



## A rare case of acromioclavicular joint injury in a 16-year-old girl

Katsumi Takase, MD, PhD\*

Department of Orthopedic Surgery, Tokyo Medical University, Tokyo, Japan



### ARTICLE INFO

#### Keywords:

Acromioclavicular joint injury  
Conoid ligament  
Trapezoid ligament  
Arthroscopic reconstruction  
Epiphyseal injury  
Teenager

In young individuals, acromioclavicular (AC) joint (ACJ) injuries often result in distal clavicle fracture, which can lead to growth plate injury when the epiphyseal cartilage remains on the ACJ side or there is an ACJ pseudo-dislocation.<sup>2</sup> However, the frequency of this injury in young individuals is extremely low as compared to that in adults. Herein, we report an exceptionally rare case of ACJ injury in which the first injury at the age of 16 years was diagnosed as ACJ subluxation or distal clavicle fracture; however, she had an additional traumatic injury one year following the initial injury, then she was diagnosed as ACJ dislocation with a coracoclavicular ligaments disruption. A successful arthroscopic conoid ligament reconstruction was subsequently performed. The patient and her family consented for the publication of this report.

### Case study

Our patient is a 17-year-old girl who has been participating in judo. At the age of 16 years, she was injured during practice by a strong blow to the right lateral shoulder when the joint was adducted and internally rotated. Immediately afterward, she was examined by a local doctor for swelling and pain upon movement of the right shoulder. Plain radiographs showed that the inferior surface of the clavicle was displaced superiorly by approximately 2 mm from the inferior surface of the acromion as compared to that on the nonaffected side. Therefore, she was diagnosed with ACJ subluxation (Fig. 1). She underwent immobilization orthosis

for approximately 3 weeks. Plain radiographs performed 1 month after the injury showed callus formation on the inferior surface of the distal clavicle with skeletally immature (Fig. 2). Therefore, the diagnosis was revised to a distal clavicle fracture. Two months after the injury, the main symptoms disappeared and she was allowed to resume judo. One year after the initial injury, she again incurred injury during practice at the same site. She was immediately examined by a local doctor for swelling and pain upon movement of the right shoulder, along with upward displacement of the distal clavicle with skeletally immature. She was diagnosed with ACJ dislocation based on plain radiographs and was referred to us.

When examined in the sitting position, the distal end of the right clavicle exhibited clear superior displacement and the piano key sign was positive. The ACJ, distal clavicle, and coracoclavicular ligaments were tender, and active movement of the shoulder joint was impossible due to pain. There were no abnormal findings of the nerves or blood vessels in the upper extremities. Plain radiographs showed group V (classification of Nenopoulos et al<sup>6</sup>) displacement of the distal clavicle superiorly as compared to the acromion. Additionally, the callus formed from the previous injury remained on the side of ACJ (Fig. 3). Therefore, further detailed examination with computed tomography (CT) and magnetic resonance imaging (MRI) was performed. Three-dimensional CT revealed a postero-superior displacement of the distal clavicle and remaining bone fragments on the ACJ side (Fig. 4). MRI showed that the acromioclavicular ligament and epiphyseal cartilage on the distal clavicle remained in the ACJ; however, the trapezoid and conoid ligaments were ruptured (Fig. 5). Based on these findings, the patient was diagnosed with a rare case pattern including both a distal clavicle fracture and rupture of the coracoclavicular ligaments.

Due to the patient's age, history of repeated injuries, involvement in sports (judo), and pathology involving rupture of

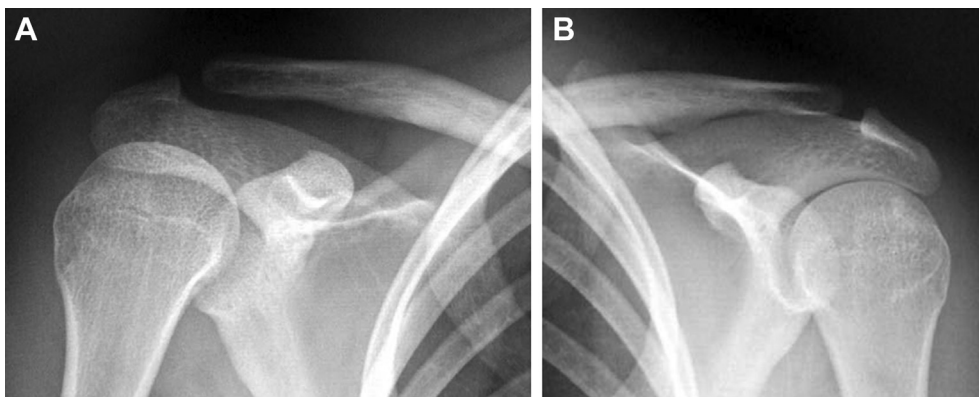
This study was approved by the institutional review board of the Tokyo Medical University.

