



# 소아 비골화된 주관절 견열골절 시 자기공명영상 촬영의 중요성

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## Importance of Magnetic Resonance Imaging Examination in Unossified Avulsion Fracture of Child Elbow

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Unossified elbow avulsion fractures of children should be treated with care. Simple avulsion fractures seen on an x-ray may actually be severe injuries such as elbow joint subluxation or radial head dislocation. So, definite diagnosis is important in determining appropriate treatment of avulsion fractures around the unossified elbow, and magnetic resonance imaging (MRI) examination plays a key role in the diagnosis. We experienced avulsion fracture of the capitulum with common extensor tendon and lateral collateral ligament injuries and ulnar coronoid process fracture in an 11-year-old boy and radial head dislocation with common flexor tendon and partial ulnar collateral ligament injuries in an 8-year-old boy. We would like to talk about the importance of MRI in unossified avulsion fracture of child elbow by reviewing 2 case reports.

**Key Words:** Radial head, Elbow, Avulsion fracture

Avulsion injuries in unossified elbow fractures are complicated in both diagnosis and management. Subtle radiological findings may be misinterpreted or overlooked and there are differences in opinion as to the indications for conservative or surgical treatment<sup>1,2</sup>.

Avulsion fractures around the unossified elbow can usually be treated with a splint or cast. However, avulsion fractures with elbow subluxation and radial head dislocation must undergo surgical treatment<sup>3</sup>. If proper treatment is not administered, there may be complications such as loss of joint motion, chronic pain, and arthritis of the elbow.

Likewise, unossified elbow avulsion fractures are complicated in both diagnosis and treatment, and special attention and magnetic resonance imaging (MRI) examination needed for accurate diagnosis and appropriate treatment. To this end, we would like to report two experiences with unossified elbow avulsion fracture.

## CASE REPORT

### 1. Case 1

An 11-year-old boy was admitted to the hospital due

Received April 10, 2019, Revised June 12, 2019, Accepted July 10, 2019

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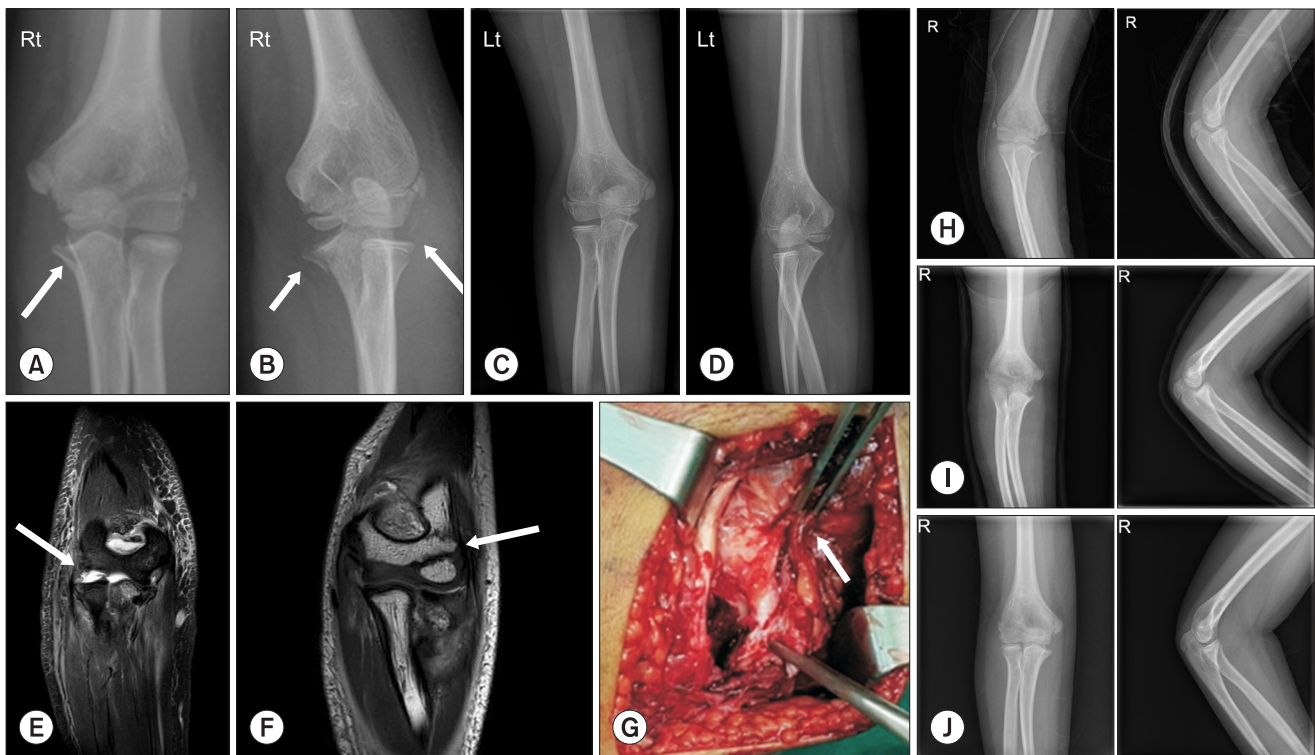
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to right elbow pain caused by a bicycle fall. Radiographs showed a right ulnar coronoid process fracture and radial subluxation (Fig. 1A-D). We applied a long arm splint and performed a MRI. The MRI finding showed fracture of the capitulum with common extensor tendon and lateral collateral ligament injuries (Fig. 1E, 1F). Surgical treatment was performed to correct the radial head subluxation. During the operation, we found a bony fragment with lateral collateral ligament injury and unstable radial head (Fig. 1G). Vicryl (Ethicon Inc., Somerville, NJ, USA) was used for sealing and a long-arm cast was applied for 4 weeks. Four months postoperatively, he had a partial limitation of elbow range of motion but no discomfort in active daily life (Fig. 1H-J).

