



# Total Ankylosis by Heterotopic Ossification in an Adolescent Anterior Trans-olecranon Fracture Dislocation: A Case Report

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The incidence of heterotopic ossification in adolescents appears to be lower than in adults. There exist very few reports of heterotopic ossification with total bony ankylosis in child or adolescent populations. We describe a case of total bony ankylosis of the elbow secondary to heterotopic ossification, in a 14-year-old female. Total ankylosis of the elbow at 45 degrees of flexion was noted 6 months post-surgery, and complete surgical excision of the heterotopic mass was performed. After an additional one-time dose of radiation therapy and nonsteroidal anti-inflammatory drug medication, full range of motion was obtained without any recurrence or other complications, up to the last follow-up of 30 months.

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Heterotopic ossification (HO) of the upper limb is an uncommon post-traumatic complication, and is even rarer among children.<sup>1)</sup> The occurrence of HO around the elbow joint results in fixed deformities and complete limitation of motion.<sup>2,3)</sup> Surgical excision of HO is subsequently required for patients afflicted with limited motion, and complete surgical excision can achieve a significant improvement of elbow functions.<sup>4,5)</sup>

Total ankylosis of the elbow joint due to HO is not common, and very little is known about HO treatment in children or adolescents. To the best of our knowledge, surgical excision of HO around the elbow joint in an adolescent has not been performed previously. We describe a case of total ankylosis of the elbow joint by HO in a 14-year-old female with anterior trans-olecranon fracture dislocation, who was successfully treated by complete surgical excision of the HO.

## Case Report

A 14-year-old right-handed female fell from a 10th floor

apartment, and presented to our emergency department with multiple trauma. She had no history of any previous illness or medication before the injury. She complained of pain in the abdomen, right elbow, pelvic area, and low back area. She underwent iliac artery embolization and exploratory laparotomy to repair the iliac artery and a liver laceration at another hospital, and was subsequently transferred to our emergency center for additional surgical intervention involving the pelvic bone, spine and anterior trans-olecranon fracture dislocation (Fig. 1). Fortunately, computed tomography (CT) confirmed that she had no brain injury and no systematic neurologic symptoms, although there was a chance fracture of the T10 vertebra. She was subjected twice to a closed reduction of the injured elbow joint, once at the first hospital, and then in our emergency room. According to the Mayo classification, the olecranon fracture was diagnosed as type IIIB. Sixteen days after the initial trauma, the anterior trans-olecranon fracture dislocation of the right elbow joint was treated by open reduction and internal fixation by applying a pre-contoured olecranon plate (Zimmer, Warsaw, IN,

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Fig. 1. (A, B) Anteroposterior and lateral elbow radiographs at initial trauma show ulna olecranon fracture with anterolateral elbow dislocation. (C, D) Open reduction and internal fixation using olecranon locking plate was done 16 days after the initial trauma, and are presented as anteroposterior and lateral radiographs. (E, F) Anteroposterior and lateral radiographs of the affected elbow reveal a large bony mass connecting the distal humerus to the ulna at 6 months of index operation.

USA) using the posterior approach incised along the triceps, followed by application of a long arm splint (Fig. 1).

After surgery, the elbow was immobilized in a long arm splint at 90 degrees of flexion and neutral rotation. Starting from the 3rd postoperative day, the patient was allowed gentle exercise of the right elbow joint, but developed aggravated pain during rehabilitation at 2 weeks post-surgery. The HO was first noted

in radiographs, at 3 weeks. At 10 weeks post-surgery, she had increased difficulty in moving her right elbow joint, and had reduced range of motion. The size of HO had progressed and was clearly revealed in radiographs. Physical examination revealed total ankylosis of the right elbow at 45 degrees of flexion, at post-operative 6 months. However, since the radioulnar joint was intact, pronation and supination of the forearm showed the full range of joint motion. Standard anteroposterior and lateral radiographs of the affected elbow revealed an unusually large mass connecting the distal humerus to the ulna (Fig. 1, 2). CT scan images revealed the progress of mineralization from the outer margins towards the center area (Fig. 3). After 6 months maturation of the heterotopic mass, surgical excision was carried out using the posterior approach through the previous incision scar. Skin, subcutaneous tissue, and deep fascia were incised in line with the skin incision. The ulnar nerve was identified and retracted. The extent of the mass was exposed adequately and was excised completely from the distal humerus and ulna (Fig. 2). Intraoperative elbow range of motion flexion 0 to 140 degree was checked.