\*Corresponding author: Katsumi Takase, MD, PhD, Department of Orthopedic Surgery, Tokyo Medical University, 6-7-1 Nishishinjuku Shinjuku-ku, Tokyo 160-0023, Japan.

E-mail address: [k-takase@muf.biglobe.ne.jp](mailto:k-takase@muf.biglobe.ne.jp).

<https://doi.org/10.1016/j.xrrt.2023.02.006>

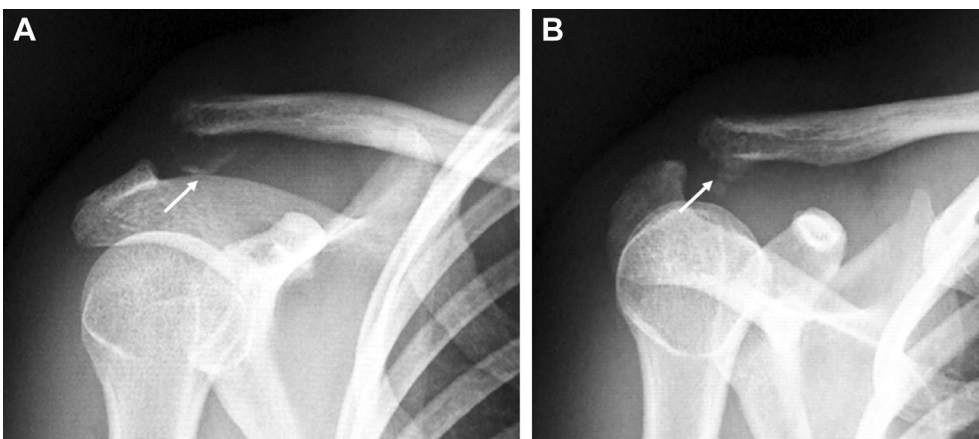
2666-6391/© 2023 The Author(s). Published by Elsevier Inc. on behalf of American Shoulder & Elbow Surgeons. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



**Figure 1** Plain radiographs (A) affected side and, (B) nonaffected side. The affected side showed that the inferior surface of the clavicle was displaced superiorly by approximately 2 mm from the inferior surface of the acromion as compared to that on the nonaffected side.



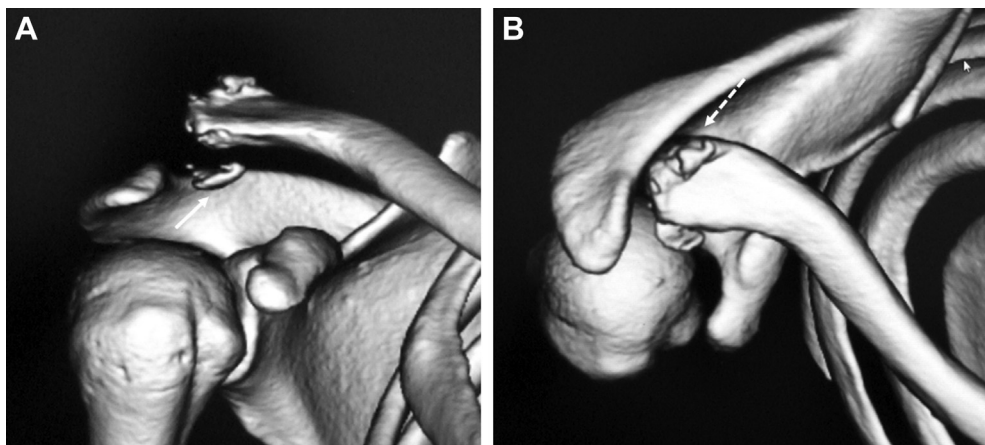
**Figure 2** Plain radiographs (A) AP view and (B) axial view. One month after the injury, the radiographs showed callus formation (white arrow) on the inferior surface of the distal clavicle. AP, anterior-posterior.