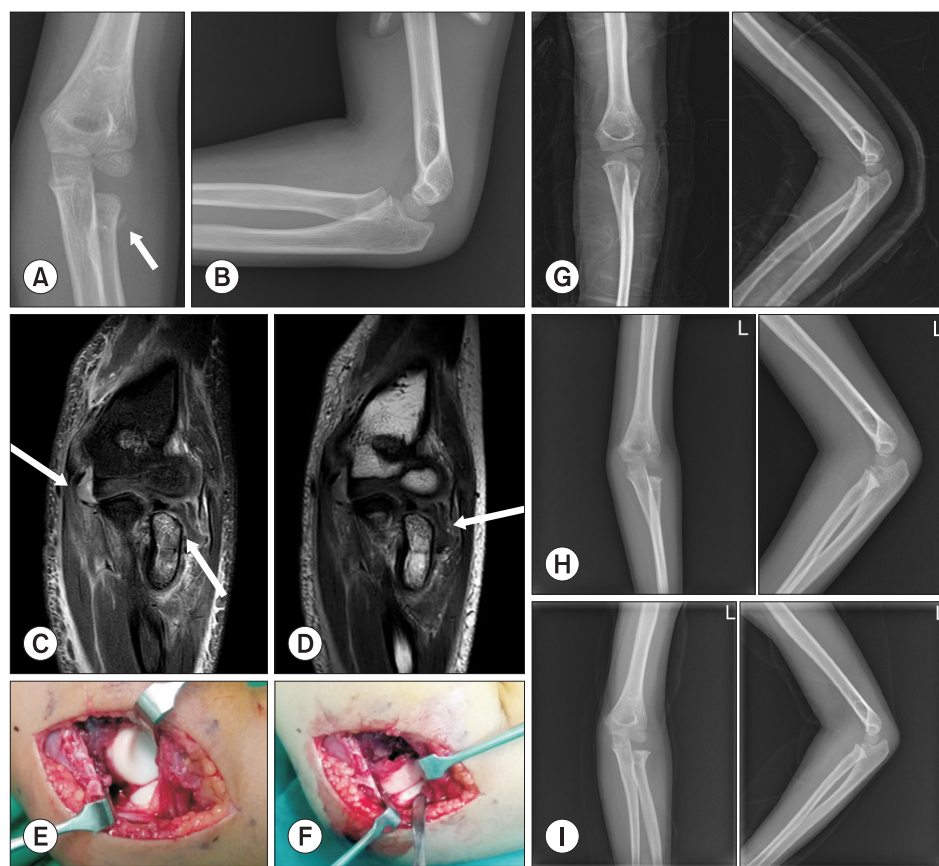
## 2. Case 2

An 8-year-old boy was admitted to the emergency

room due to left elbow pain caused by a 1 m fall. Radiographs showed a bony fragment around a radial head (Fig. 2A, 2B). We applied a long arm splint and followed up him at the outpatient clinic. According to the MRI, it showed a fracture with epiphyseal separation of the left radial head and neck along with a partial tear of ulnar collateral ligament and common flexor tendon located at the inferior aspect of medial epicondyle (Fig. 2C, 2D). Surgical treatment was performed for radial head reduction (Fig. 2E, 2F). As a result, the radial head had been completely reduced without causing damage to the soft tissue surrounding it to avoid postoperative necrosis (Fig. 2G). A long arm cast was applied for 4 weeks. One, five months postoperatively, he recovered fully the range of motion of the elbow (Fig. 2H, 2I).



**Fig. 1.** Initial (A) anteroposterior and (B) oblique plain radiographs showed a right ulnar coronoid process fracture (arrows in A and B) and (C) anteroposterior and (D) oblique plain radiographs show the opposite side. (E) Magnetic resonance imaging showed radial head subluxation (arrow) with lateral collateral ligament injury. (F) Magnetic resonance imaging showed capitulum fracture (arrow) with common extensor tendon and collateral ligament injuries. (G) In gross photo, common extensor tendon and lateral collateral ligament were injured. (H), (I), and (J) plain radiographs taken after operation and in one, four month, respectively.



