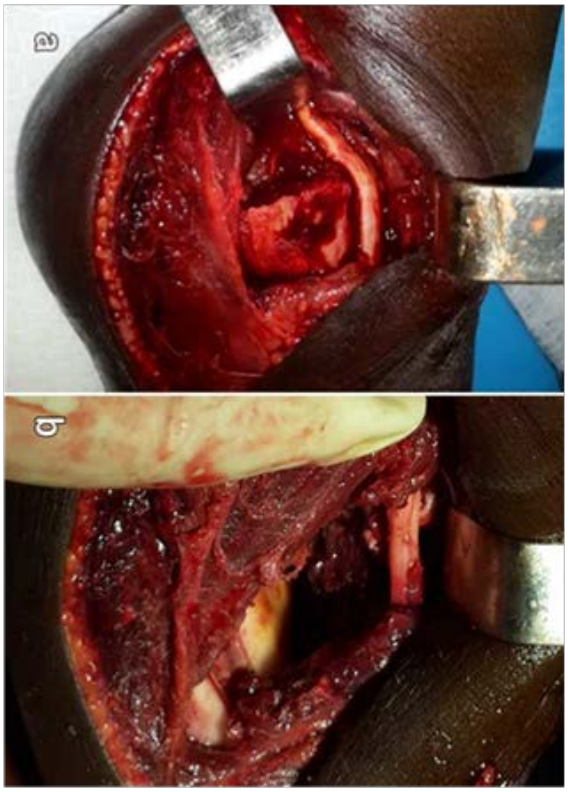

Figure 4. Per-operative images showing the radial nerve extrication (a) and the fracture reduction (b).

Figure 5. Post-operative anteroposterior view (a) and lateral view (b) radiographs of the elbow showing a reduced fracture with K-Wire internal fixation.

Table 1. Supracondylar humeral fractures (SHF) with neurological lesions.

Authors	Year	Cases (n)	Radial	Median	Ulnar	Entrapment	Laceration
Banskota[14]	1984	1	1	0	0	0	1
Mc Graw[11]	1986	17	4	9	4	0	1
Martin[15]	1989	1	1	0	0	0	1
Setton[5]	1992	11	11	0	0	1	1
Brown[3]	1995	23	12	5	6	0	0
Dormans[4]	1995	19	5	11	3	0	0
Campbell[12]	1995	23	8	15	0	0	0
Kiyoshige[13]	1999	6	3	3	0	0	0
Ramachandran[7]	2006	37	10	19	8	1	0
Babal[1]	2010	447	131	283	78	0	0
Tomaszewski[6]	2012	11	1	7	3	0	0
Garg[2]	2014	105	27	94	16	0	0
Kassé	2015	2	2	0	0	2	0

emergency context with many patients and young inexperienced physicians on the first line.

Statistically, high energy traumas that produce displaced fractures (Type 3 of Gartland and Type 4 Rigault and Lagrange) lead to neurological complications [11]-[13]. The radial nerve entrapment was evoqued in series with neurological injuries in DSHF without being focused [5] [7]. However, rare cases of the RN entrapment in a minimal displaced fractures have been reported [8].

The mechanism of RN injuries is the known in medial displaced DHSF. The nerve is contused by the lateral spicule of the proximal fragment and stretched by the postero-medial displacement. Kiyoshige *et al.* [13] stated that the RN was injured if the posteromedial displacement was over 190% of the diaphysis circumference.

The mechanism of radial nerve entrapment is not described in literarture. We think that the bone overlapping (over the distal epiphysis height) and the distal fragment pronation are determinants in the RN entrapment. An important bone overlapping allows the RN to be on the medial side of the proximal fragment and the entrapment to be possible (**Figure 1**). Our per-operative findings suggest that it is the fracture proximal fragment which herniated through the brachialis muscle and appears in the bicipitalgutter on the lateral side of the RN (**Figure 3**).

The practical approach of neurological complications associated to DHSF was discussed. The majority of authors propose a four-month clinical and electromyographic surveillance before any surgical exploration [2]-[6] [8]. The majority of these neurological injuries are contusion with a good outcome [5]. Otherwise, results of primary emergency surgical explorations are better than late surgical explorations [7]. We think that, in this particular situation, a surgical exploration must be undertaken in a postero-medially displaced DHSF associated with a RN palsy and a sub-cutaneous lateral hernia of the proximal fragment. The risk of aggravation of neurological status by any closed reduction attempt may compromise the neurologic prognosis. We found in literature four cases of RN lacerations due to closed maneuvers (**Table 1**) [5] [11] [14]. The magnetic resonance imaging (MRI) may be useful in emergency for these cases for confirmation of entrapment.

The RN entrapment must be evocated in the postero-medial displaced extension-type DHSF with RN palsy. So, we propose a surgical exploration in the postero-medial displaced extension-type DHSF with RN palsy and a lateral sub-cutaneous herniated proximal fragment.

Conflict of Interest

None.

Agreement of Family's Patients

OK.

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