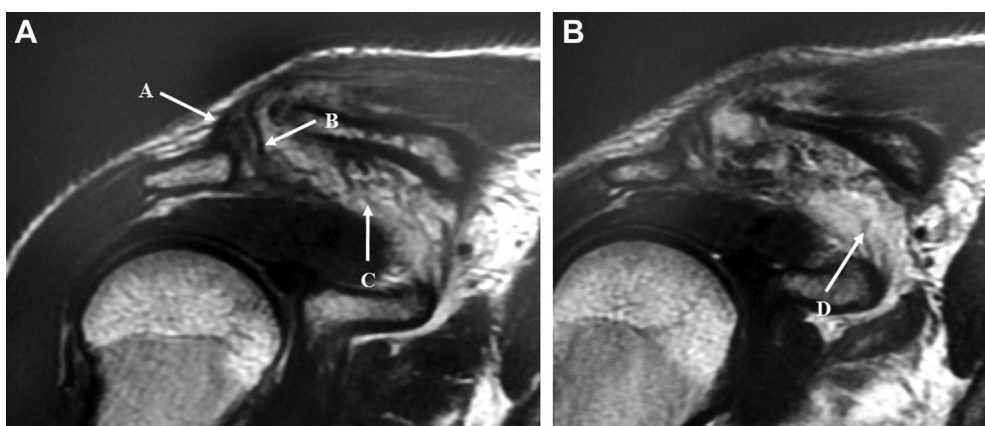
**Figure 3** Plain radiographs at second injury (A) AP view and (B) axial view. These radiographs showed group V (classification of Nenopoulos et al) displacement of the distal clavicle superiorly as compared to the acromion. Additionally, the callus (white arrow) formed from the previous injury remained on the side of ACJ. AP, anterior-posterior; ACJ, acromioclavicular joint.

both the coracoclavicular ligaments, we performed an arthroscopic conoid ligament reconstruction procedure as reported by Takase et al<sup>8</sup> in 2012. The patient was placed in the beach chair position and the procedure was performed from 2 portals (anterior and posterior). The Dacron artificial ligament ( Smith &

Nephew Endoscopy, Memphis, TN, USA ) was used for the reconstructed ligaments, and the internal fixation materials were EndoButton ( Smith & Nephew Endoscopy, Memphis, TN, USA ) on the coracoid process side and a screw and spike washer on the clavicle side.



**Figure 4** Three dimensional CT (A) frontal view and (B) superior view. These CT revealed a superior (white arrow) and posterior (white dotted arrow) displacement of the distal clavicle and remaining bone fragments on the ACJ side. CT, computed tomography; ACJ, acromioclavicular joint.



**Figure 5** Magnetic Resonance Imaging (A, B). These images showed that the (A) acromioclavicular ligament and (B) epiphyseal cartilage on the distal clavicle remained on the ACJ, however, the (C) trapezoid and (D) conoid ligaments.

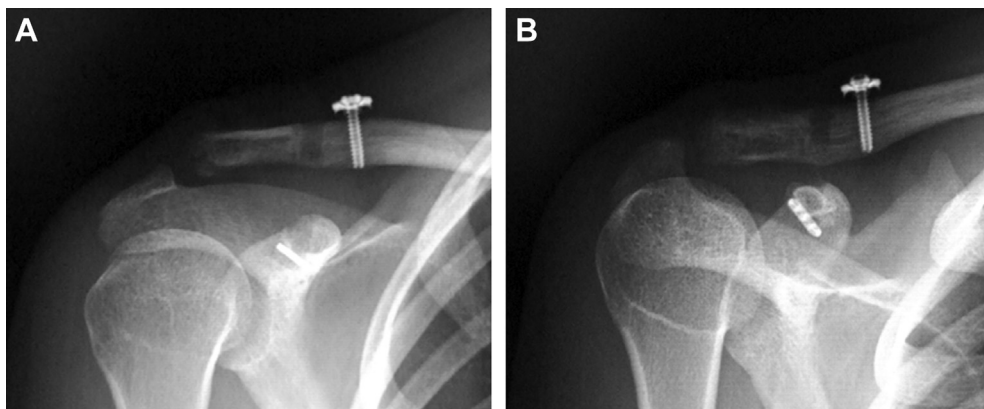
Postoperative treatment consisted of immobilization in the Desault position immediately postoperatively, which was replaced by a sling on postoperative week 2; all external immobilizations were removed in week 3. Rotator cuff strength exercise was initiated in the fourth postoperative week, and deltoid muscle strength exercise was started at the sixth postoperative week. The patient was allowed to resume judo 3 months after surgery ensuring that the range of motion and strength of the shoulder had recovered sufficiently.

