Dynamic Sonographic Diagnosis of Snapping Elbow Associated with Congenital Radioulnar Synostosis

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**short running-head title:** Dynamic Sonographic Diagnosis of Snapping Elbow

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Case

The patient was a 13-year-old boy with a main complaint of right elbow locking. The patient had no medical history. Radiographic examination revealed fusion of the proximal radial ulnar joint. There was no obvious history of trauma, which usually leads both-bone forearm fractures at the same level. The patient was diagnosed with congenital radioulnar synostosis. As the cause of the locking was unknown, the patient was referred to our department. The range of motion of the elbow joint (right/left) was 140°/150° in flexion, −80°/5° in extension, 0°/0° in pronation, and 0°/0° in supination. There was pain in the radial head during extension; however, there was no tenderness. Plain radiography and computed tomography (CT) revealed fusion of the proximal radius and ulnar joints bilaterally. The right side of the elbow was associated with anterior dislocation of the radial head, and the left side was associated with posterior dislocation of the radial head, and they were classified as Cleary classification type IV and type III, respectively (Figs. 1, 2). Magnetic resonance imaging (MRI) revealed a high T2 signal around the annular ligament, with no obvious cause of locking in the radiocapitellar joint (Fig. 3).[7]

Brachial plexus block was performed using 15 mL of mepivacaine. After confirming that there was no pain during flexion and extension, we performed manipulation. After extension,
locking was released with snapping, and it was re-locked after flexion (Video 1). Since the cause of the locking was unknown, a probe was applied from the anterior elbow joint, and the radial joint was observed. The elbow joint was observed from its anterior aspect of the elbow joint, and the radial joint was locked by a cord similar to the annular ligament (Fig. 4, Video 2). Because of repeated rocking, the patient underwent surgery under general anesthesia. It was confirmed that the annular ligament was the cause of the locking, which was resolved following partial excision of as much of the annular ligament as possible. Six months after the surgery, the active range of motion of the elbow joint was $5^\circ$ in extension and $145^\circ$ in flexion, and the patient progressed without recurrence of the elbow locking. There were no changes in pronation and supination.

Discussion

The causes of a snapping elbow can be broadly classified into intra- and extra-articular types. The intra-articular type causes include abnormalities of the annular ligament, synovial folds, and intra-articular free bodies. On the hand, the extra-articular causes include abnormalities of the triceps muscle attachment and a snapping ulnar nerve. [10] This case was classified as intra-articular type, in which snapping was caused by the annular ligament and an abnormal morphology of the radial head due to congenital radioulnar synovial stenosis.

Generally, in snapping elbow caused by the annular ligament, the annular ligament impinges on the radiocapitellar joint during extension. It is pushed out during flexion, resulting in
However, in this case, the radial head was anteriorly dislocated because of congenital radial ulnar fusion, and the annular ligament was usually located in the radiocapitellar joint. The locking occurred when the annular ligament was lodged in the neck of the radius during flexion, and the locking was released with snapping when the annular ligament relocated to the radiocapitellar joint during extension.

When the snapping is extra-articular type, snapping caused by the ulnar nerve or subluxation of the medial head of the triceps can be captured dynamically using ultrasonography, and its usefulness in diagnosis has been reported. This is because snapping can be palpated from the body surface and easily diagnosed by applying ultrasonography to the area.

However, in the case of intra-articular snapping, such as this case, there are few studies that reports that use ultrasonography for diagnosis because it is far from the body surface and the bullet cannot be touched. In most previous reports, MRI was used for the diagnosis of a snapping elbow. In practice, however, MRI alone is not sufficient for preoperative diagnosis, and diagnostic arthroscopy and other tests such as magnetic resonance arthrography, arthrography, high-resolution MRI, and ultrasonography have been reported to be useful for diagnosis. Antuna et al reported that five of six cases of painful snapping elbow appeared normal on MRI. In this case, MRI was insufficient to make a definitive diagnosis. The superiority of ultrasonography is that it can capture dynamic images and the imaging test believed to be particularly useful in capturing snapping joints.
dynamically. MRI and arthrography require intra-articular injection of contrast agents, whereas ultrasonography is non-invasive and does not require such injection. In this case, we were able to diagnose the cause of an intra-articular snapping elbow using ultrasonography. Ultrasonography may be useful not only for extra-articular elbows but also for intra-articular elbows.

**Conclusion**

Locking of the annular ligament caused by congenital radioulnar synostosis was diagnosed easily and dynamically using ultrasonography. Ultrasonography is useful in identifying the pathogenesis of snapping elbow.

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Figure 1. (a,b) Simple radiographs of the right elbow. There is fusion of the proximal radial ulnar joint, and the radial head is in the anterior dislocation position. (c,d) Simple radiographs of the left elbow. There is fusion of the proximal radial ulnar joint and the radial head is in the posterior dislocation position.

Figure 2. 3D computed tomography of the right elbow joint. There is fusion of the proximal ulnoradial joint (arrow). (a) Cleary classification type IV. (b) Cleary classification type III.

Figure 3. Magnetic resonance imaging (fat suppressed T2-weighted imaging, sagittal section). There was no obvious cause for locking within the elbow joint. A high T2 signal can be seen around the annular ligament.

Figure 4. Ultrasonographic still images from Video 2. BR, brachioradialis; H, humerus; RH, radial head; *, cord-like annular ligament. (a) Elbow in flexion (locking position). The annular ligament is lodged in the radial head. (b) Elbow in extension (unlocked). The annular ligament relocated to the elbow joint.

Video 1. Manipulation and re-locking. The locking was released with snapping after extension and re-locked after flexion under brachial plexus block.

Video 2. The elbow joint is locked by a cord-like annular ligament.