**Fig. 2.** Initial (A) anteroposterior (arrow) and (B) lateral radiograph of left elbow showed a bony fragment around the radial head. (C) and (D) magnetic resonance imaging showed a fracture with epiphyseal separation of radial head and neck (arrow at right lower in C and D) along with a partial tear of ulnar collateral ligament (arrow at left upper in C). (E) Radial head was completely dislocated and (F) reduced. (G) In postoperative radiograph, dislocated bony fragment was located on arrow. (H) After 1 month from operation, plan radiograph was taken. (I) After 5 months from operation, plan radiograph was taken.

## DISCUSSION

Secondary ossification of the elbow begins at the capitulum and radial head at the age of 1-2 years and ends with fusion of the medial epicondyle and trochlea at the age of 17-18 years. The different parts of the elbow in pediatric patients are ossified and fused at different times, which explains the varying points of injury and fracture depending on the age of a patient. Elbow ossification occurs at the six elbow ossification centers in a reproducible order. The order of appearances of the elbow ossification centers is highly reliable and in most individuals, is consistent: capitulum, radial head, medial epicondyle, trochlea, olecranon, and lateral epicondyle. The age interval of appearance and fusion were, respectively: capitulum (0 to 1 year; 10 to 15 years), radial head (2 to 6 year; 12 to 16 years), medial epicondyle (2 to 8 years; 13 to 17 years), trochlea (5 to 11 years; 10 to 18 years), olecranon (6 to 11 years; 13 to 16 years), lateral epicondyle (8 to 13 years; 12 to 16 years)<sup>4</sup>. The elbow is primarily composed

of cartilage prior to ossification and is harder to visualize injuries in this area on radiographs. For this reason, there is a high risk of mistaking an elbow injury for a simple fracture in children. Especially, medial epicondyle fractures associated with ligament injury or radial head fracture with dislocation, prior to ossification, may not be obvious on simple radiographs as in this case, even with associated dislocation or subluxation. Supportive treatment in such cases may lead to serious complications such as chronic pain, restricted range of motion, and traumatic arthritis.

The epicondyle in pediatric patients is too small to be visualized on a simple radiography, even if it is displaced, and may overlap with distal humeral metaphysis or be confused with the ossification center of the trochlea<sup>5</sup>.

Tanabe and Miyamoto<sup>6</sup> stated that medial epicondylar fracture is difficult to detect by simple radiography. They presented a case of a 9-year-old girl patient with complete separation of her medial epicondyle and metaphysis which was successfully treated with surgery. Simple

radiography and computed tomography failed to show any fracture or dislocation in this case, but MRI showed the lesion<sup>6</sup>. Also, Pudas et al.<sup>7</sup> reported that MRI is a sensitive and accurate diagnostic tool for elbow fractures. They found that, in seven out of nine pediatric cases, MRI successfully revealed occult fractures, which were depicted as effusions on simple radiographs<sup>7</sup>. According to Beltran et al.<sup>8</sup>, because ossification centers present in pediatric patients, it is challenging to diagnose fractures with a simple radiograph. Hence, until ossification occurs by the age of 11-12 years, MRI is a better diagnostic tool than simple radiography to accurately delineate the fracture line<sup>8</sup>.

MRI is recommended if positive fat pad sign is the only radiological finding, if there is a lateral condyle fracture, or if there is elbow dislocation. In these cases, MRI helps in making the correct diagnosis, in making it easier to assess the extent of the damage, and in helping the clinician choose the optimal therapy<sup>7</sup>.

Based on my experience, simple fractures show gradual improvements in symptoms and swelling with time. On the other hand, fractures involving cartilage and those associated with joint dislocations or subluxations result in persistent discomfort, swelling, and anxiety in patients. In such patients with persistent symptoms, it is necessary to thoroughly examine the adjacent ligaments and consider the possibility of epiphyseal plate injury or dislocation of unossified regions by MRI.

## CONFLICTS OF INTEREST

The authors have nothing to disclose.

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## 소아 비골화된 주관절 견열골절 시 자기공명영상 촬영의 중요성

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아이들의 비골화된 주관절 견열 골절은 주의해서 치료해야 한다. 엑스레이에서 단순 견열 골절로 보일지라도 실제로는 주관절 아탈구나 요골두 탈구와 같은 심각한 손상일 수 있다. 그래서 비골화된 주관절의 견열 골절 치료 시 정확한 진단이 중요하며 magnetic resonance imaging (MRI) 검사가 진단 시 중요한 역할을 한다. 저자들은 신근 건 및 외측 측부 인대 손상 및 척골 돌기 골절이 있는 11세 소년과 8세 소년에서 굴곡근 및 부분 척골 측부 인대 손상을 동반한 요골 두위 탈구를 경험하여 2예의 증례 보고를 통해 비골화된 주관절 골절 탈구에서 MRI의 중요성에 대해 말하고자 한다.

**색인단어:** 요골두, 주관절, 견열골절

접수일 2019년 4월 10일 수정일 2019년 6월 12일 게재확정일 2019년 7월 10일

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