Currently, 2 years after the surgery, the shoulder range of motion is forward elevation 180°, abduction 180°, external rotation on the arm side 50°, external rotation at 90° abducted position 100°, horizontal adduction 130°, and horizontal abduction 30°, respectively. Plain radiographs (Fig. 6) and 3-dimensional CT (Fig. 7) showed that the posterosuperiorly displaced clavicle maintained the reduced position, there was no deformation of the ACJ or narrowing of the joint space, and there was no enlargement of the bone tunnels for the reconstructed ligaments due to loosening or sinking of the internal fixation materials.

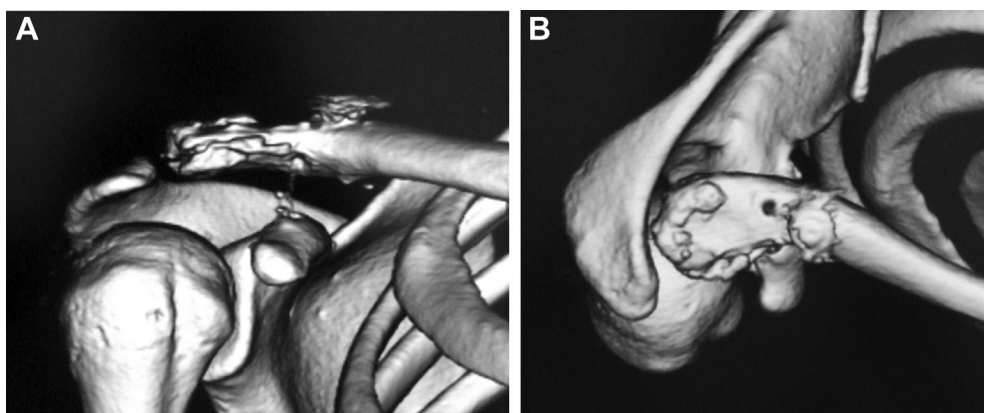
## Discussion

The epiphysis of the distal clavicle generally fuses at the age of 20 years. Therefore, trauma from a direct external force to the lateral ACJ in teenagers rarely results in ACJ dislocation; instead, it occurs as a distal clavicle fracture appearing as an epiphyseal injury (dehiscence). Moreover, the thick periosteum covering the clavicle not only forms a protective sleeve on the clavicle, but also functions as an attachment of the coracoclavicular ligaments.<sup>1</sup> Because the periosteum is weaker than the attachment of the coracoclavicular ligaments, when a distal clavicle fracture occurs, the distal clavicle is dislodged at the site of the periosteum injury, without damaging the coracoclavicular ligament. This is either a type I or type II epiphyseal plate fracture (Salter–Harris classification) that appears as an AC dislocation on plain radiographs (pseudo-dislocation).<sup>2</sup>

In our case, the initial injury resulted in a Salter–Harris type 2 distal clavicle fracture presenting only with a slightly superior displacement. The second injury resulted in a similar Salter–Harris



**Figure 6** Plain radiographs 2-years postoperatively (A) AP view and (B) axial view. AP, anterior-posterior.



**Figure 7** Three dimensional CT 2-years postoperatively, (A) frontal view and (B) superior view. These findings showed that the posterosuperiorly displaced clavicle maintained the reduced position. CT, computed tomography.

type 1 distal clavicle fracture, although with severe superior and posterior displacement of the clavicle. This difference in the displacement was due to the complicated trapezoid and conoid ligament tears, as shown in MRI. As for other injuries with this kind of presentation, we could only find a single case in the literature.<sup>3</sup> Therefore, we inferred that this extremely rare type of injury occurred as a result of the following processes. The healing process of the initial injury resulted in thickening of the periosteum and adhesions to the clavicle. Due to an incomplete fusion of the epiphyseal cartilage, the subsequent injury resulted in a Salter–Harris type 1 damage of the epiphyseal plate of the distal clavicle. At that time, because of the periosteal thickening around and adhesions to the clavicle, the fracture was similar to that in adults, characterized by the displacement of the clavicle along with the periosteum. Because the periosteum at the site of attachment of the coracoclavicular ligaments was displaced along with the clavicle, the posterosuperior displacement of the clavicle was accompanied by a rupture of the trapezoid and conoid ligaments.

