Case report: lateral capsular release for acute extension deficit in a child with congenital radioulnar synostosis
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Acute elbow extension deficit is an unusual phenomenon that has been observed in patients with congenital radioulnar synostosis. We report the case of an 11-year-old girl with congenital radioulnar synostosis who developed acute extension deficit of the right elbow and whose elbow range of motion was restored following lateral capsular release. J Pediatr Orthop B 2015, 24:71–74 © 2014 Wolters Kluwer Health | Lippincott Williams & Wilkins.

Introduction
Acute elbow extension deficit is an unusual phenomenon that has been observed in patients with congenital radioulnar synostosis. This deficit has been attributed to the presence of a tight, hypoplastic annular ligament that traps the radial head [1–5]. We report the case of an 11-year-old girl with previously undiagnosed congenital radioulnar synostosis, who developed an acute extension deficit of the right elbow after a fall. The elbow extension deficit was restored following lateral capsular release.

Case report
An 11-year-old, right-handed, otherwise healthy girl suffered a fall from standing and subsequently developed pain and limited range of movement (ROM) in her right elbow. Initial radiographs revealed congenital radioulnar synostosis with anterior dislocation of the radial head (Fig. 1). The patient and her family reported no history of pain, stiffness, or decreased ROM involving the right elbow before this injury. The patient underwent closed manipulation. Examination under anesthesia revealed a ROM from 0° to 135°. Snapping occurred as the elbow was extended from a position of maximal flexion to 30° but did not occur from extension back to flexion. In addition, the right forearm was fixed in 5° of supination.

After awakening from anesthesia, the patient could flex her elbow to 135° but could extend her elbow only to 30°. The right forearm remained fixed in 5° of supination. Treatment with physical therapy and anti-inflammatory drugs for 1 month failed to restore her ROM to that observed under anesthesia. MRI of the right elbow revealed a bony fusion between the proximal one-third of the radius and the ulna (Fig. 2). The patient underwent a lateral capsular release and radial head excision.

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Fig. 1
Preoperative right elbow lateral radiograph. A radioulnar synostosis and anterior radial head dislocation are present.
the ulna and the radius, involving the radial head and the coronoid process. The radial head was displaced anteriorly, placing tension on the anterior capsule. Alignment of the olecranon–humeral articulation was normal.

The T2-weighted sequences showed an effusion within the elbow joint and edema in the anterior soft tissues (Fig. 2). On the basis of the MRI results, a diagnosis of type IV radioulnar synostosis [6] was established, but the reason for the patient’s limited ROM remained unclear.

A second examination under anesthesia revealed the same snapping associated with extension that was observed during the initial examination. The elbow was then explored using a lateral approach. Overgrowth of the radial head and a concave deformity at the base of the radial neck (Fig. 3) were observed. As the elbow was flexed, the radial neck passed anterior to the supracondylar groove of the humerus. An annular ligament-like structure overlapped the radial neck and fixed it to the anterior capsule; however, there was no trapping of the radial head during flexion or extension (video, Supplemental digital content 1, http://links.lww.com/JPOB/A8). The radial head and neck articulated with the convex shape of the lateral condyle. Following the capsular incision, no locking or snapping was observed as the elbow moved from maximal flexion to maximal extension. However, following repair of the lateral capsule, locking and snapping reappeared as the elbow was extended from full flexion. The snapping was linked to the passage of the radial head over the prominence of the lateral condyle. The complete capsular repair was then undone, and a partial repair was performed with two stitches (Fig. 4). Following this revision of the capsular closure, the right elbow showed full extension and flexion without snapping. Postoperatively, the patient retained full elbow extension and flexion without snapping. A 5-year follow-up examination revealed full extension and flexion with no recurrence of the snapping. However, the right forearm was fixed in 5° of supination.

**Discussion**

Proximal radioulnar synostosis is a rare congenital upper-extremity disorder that can be associated with a 10–30° limitation in terminal elbow extension [7]. A literature review identified 16 case reports on elbow motion deficits occurring in patients with type IV radioulnar synostosis, and a summary comparison between these reports is presented in Table 1.
Unlike the present case, no history of elbow trauma was documented before the development of the elbow extension deficit in the earlier published case reports. The indication of surgery in general is to improve elbow extension deficit in this kind of congenital anomaly.

The different surgical methods were compared, and only in four of the 16 cases was the snapping problem solved solely by excision of annular ligament-like tissue (ALLT). Shinohara et al. [3] reported on two arthroscopic cases that required more advanced techniques for the excision of this structure to restore the elbow ROM.