Postoperative radiographs showed no trace of HO (Fig. 4). One day after the operation, a 1-time dose of radiation therapy (800 cGy) was provided to prevent recurrence. Four days after surgery, the elbow range of motion exercise was started, as tolerated.

At 30 months after surgery, patient had no pain in the elbow; radiographs revealed no further development of the HO, and a residual flexion deformity of 10 degrees with flexion up to 145 degrees, and supination and pronation of the forearm were achieved with full range of motion (Fig. 4, 5). The patient was permitted to return to play, without any restrictions.

The Patient was given an opportunity to review the manuscript and consented to its publication.

## Discussion

In the current case, the HO around the elbow was especially problematic for many reasons. Since the neurovascular structure lies within the elbow joint, this increased the possibility of complications. Second, the ankylotic tendency of the elbow joint to occur after injury further complicates the treatment of heterotopic ossification in the elbow joint.<sup>2)</sup>

Complete ankylosis of the elbow secondary to HO results in severe disability.<sup>4)</sup> More than 20% patients who develop HO have clinically limited motion in the form of decreased arc of the flexion-extension to under 100 degrees. In our case, the HO was located on the posteromedial side, and the elbow range of motion was assessed as 30 to 60 degrees at post-operative 4 weeks, which gradually progressed to total ankylosis of the right elbow at 45 degrees of flexion. Restoration of elbow motion with complete ankylosis can be difficult.<sup>6)</sup> During surgery,

