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Case Report

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Proximal humerus fracture-dislocation in a pediatric patient: a case report

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ABSTRACT

Proximal humerus fractures in pediatric patients have a low incidence, accounting for less than 1% of all pediatric fractures. The association between a proximal humerus fracture and ipsilateral glenohumeral dislocation has an even lower incidence, particularly in patients under 5 years of age. We report the case of a 4-year-old female patient who presented with a proximal humerus fracture associated with an ipsilateral glenohumeral dislocation after falling from a height of 1.5 meters. A surgical procedure was performed under general anesthesia, consisting of closed reduction and percutaneous fixation of the fracture with two 1.6 mm k-wire. The fracture was protected with a universal shoulder immobilizer. Adequate clinical and radiological evolution was observed after one year of follow-up. Proximal humerus injuries in pediatric patients, given their low incidence, require expertise for proper diagnosis and management. Repots in the literature are scare, and therefore, a clear consensus on a treatment has not been reached. However, our treatment with a less aggressive approach compared to others reported in the literature showed adequate clinical and radiological results.

Keywords: Fracture, Dislocation, Pediatric humerus, Physeal injury

INTRODUCTION

Proximal humerus injuries are rare in children and adolescents, with an incidence of 6.8 fractures/10,000 children per year, and a significant proportion of these fractures occur between 11 and 15 years of age.[1] They represent 0.45% of all pediatric fractures.[2] According to Neer and Horwitz, fractures involving the proximal humeral physis account for 3% of all physeal injuries.[3] Trauma resulting in a proximal humerus fracture and ipsilateral glenohumeral dislocation is extremely rare in children, especially in those under 5 years of age.[4]

The proximal humeral physis is responsible for approximately 80% of the longitudinal growth of the humerus.[5] The high level of activity of this physis explains the advanced remodeling capacity of the proximal humerus in the pediatric population.[5] The younger the patient, the greater the remodeling capacity.

In children under 5 years of age, the proximal humeral physis has a transverse shape like a hockey puck. As the child grows, the shape of the physis becomes more conical.[6] The vascular supply to the proximal humerus is derived from the axillary artery. The anterior and posterior circumflex arteries branch off from the axillary artery.[7] The proximity of the axillary nerve to the proximal humerus makes it vulnerable to injury following a fracture, fracture-dislocation, or percutaneous fixation of the proximal humerus.

The axillary nerve is a branch of the posterior cord of the brachial plexus. It enters the quadrangular space along with the posterior circumflex artery and divides into anterior and posterior branches. These branches innervate

the deltoid and teres minor muscles and provide sensation to the lateral aspect of the shoulder.[7]

The pattern and displacement of proximal humerus fractures are often influenced by the patient's age and the mechanism of injury.[8]

Several mechanisms can be involved in the occurrence of proximal humerus fractures. In pediatric and adolescent patients, it may result from a direct injury to the affected shoulder or due to a fall onto an outstretched hand with the arm in an abducted and externally rotated position.[9]

The Neer-Horowitz classification for proximal humerus metaphyseal fractures distinguishes four grades. Types 1 and 2 are non-displaced or minimally displaced fractures (<5 mm and <1/3 of the diaphyseal diameter). Types 3 and 4 are fractures with more severe displacement (>1/3 of the diaphyseal diameter).[10] For epiphyseal fractures, the Salter-Harris classification can be used.[11]

CASE REPORT

We present a 4-year-old female patient, with no relevant medical history, who accidentally fell into an empty pool approximately 1.5 meters deep while engaging in recreational activities, sustaining indirect trauma to the left shoulder. This resulted in severe pain and functional limitation.

The patient was brought to the orthopedic emergency department of our hospital by a family member, where an anteroposterior radiograph of the left shoulder was performed (Figure 1), documenting a proximal humerus fracture with physeal involvement, associated with an ipsilateral anteroinferior glenohumeral dislocation. Clinically, deformity was found at the level of the left shoulder, with intense pain on mobilization. There were no signs of vascular or neurological damage. The diagnosis of "Fracture-Dislocation of the proximal humerus AO 11-M/3.2, Salter-Harris II, Neer-Horwitz IV" was established.

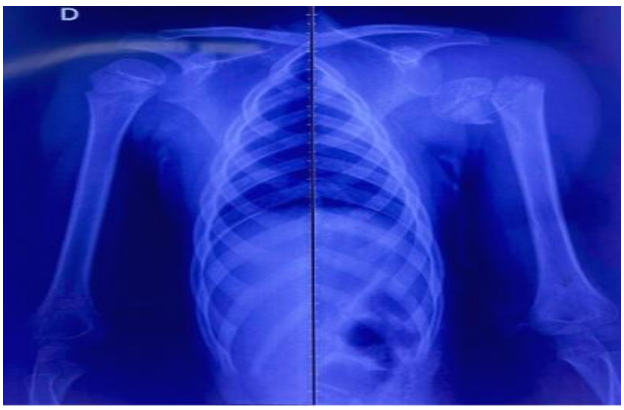

Figure 1: Comparative anteroposterior radiograph of the arm, showing a left glenohumeral dislocation associated with a Salter-Harris type II proximal humerus fracture.