Table 1: Reported cases of elbow motion deficit in patients with type IV congenital proximal radioulnar synostosis [6]

| References          | Sex | Age (years) | Motion deficit | ROM (deg.) | Symptoms and signs | Overgrowth of radial head | Pathogenesis of contracture | Operative procedure | Follow-up (months) |
|---------------------|-----|-------------|----------------|------------|-------------------|----------------------------|----------------------------|---------------------|-------------------|
| Kurihara et al. [1] | M   | 24          | NR             | NR         | NR                | ?                          | ALLT                       | Excision of the ALLT and radial head | 16                |
| Masuko et al. [2]   | M   | 13          | Extension deficit | 75–135°   | Locking during extension | Yes                        | ALLT                       | Excision of the ALLT          | 36                |
|                     | M   | 12          | Extension deficit | 50–140°   | ALLT             | 0–130°                     |/allt                       | Excision of the ALLT          | 144               |
| Shinohara et al. [3] | M   | 13          | Extension deficit | No        | Painful snapping during extension | ?                          | ALLT                       | Excision of the ALLT          | 65                |
| Takamine et al. [4] | M   | 12          | Extension deficit | 70–full   | Locking during extension | ?                          | ALLT, hypertrophic anterior capsule | Excision of the ALLT and anterior capsule | 4                 |
|                     | M   | 12.5        | Extension deficit | 40–145°   | ALLT             | 0–130°                     | ALLT                       | Excision of the radial head    | 45                |
|                     | F   | 7           | Extension deficit | 60–150°   | ALLT             | ?                          | Hypertrophic anterior capsule | Excision of the anterior capsule and radial head | 24                |
|                     | M   | 16          | NR             | NR         | NR                | ?                          | Hypertrophic anterior capsule | Excision of the anterior capsule and radial head | 26                |
| Shin et al. [9]     | F   | 11          | Flexion deficit | 5–95°     | Restriction in elbow flexion | Yes                        | Radial head impingement      | Excision of the radial head    | 6                 |
| VanHeest et al. [10]| M   | 15          | Extension deficit | 0–140°    | Pain during flexion | Yes                        | Radial head impingement      | Excision of the radial head    | 6                 |
|                     | M   | 15          | Extension deficit | 50–130°   | ALLT             | 0–130°                     | ALLT                       | Excision of the radial head    | 24                |
|                     | M   | 12          | Extension deficit | 25–120°   | ALLT             | 0–130°                     | ALLT                       | Excision of the radial head    | 32                |
|                     | M   | 15          | Extension deficit | 25–120°   | ALLT             | 0–130°                     | ALLT                       | Excision of the radial head    | NR                |
| Present report      | F   | 11          | Extension deficit | 30–140°   | Locking during extension | Yes                        | Tension of anterior capsule   | Lateral release               | 60                |

ALLT, annular ligament-like tissue; NR, not reported.
With the exception of the excision of the ALLT, other findings at the time of surgery included hypertrophy of the anterior capsule, which required treatment with capsular excision [4,8].

Most cases (10/16) show overgrowth of the radial head, which is treated with excision [5,9,10], and the radial head was usually entrapped by hypertrophic ligamentous tissues in the flexion position. However, radial head resection may affect the weight-bearing ability of the upper extremity and compromise elbow function on the basis of anatomical and biomechanical considerations.

Lateral release is a simple method with a short operation time and less tissue damage. Moreover, a large amount of musculotendinous units originate from the lateral condyle to provide stability over the lateral aspect of the elbow joint. If the snapping persists after the lateral release method, it could be treated using an approach like ALLT or even radial head resection. Meanwhile, ultrasonography may be useful for yielding real-time information in a minor operation theater setting. In our case, tension in the anterior capsule, resulting from the progressive anomalous development of the dislocated radial head, may have contributed to the decreased elbow ROM and snapping symptoms. The minor trauma preceding the patient’s presentation likely induced joint swelling and thereby also contributed to the acute decrease in ROM. As the elbow was extended to 30° from full flexion, the radial head passed over the prominence of the lateral condyle. This motion placed additional tension on the anterior capsule, which compressed the radial head against the concavity of the lateral condyle and prevented full extension of the elbow.

Similar to the other reported cases, our patient was also found at surgery to have a tight and hypoplastic annular ligament. Full extension and flexion without any snapping was observed following the release of the lateral capsule. These findings supported our proposed explanation, indicating that anterior capsular tension in this patient and the lateral capsular release had basically increased the volume of the joint to accommodate the overgrown radial head articulating with the convexity of the lateral condyle. However, the incongruent radiocapitellar articulation of the elbow remains as such. Thus, the absent forearm rotations may be due to the synostosis. In summary, lateral capsular release may be an alternative and effective surgical treatment method for acute elbow extension deficits associated with type IV radioulnar synostosis.

**Conclusion**

We described a patient with an elbow extension deficit and type IV congenital radioulnar synostosis. Her elbow flexion–extension was restored and elbow snapping was eliminated after isolated lateral capsular release. We thereby suggest that lateral capsular release be considered as a potential treatment method for acute elbow extension deficits with type IV radioulnar synostosis.

**Acknowledgements**

**Conflicts of interest**

There are no conflicts of interest.

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