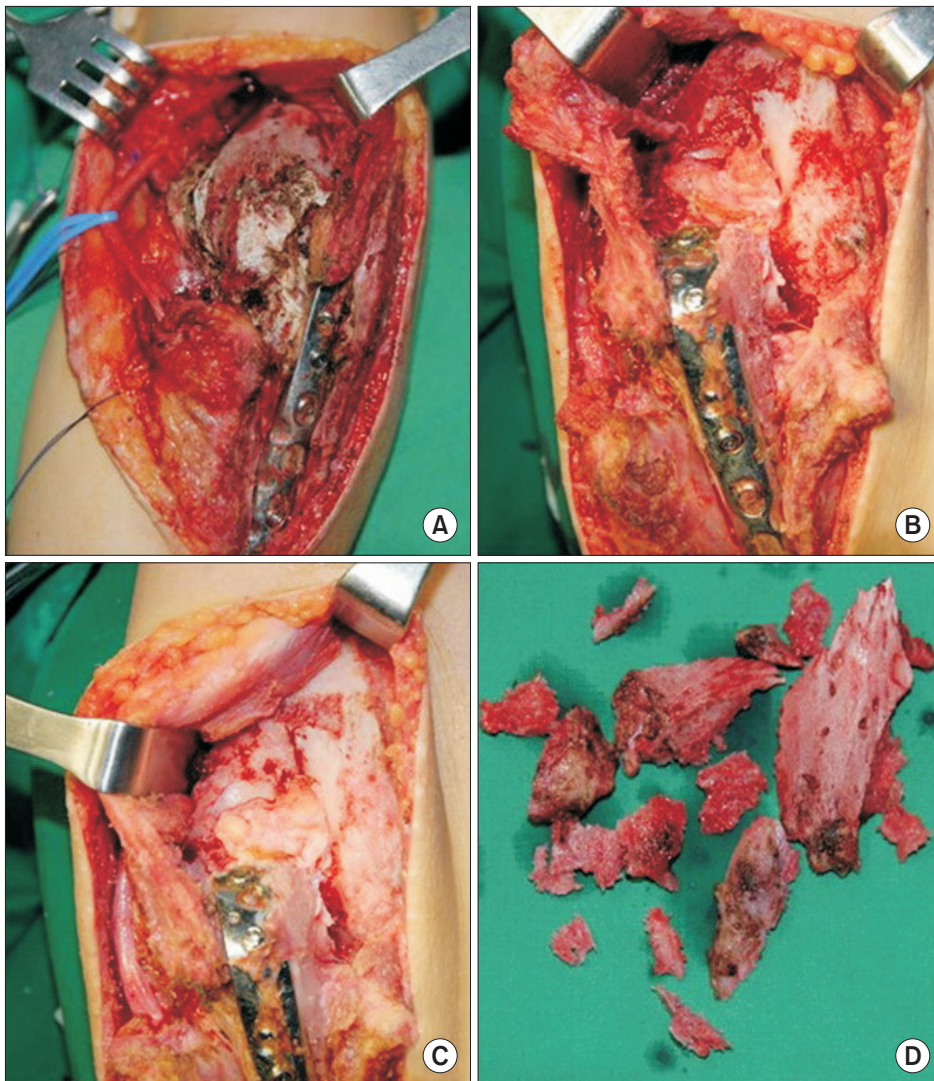


Fig. 2. (A) An intraoperative view of the untreated heterotopic ossification of the posterior elbow joint shows a neurovascular bundle, which was identified and retracted. (B) An intraoperative view of the posterior elbow joint. (C, D) Elbow joint after excision of the mass of bone.

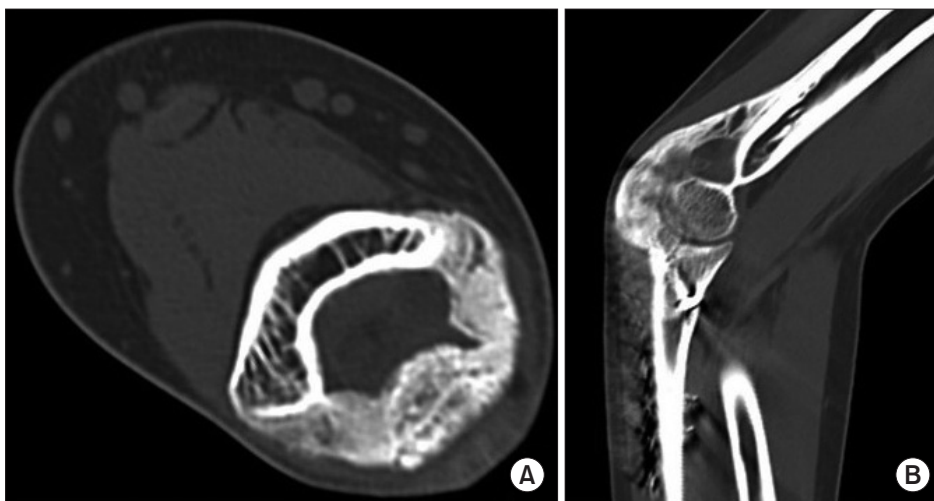


Fig. 3. (A, B) Images of computed tomography scan reveal fully matured mineralized cortical bone connecting the distal humerus to the ulna.





Fig. 4. (A, B) Postoperative anteroposterior and lateral elbow radiographs show complete excision status of a heterotopic ossification. (C, D) Radiographs show no further development of heterotopic ossification of the elbow joint at 30 months after index operation.

after resection of HO, the elbow range of motion was found to be 0 to 140 degrees. At the final follow-up, the range of motion checked at 10 to 145 degrees.

