Sindrom anteriornega intraosalnega živca pri otroškem suprakondilarnem prelomu nadlaktnice – prikaz primera

Anterior interosseous nerve syndrome following paediatric supracondylar humeral fracture: A case report

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Izvleček

Namen: *Anteriorni interosalni živec (AIŽ) je motorična veja medianega živca in poteka globoko v podlakti. Oživčuje tri mišice podlakti. Izolirana pareza je znana kot AIŽ sindrom. Pri otrokih so zlomi distalnega dela nadlaktnice pogosti prelomi, pri katerih so prav tako pogosto pridruženi nevrovaskularni zapleti. V članku prikazujem v naši vsakdanji praksi sorazmerno redek zaplet suoprakondilarnega preloma z razvojem AIŽ sindroma.*

Poročilo o primeru: *Petletni fant je padel z gugalnice in si zlomil nadlaktnico. Šlo je za suprakondilarni prelom. Nevrološki izpadi niso bili opisani. Narejeni sta bili repozicija in učvrstitev s K žicami. Med kontrolami je mati opozorila, da bolnik ne more pokrčiti palca na operirani roki. Prepoznali smo AIŽ sindrom.*

Zaključek: *Najverjetneje je bil sindrom AIŽ posledica poškodbe komolca samega. Zavoljo osredotočenosti na pogostejše nevrološke izpade, predvsem ulnarnega živca, smo razvoj AIŽ zaznali sorazmerno pozno.*

Abstract

Purpose: *The anterior interosseous nerve (AIN) is a motor branch of the median nerve that runs deep into the forearm where it innervates three muscles. Their isolated palsy is known as AIN syndrome. Distal forearm fractures are some of the most common fractures in children and are associated with frequent neurovascular complications. This report described a relatively rare complication in our everyday medical practice: AIN syndrome following a supracondylar fracture.*

Case report: *A 5-year-old boy fell off of a swing and suffered a supracondylar fracture. No neurological disorders were described. Manual reduction and K-wire fixation were performed. At a follow-up visit, the mother pointed out that the child was unable to flex the thumb of the treated arm. We diagnosed the case as AIN syndrome.*

Conclusion: *The AIN syndrome was most likely a consequence of the injury to the elbow itself. Due to our focus on more frequent neurological disorders, especially those of the ulnar nerve, AIN syndrome*

was detected relatively late. In preoperative care, and especially postoperative care of children with distal forearm fractures, precise assessments of the patient's neurological status are required for the early detection of associated injuries.

INTRODUCTION

Supracondylar fractures in children account for 16% of all paediatric fractures (1). Because both the radial and median nerves can be in the vicinity of the fracture line, there is a possibility of primary injury to one of these nerves. Closed reduction with internal fixation is the primary method for managing certain types of supracondylar fractures (2). When the wire is placed medially, there is a danger of damaging the ulnar nerve, i.e., a danger of secondary injury to the nerve (3).

Anterior interosseous nerve (AIN) syndrome is a rare syndrome that accounts for <1% of all upper extremity palsies (4). The AIN is a pure motor branch of the median nerve that emerges dorsomedially below the elbow, approximately 5–8 cm distal to the lateral epicondyle, and 4 cm distal to the medial epicondyle. It innervates three forearm muscles: m. *flexor pollicis longus, m. pronator quadratus, and the radial part of m. flexor digitorum profundus (5).*

Here, we report the case of a patient with a distal humeral fracture in which AIN syndrome was detected relatively late.

CASE PRESENTATION

A 5-year-old boy fell off of a swing and presented with a swollen, deformed, and severely painful left elbow. The child's peripheral pulse was palpable, and he could feel all of his fingers. X-ray scans showed a displaced supracondylar fracture (Gartland III) with posterolateral displacement of the distal fragment (Figure 1). After the patient was prepared for surgery, we performed a closed reduction and stabilised the fracture using K-wire fixation (Figures 2, 3).

Figure 1. *Anteroposterior X-ray of the distal humerus fracture.*

Figure 2. *Anteroposterior X-ray after ostheosynthesis.*

Figure 3. *Lateral view X-ray of the distal humerus fracture.*

The patient could feel his fingers after the procedure. We feared a possible iatrogenic injury to the ulnar nerve, but no signs were found. Finally, the arm was placed in a plaster cast.

At follow-up visits, neither the mother nor medical staff described any outstanding features in the anamnesis. The K-wires were removed 5 weeks after surgery, after which the patient started an exercise regime. Mobility exercises for the elbow were done successfully, but at the first follow-up visit (after 2 months), the mother pointed out that the child was unable to flex his thumb.

Figure 4. *Anteroposterior X-ray of the distal humerus fracture, final results.*

We performed a clinical examination and found no sensory loss in the fingers, but the patient was unable to form a circle with his index finger and thumb.
We sought consultation with a neurosurgeon, and the patient was scheduled for an electromyography and NMR scan. While waiting for these examinations (approximately 3 months after the injury), the patient regained full mobility of his fingers. His elbow was also fully mobile. The X-ray showed that the fracture had healed properly (Figures 4, 5).

Figure 5. *Lateral view X-ray of the distal humerus fracture.*

DISCUSSION

Herein, we described the case of a 5-year-old child with a distal forearm fracture and an associated neurological disorder. Forearm fractures are common, and the clinical picture is often dramatic: the sight of a deformed extremity, the pain and distress the child suffers, and the presence of concerned parents prompt surgeons to take immediate action.
Regarding these kinds of forearm fractures in children, the relative incidence of associated or iatrogenic injuries is quite high, 12–20% (6). Campbell et al. reported that the incidence was extremely high for third-degree distal forearm fractures in children (7). Damage to the median nerve occurred in 50% of these cases, and damage to the radial nerve occurred in 28%. They also state that in as many as 87% of patients with an associated injury to the median nerve, there was posterolateral displacement of the distal fragment. These injuries usually occur due to the agency of the proximal fragment, while iatrogenic injuries occur due to the manipulation required to perform the reduction and percutaneous K-wire fixation of fractured fragments. The reduction manoeuvres themselves can also cause injuries.

Given the fragment displacement, the fracture was classified as a third-degree fracture according to the Gartland classification (8). We recognised the neurological complication late, most likely because we were overly focused on the possibility of ulnar nerve damage, which can occur during the medial placement of K-wire. Patients with AIN syndrome are typically unable to form a circle with their index finger and thumb due to paralysis of FPL and the radial FDP (impaired flexion of the interphalangeal joint of the thumb and the distal interphalangeal joint of the index finger).
Regarding the nerve injuries associated with supracondylar forearm fractures in children, most studies predict good outcomes and a spontaneous return of function within a period of 3–5 months (9-11). Thus, most surgeons take a "monitor and wait" approach and only plan a surgical intervention if nerve function is not regained after a specified period of time (3). In our case, spontaneous return of nerve function occurred.
In the differential diagnosis of AIN syndrome, a thumb flexor injury called stenosing tenosynovitis should be considered (12). Previous studies have mentioned that a relatively small number of AIN syndrome cases are detected by NMR and suggest that electromyography be used in diagnosis. Surgical exploration is recommended if there is no progress after 3 months of conservative treatment, including physical therapy. However, there remains a lack of relevant studies to adequately determine the most appropriate time for surgical intervention.

CONCLUSION

In the preoperative, and especially in the postoperative care of children with distal forearm fractures, precise assessments of the patient's neurological status are

required for the early detection of associated injuries. Despite preoperative evaluations being difficult due to the child's distress and non-cooperation, an accurate neurological status makes postoperative care easier.

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