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Pediatric Olecranon Fracture with Coronoid Process Osteochondral Flap Fracture: A Rare and Challenging Case

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Purpose: Osteochondral flap fracture is a variant of fracture in the pediatric age group. It is caused by a shearing force that separates the articular cartilage from the underlying subchondral bone. We present a pediatric case of an olecranon process fracture with an osteochondral flap fracture of the coronoid process.

Case report: A 10-year-old child presented with swelling and pain in the right elbow after an incident of direct trauma. A plain radiograph revealed multiple small fracture fragments, inconclusive of coronoid process involvement. Intraoperatively, we found an osteochondral fracture of the coronoid process with anteromedial facet displacement. The fracture was reduced and secured with two K-wires. The undisplaced olecranon fracture was fixed with a K-wire in situ.

Conclusions: Osteochondral flap fractures of the coronoid process can be easily missed and underestimated in imaging studies. Neglected fractures can lead to severe impairment of elbow motion and function and cause chronic pain. The anatomical reduction of the coronoid facet is crucial and yields the best outcome.

Keywords: Osteochondral flap fracture, coronoid osteochondral flap, pediatric coronoid process fracture

Pediatric osteochondral flap fractures are rare[1]. Unlike adults, children have thicker cartilage on bone surfaces, making radiographic findings less definitive and leading to diagnostic difficulties. A missed diagnosis can lead to limitations in the range of motion, elbow instability, and, eventually, osteoarthritis, affecting hand function and quality of life[2,3]. We report a case of pediatric coronoid process osteochondral flap fracture with a concomitant olecranon process fracture.

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CASE REPORT

A 10-year-old boy presented with right elbow pain and swelling after falling on a flexed elbow. He did not recall experiencing any dislocation or hearing popping sounds. Examination revealed non-specific tenderness and a limited range of motion due to pain. A plain radiograph showed an olecranon process fracture with bone chips of unknown origin at the medial and lateral aspects and a larger bone fragment at the anterior part of the elbow (Figure 1A). The provisional diagnosis was a closed fracture of the trochlea and olecranon process. A long arm posterior slab was applied, and he was admitted for surgery the following day.

Under general anesthesia, right elbow range of motion assessment revealed a restriction extension of 30–100° of maximum flexion. Preoperative examination showed a positive anterior drawer at 90° flexion. However, posterior subluxation and varus and valgus laxity could not be achieved. A tourniquet and sterile draping were applied. The arthrogram was inconclusive of the any trochlear or coronoid fracture. We percutaneously fixed the undisplaced olecranon process fracture with a 1.8-mm K-wire. A curvilinear incision was made at the medial elbow, slightly anterior to the medial epicondyle. A surgical plane was developed between the pronator teres and flexor carpi radialis to expose the anteromedial joint capsule. The capsule was opened, and joint washout was performed to remove the hematoma inside. We noted the fracture at the anteromedial facet of the coronoid process, along with its osteochondral fragment that was displaced anteriorly and superiorly (Figure 1B). We reduced the fracture and secured it with two 0.9-mm K-wires using the retrograde technique (Figure 2A). The trochlear, radial head, and capitulum articular surfaces and the medial collateral ligament were intact. The capsule was closed and the skin, sutured. A long arm posterior slab was applied. The diagnosis was revised to a closed fracture of the anteromedial facet of the coronoid process and a closed undisplaced fracture at the olecranon process of the right proximal ulna.

The child was discharged the next day with advice for pain-site dressing once every three days. At three weeks post-operation, the long arm slab and K-wires were removed, and elbow range of motion exercise was initiated. Six weeks after surgery, the child returned to school with nearly restored elbow motion, except for a slight residual extension lag of less than 10°. There was no laxity observed with the varus and valgus stress test. A radiograph showed the united fracture of coronoid and olecranon processes (Figure 2B). A six-month follow-up was given to monitor for any growth disturbances of the right elbow.

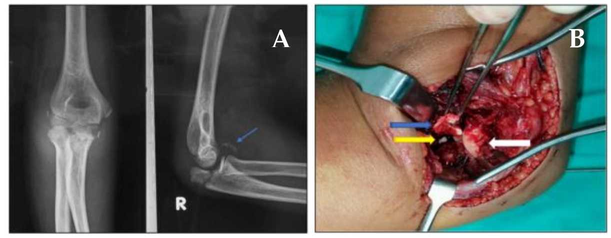

Fig. 1A Radiographs of right elbow. The blue arrow points to the osseous part of the displaced coronoid osteochondral flap fracture, which was initially thought to have originated from the humeral trochlear. **1B** Intraoperative image shows an anteromedial osteochondral flap fracture of the coronoid process (blue arrow) and intact lateral basal facet of the coronoid process (yellow arrow) and the trochlea (white arrow).