Surgical removal of the ectopic bone should be undertaken only for clear functional goals. Excision should be considered for patients in whom elbow motion is severely limited by extensive HO and other neurologic symptoms of the elbow joint. In the current case, our patient had complaints of ulnar nerve symptoms such as tingling sensation and numbness. Since timing surgical excision of the heterotopic bone is important<sup>7</sup> and maturation of the HO was noted on radiographs after 6-month follow-up in our patient, we determined to remove the mass at that instance.

Risk factors of HO development include neurologic injury, delayed internal fixation, use of bone graft, and the pattern of the fracture.<sup>2</sup> Delay in surgery increases the risk for HO, thereby prompting that operative fixation is imperative.<sup>8</sup> In our case, internal organ damage had made her vital signs unstable, and we first had to manage life threatening complications. The injured elbow was therefore treated 16 days after the initial trauma, which may have increased the possibility of the developing HO.

Radiation is effective for prophylaxis and recurrence against HO. Radiation may be given at a dose of 700 to 800 cGy in single fraction, administered from 24 hours preoperatively until 48 to 72 hours postoperatively.<sup>3</sup> In our case, the patient was given a single dose of 800 cGy 1 day after surgery to prevent recurrence. Furthermore, prophylactic management was administered by prescribing nonsteroidal anti-inflammatory drugs (NSAIDs) for 2 months. NSAIDs prevent HO by inhibiting the osteogenic differentiation of progenitor cells.<sup>9</sup> Radiation and the NSAID therapy are both effective prophylactic treatments for the development of HO.<sup>10</sup> At the last follow-up, no recurrence was observed.

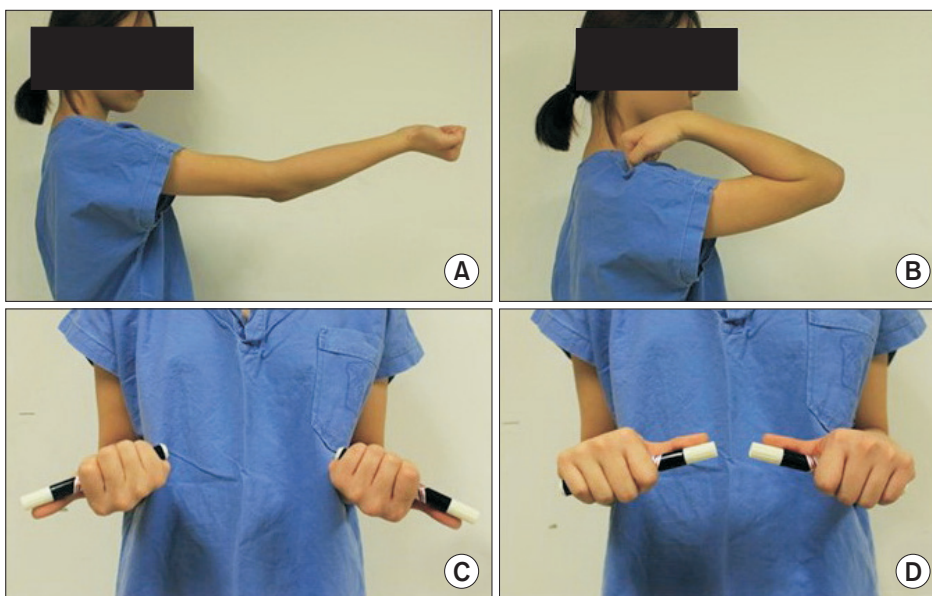


Fig. 5. Clinical photographs of extension and flexion of the elbow joint (A, B), and supination and pronation of the forearm showing functional outcome at 30 months after last surgery (C, D). The Patient was given an opportunity to review the manuscript and consented to its publication.

In conclusion, surgical excision for a patient who had a fully mature HO bridging led to significant improvement in the elbow range of motion, ulnar nerve symptoms, and functional results, notwithstanding the subject being an adolescent patient. Complete excision with subsequent postoperative radiation and NSAID therapy helped to prevent recurrence of HO.

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