Conservative treatment is primarily used for distal clavicle fractures in teenagers with an incomplete fusion of the epiphyseal cartilage,<sup>5,7</sup> although invasive therapy using Kirschner wire may be

required depending on the degree of the distal clavicular translocation.<sup>4</sup> In our case, because the patient was 17 years old with skeletally immature and there was a history of repeated injuries, epiphyseal damage, and rupturing of both coracoclavicular ligaments, we performed the arthroscopic conoid ligament reconstruction procedure, as reported by Takase et al.<sup>8</sup> Although the subjects of the report were adults, bone union was achieved in all cases after approximately 3 months with functional training starting after around 2 weeks of external fixation. Further, in a previous report,<sup>9</sup> both the superior and posterior displacement of the clavicle was halted only by reconstructing the conoid ligament. Also, this procedure is a minimally invasive surgical technique and enabled the conoid ligament to be reconstructed along its anatomical course with greater accuracy. Similar results were obtained in our case.

## Conclusion

We report a case of pediatric ACJ injury having a unique course in a 17-year-old female high-school judo player. Arthroscopic conoid ligament reconstruction was performed. At 2 years after



surgery, she showed no disability and was able to participate in the same competitive level as that before the injury.

#### Disclaimers:

**Funding:** No funding was disclosed by the authors.

**Conflicts of interest:** The author, their immediate family, and any research foundation with which they are affiliated have not received any financial payments or other benefits from any commercial entity related to the subject of this article.

**Patient consent:** Obtained.

#### References

1. Bishop JY, Flatow EL. Pediatric shoulder trauma. *Clin Orthop Relat Res* 2005;432:41-8. <https://doi.org/10.1097/01.blo.0000156005.01503.43>.
2. Black GB, McPherson JA, Reed MH. Traumatic pseudodislocation of the acromioclavicular joint in children. A fifteen year reviews. *Am J Sports Med* 1991;19:644-6.
3. Kirkos JM, Papavasiliou KA, Sarris JK, Kapetanos GA. A rare acromioclavicular joint injury in twelve-year-old boy. *J Bone Joint Surg Am* 2007;89:2504-7. <https://doi.org/10.2106/JBJS.F.01449>.
4. Kotb A, Yong T, Abdelgawad A. A posteriorly displaced distal metaphyseal clavicular fracture (Type IV AC Joint Dislocation-like) in children: A case report and literature review study. *Case Rev Orthop* 2016;2016:4015212. <https://doi.org/10.1155/2016/4015212>.
5. Kubiak R, Slongo T. Operative treatment of clavicle fractures in children; a review of 21 years. *J Pediatr Orthop* 2002;22:736-9.
6. Nenopoulos SP, Gigin IP, Chytas AA, Beslikas TA, Nenopoulos AS, Christoforidis JE. Outcome of distal clavicular fracture separations and dislocations in immature skeleton. *Injury* 2011;42:376-80. <https://doi.org/10.1016/j.injury.2010.09.036>.
7. Sarwark JF, King EC, Luhmann SJ. Proximal humerus, scapula and clavicle. In: Rockwood Jr CA, Wilkins KE, editors. *Fractures in children*. 7<sup>th</sup> ed. Philadelphia, Pa, USA: Lippincott, Williams & Wilkins; 2010. p. 621-30.
8. Takase K, Kono R, Yamamoto K. Arthroscopic stabilization for Neer type 2 fracture of the distal clavicle fracture. *Arch Orthop Trauma Surg* 2012;132:399-403. <https://doi.org/10.1007/s00402-011-1455-6>.
9. Takase K, Yamamoto K. Outcomes and functional of conoid ligament on the basis of postoperative radiographic findings of arthroscopic stabilization for the distal clavicle fractures. *Orthop Traumatol Surg Res* 2019;105:281-6. <https://doi.org/10.1016/j.ost.2018.12.005>.