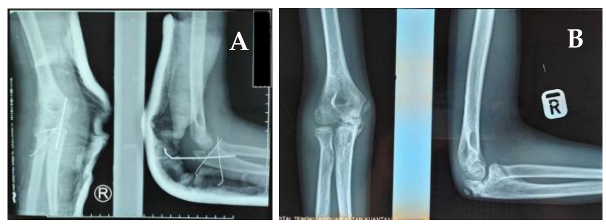

Fig. 2A Postoperative radiographs of the right elbow. **2B** Six-week follow-up radiographs.

DISCUSSION

Osteochondral flap fractures of the coronoid process in the pediatric age group are rare; to date, only a few cases have been reported[2-4]. Unlike adult hyaline cartilage, which comprises calcified and non-calcified layers, children's cartilage lacks calcification. Consequently, force is directly transmitted to the subchondral bone, causing osteochondral lesions instead of pure chondral injury, which is more common in adults[5]. Two injury mechanisms occur: first, during elbow dislocation reduction, the trochlea collides with the coronoid process, shearing off the osteochondral flap into the ulno-humeral joint. Second, falling with an outstretched hand and extended elbow causes the coronoid process to impinge on the trochlea, resulting in a fracture[2]. Osteochondral flap fractures can be classified into tip, anteromedial facet, and basal type fractures, further subdivided according to severity and associated fractures[6]. Posterolateral elbow dislocation involves a coronoid tip avulsion associated with a proximal radius fracture, while posteromedial dislocation is characterized by anteromedial facet fractures and collateral ligament complex injury(2). Anteromedial facet fractures are important because they are associated with posteromedial rotatory and varus instability, requiring vigilant and aggressive management(6). Reported injuries associated with a coronoid process osteochondral flap fracture include elbow dislocation, humeral lateral condyle fracture, ulnar collateral ligament injury, neck of radius fracture, and olecranon process fracture(1-4). Coronoid process osteochondral flap fracture with a concomitant olecranon process fracture has been described in younger children below 5–7 years of age, while our patient was 10 years old(2,4,7). We hypothesized that our patient presented after a spontaneously relocated elbow, similar to the case reported by Valisena et al.(2)

The diagnosis of coronoid process osteochondral flap fractures is a formidable challenge. Children have difficulty explaining the exact mechanism of their injury. Moreover, physical examination typically reveals nonspecific tenderness and limited range of motion due to pain from intra-articular fragment impingement. The small size and radiolucency of the fragment often lead to missed diagnosis on plain radiographs(1,3). A subtle increase in ulno-humeral joint space may be observed(4,6). Differential diagnoses include medial epicondyle, trochlear, olecranon, and radial head fractures. An early and accurate diagnosis is the cornerstone in treating osteochondral flap fractures. Therefore, due to the non-specific presentation and radiograph findings, we suggest proceeding further with computed tomography (CT) or magnetic resonance imaging (MRI) in suspected cases. CT helps in delineating fracture configuration but requires vigilant observation to detect the osteochondral fragment(1,2). MRI offers greater accuracy but is limited by its cost, availability, and the need for sedation in uncooperative children. Intraoperative arthrogram is another diagnostic option but may be challenging to interpret for inexperienced individuals. Open diagnostic exploration is the most specific method but is typically reserved for patients with additional injuries that require surgery.

It is pertinent to examine the integrity of collateral ligament complexes in all cases of coronoid fractures. However, stability assessment in children is difficult due to patient uncooperativeness and can, therefore, be performed under sedation or anesthesia. The medial ligamentous complex is assessed by applying valgus force with forearm supination at 30° of elbow flexion(8). Meanwhile, varus instability can occur in lateral ligament complex injuries with fracture of the coronoid, causing loss of the medial buttress. It is tested by applying varus stress with forearm pronation at about 30° of elbow flexion(9). Younger children have more laxity in their ligaments and yield a false positive unless compared to the normal side. Surgery is the mainstay of treatment for displaced osteochondral flap fractures as fracture reduction is crucial for the restoration of articular congruency and elbow stability. The medial approach to the coronoid process is advantageous as it allows direct access to the fracture site and medial ligamentous complex(4). The method of fixation varies among cases. Fragments larger than 5 mm should be fixed with K-wires, while smaller fragments can be fixed with absorbable sutures or fibrin glue(2,5). Elbow stability should be reassessed after fixation, possibly aided by observing joint space widening on the C-arm Image Intensifier. The passive range of motion in flexion–extension and supination–pronation should also be documented. In some cases, if stability is achieved post-reduction or the fragment is insignificant, fixation may not be necessary, and excision can be considered(2).

CONCLUSIONS

Coronoid process osteochondral flap fractures are challenging to diagnose and are often overlooked, especially when accompanied by other elbow fractures such as that of the olecranon process. Neglected fractures can result in the significant impairment of elbow function and in chronic pain. Imaging studies may underestimate the injury; therefore, careful clinical suspicion with surgical exploration is the most reliable diagnostic method. The assessment of elbow stability is necessary to identify any accompanying ligamentous injuries. Anatomical reduction of the coronoid facet is essential for optimal outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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