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* 24:71–74 © 2014

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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

Fig. 1

Preoperative right elbow lateral radiograph. A radioulnar synostosis and anterior radial head dislocation are present.

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Fig. 2

MRI of the right elbow (T2 image) demonstrates fusion of the proximal one-third of the ulna and radius. Note the anterior dislocation of the radial head, joint fluid effusion, tension of anterior capsule, and edema signal in the anterior soft tissue.

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

Fig. 3

lateral exposure of the right elbow. The lateral collateral ligament was incised and opened. The base of the radial neck (a) had concave deformations. An annular ligament-like structure (b) overlapped the radial neck and fixed it to the anterior capsule and the lateral collateral ligament. The radial head (c) was seated on the anterior aspect of the distal humerus. A supracondylar groove was observed concave to the cartilage surface (d). While extending the elbow to 30° from full flexion, the dislocated radial head was observed to pass over the prominence of the lateral condyle (e).

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.

Fig. 4

Lateral exposure of the right elbow: the complete capsular repair was then removed and partial repair was performed with two sutures (a). Video, Supplemental digital content 1, <http://links.lww.com/JPOB/A8>: Snapping was observed during the extension from full flexion to 30°, but not during flexion from full extension. This snapping was no longer observed following lateral release.

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 extension deficit in this kind of congenital anomaly. Elbow extension deficit to some extent does not interfere with normal function in daily life. The major function of the upper extremity is open kinetic chain movement, where the hand is free to move, such as eating, throwing, carrying objects. However, some weight-bearing activities of the upper extremity (push-up, falling down protection by hand, and elbow extension) may need full extension of the elbow to increase joint stability.

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. Masuko *et al.* [2] also proposed the lateral approach to excise ALLT, with good results through intensive exploration.

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 <i>et al.</i> [1]	M	24	NR	NR	NR	?	ALLT	Excision of the ALLT and radial head	16
Masuko <i>et al.</i> [2]	M	13	Extension deficit	75–135°	Locking during extension	Yes	ALLT	Excision of the ALLT	36
Shinohara <i>et al.</i> [3]	M	12	Extension deficit	50–140°	Locking during extension	Yes	ALLT	Excision of the ALLT	144
	M	13	No	0–130°	Painful snapping during extension	?	ALLT	Excision of the ALLT	65
Takamine <i>et al.</i> [4]	M	19	Extension deficit	70–full	Locking during extension	?	ALLT	Excision of the ALLT	18
	M	12	NR	NR	NR	?	ALLT, hypertrophic anterior capsule	Excision of the ALLT and anterior capsule	4
Wang <i>et al.</i> [5]	M	13	Extension deficit	45–140°	Locking during extension	?	NR	NR	NR
	M	12.5	Extension deficit	40–145°	Locking during extension	Yes	ALLT	Excision of the radial head	45
Kikuchi <i>et al.</i> [8]	F	7	Extension deficit	60–150°	Locking during extension	Yes	ALLT	Excision of the radial head	24
	M	16	NR	NR	NR	?	Hypertrophic anterior capsule	Excision of the anterior capsule and radial head	26
Shin <i>et al.</i> [9]	M	12	Flexion deficit	5–95°	Restriction in elbow flexion	Yes	Radial head impingement	Excision of the radial head	6
	F	11	No	0–140°	Pain during flexion	Yes	Radial head impingement	Excision of the radial head	6
VanHeest <i>et al.</i> [10]	M	15	Extension deficit	50–130°	Locking during extension	Yes	Radial head impingement	Excision of the radial head	24
	M	12	Extension deficit	25–120°	Locking during extension	Yes	Radial head impingement	Excision of the radial head	32
Present report	M	15	Extension deficit	25–120°	Pain, decrease in elbow extension	Yes	Radial head impingement	Excision of the radial head	NR
	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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