Emergency management was proposed to the family, consisting of closed reduction under sedation, which was performed in the pediatric emergency area, with informed consent signed by the family member, using a traction-countertraction maneuver. A control radiograph was taken, showing unsatisfactory results, so emergency surgical management was decided. The procedure was performed under balanced general anesthesia, in a beach chair position for adequate fluoroscopic visualization, closed reduction, and stabilization of the fracture with two 1.6 mm K-wires (Figure 2).

Figure 2: Intraoperative anteroposterior radiograph of the left humerus, showing reduction of the glenohumeral dislocation and the fractured fragment.

Immediately post-operatively, a universal shoulder immobilizer was placed. The patient showed adequate evolution, and discharge was decided 24 hours post-surgery.

Fifteen days later, the patient presented to our hospital's emergency department, brought by a family member, reporting accidental removal of a Kirschner wire during dressing change at their local health center. A new anteroposterior radiograph of the left shoulder was taken, confirming the positioning of the humeral head and reduction of the fracture. (Figure 3) It was decided to continue management with the universal shoulder immobilizer, with a follow-up appointment in 4 weeks and a new radiograph.

The patient was brought to a follow-up appointment 6 weeks post-operatively, and the K-wire and universal shoulder immobilizer were removed, with a control radiograph taken (Figure 4). Instructions and an appointment were given to the family member to start physical therapy.

Figure 3: Anteroposterior radiograph of the left humerus taken 15 days post-operatively, showing 1 k-wire and adequate reduction of the dislocation and fracture.

Figure 4: Anteroposterior radiograph of the left humerus after 6 weeks of follow-up, prior to removal of the K-wire.

At the 12-week post-operative follow-up appointment, physical examination revealed a full range of motion of the shoulder, with flexion of 160°, extension 40°, abduction 180°, adduction 30°, external rotation 50°, and internal rotation 70°. No upper limb dysmetry was found. Radiologically, a Montoya III consolidation and adequate positioning of the humeral head with respect to the glenoid were observed. The patient scored 4.5454/100 on the Quick DASH disability scale, which was applied with the support of the family member and adaptations made to the patient's routines, as there is no specific scale for evaluating pediatric patients.

At the 6-month post-operative follow-up appointment, the left shoulder showed complete and pain-free range of motion. Radiologically, a complete Montoya IV consolidation was observed (Figure 5).

Figure 5: Anteroposterior radiograph of the left humerus at 6 months post-operatively, showing complete consolidation of the fracture.

At the 1-year follow-up, the patient was clinically pain-free, with no upper limb dysmetry, and full range of motion of the left shoulder, scoring 0/10 on the Quick DASH disability scale.

DISCUSSION

Proximal humerus fractures associated with ipsilateral glenohumeral dislocation are severe and significantly rare injuries.[1] There is no real and updated epidemiological data on their incidence in the pediatric population. The first reported case dates to 1982 by Nicastro and Adair and since then, few cases have been described in the literature, less than 100.[12] To diagnose this type of injury, a high index of suspicion and adequate radiographic evaluation are required.[13] Most of these fractures can be classified as Salter-Harris type II lesions which coincides with our patient's case.[14] The youngest patient reported in the literature with a proximal humerus fracture associated with ipsilateral glenohumeral dislocation was presented by Winmmon et al a 2-year-old male patient with a Salter-Harris type I physeal injury of the proximal humerus associated with an anterior glenohumeral dislocation; for which the authors recommend that open reduction be reserved only for irreducible cases.[14,15] Ghazi et al. reported the case of a 10-year-old female patient with a Salter-Harris type II lesion of the proximal humerus associated with a glenohumeral dislocation, which was treated with open reduction and internal fixation with a titanium elastic nail, obtaining adequate results.[14]

In this case, we opted for closed reduction and percutaneous fixation with 1.6 mm K-wire, plus protection

of the extremity with a universal shoulder immobilizer, with satisfactory clinical and radiological results.

CONCLUSION

The diagnosis of proximal humerus injuries, especially in young patients, requires a high level of suspicion and a keen clinical eye for adequate radiological evaluation. The use of K-wires is a less traumatic option compared to titanium elastic nails, as it does not require a second surgery for removal, with minimal complications and a lower risk of humeral head necrosis. Percutaneous fixation offers relatively rigid fixation, allowing for earlier rehabilitation and resulting in good shoulder function. Therefore, we recommend the use of percutaneously placed K-wires to treat physeal injuries of the proximal humerus, including those associated with ipsilateral glenohumeral dislocation.

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