Clavicle fracture after reverse total shoulder arthroplasty: a case report with literature review

Young Sin Kim, Seong-Il Wang, Ju Hong Lee

Chonbuk National University, Biomedical Research Institute of Chonbuk National University Hospital, Research Institute of Clinical Medicine of Chonbuk National University, Department of Orthopaedic Surgery, Jeonju, Republic of Korea

In reverse total shoulder arthroplasty, retensioning of the deltoid muscle is essential for regaining active elevation. However, the procedure remains problematic, in that it may potentially produce complications not only because it is a complex procedure but also because it causes anatomical changes. We experienced a rare case of a 64-year-old woman presenting with non-traumatic clavicle fracture after reverse total shoulder arthroplasty via a deltopectoral approach. In our case, the patient presented with pain in the clavicle area, which worsened during joint movement. Therefore, surgeons should consider the possibility of clavicle fracture in patients presenting with pain in the clavicle area which worsens.

Keywords: Clavicle fracture; deltopectoral approach; reverse total shoulder arthroplasty.

Reverse total shoulder arthroplasty was developed to treat patients with irreparable rotator cuff tear. Clinically, these patients present with painful pseudoparalysis of the arm and superior migration of the humeral head arising from the imbalance of the force couples. It is advantageous in fixing the glenohumeral center of rotation to the new position, thus defining the moment arms and resting tension of the scapulohumeral muscles.[1,2]

Retensioning of the deltoid muscle is essential for regaining active elevation. However, the procedure remains problematic, in that it may potentially produce complications not only because it is a complex procedure but also because it causes anatomical changes.[3,4] Its typical complications include acromial fracture, scapular notching, baseplate failure, periprosthetic fracture, scapular fracture, infection, hematoma, instability, and nerve lesions.[5]

We experienced a rare case of a 64-year-old woman presenting with non-traumatic clavicle fracture after reverse total shoulder arthroplasty via a deltopectoral approach. Here, we report our case with literature review.

Case report

A 64-year-old right-handed woman presented with a painful massive left rotator cuff tear. The patient had a past history of type 2 diabetes mellitus and hypertension, both of which were well controlled by medications.

Preoperatively, the patient had an active range of motion (ROM) of forward elevation of 65°, abduction of 50°, external rotation of 40°, and internal rotation at the sacral level. Preoperative radiographs showed findings that were suggestive of osteoarthritis and superior migration of the left humeral head. This was accompanied by the acetabularization of the acromion (Figure 1a). In addition, on preoperative magnetic resonance imaging scans, the patient had a massive cuff tear and fatty degeneration extending to the supraspinatus and infra-
spinatus muscles. Furthermore, the patient had findings that were suggestive of complete rupture of the subscapularis muscle (Figures 1b–d).

The patient therefore underwent reverse total shoulder arthroplasty in January 2011 and developed no complications (Figure 2a).

After being placed in an abduction pillow for 3 weeks, the patient began to perform pendulum and passive ROM exercises. Following this, the patient experienced aggravation of pain in the left shoulder. At postoperative Week 6, the patient had a tenderness on the anterior aspect of the shoulder in the clavicle area. The patient had a displaced clavicle fracture on radiographs (Figure 2b).

The patient was recommended conservative treatment. Therefore, the patient underwent immobilization using the abduction pillow again for 3 weeks and then performed a pendulum exercise only in a tolerable degree. Thereafter, the patient carefully began to perform a passive ROM exercise. At postoperative Month 8, the patient had union of the fracture on radiographs (Figure 2c).

At postoperative Month 30, the patient had forward elevation ROM of 120°, abduction of 110°, external rotation of 40°, and internal rotation at the fourth lumbar level. At final follow-up, the patient achieved recovery of the functions and symptoms.

Discussion
The length of the arm is increased by approximately 2.5 cm in patients undergoing reverse total shoulder arthroplasty.[5] This is accompanied by the increased tension of the deltoid muscle and the increased loading on the ori-
origin of the deltoid muscle by the action of the substantially longer lever arm of the deltoid muscle, which is due to the medialization of the center of rotation. This explains the possible occurrence of fracture of the origin of the deltoid muscle. It has been reported that the acromial fractures occur in 1–7% of patients undergoing reverse shoulder arthroplasty.  

In accordance with this, Crosby et al. reported that ipsilateral scapular fracture occurred during follow-up in 5.5% (22/400) of patients undergoing reverse total shoulder arthroplasty. As mentioned above, the anterior belly of the deltoid muscle originates from the lateral one-third of the clavicle, as well as the anterior acromion. However, there are no reports addressing fracture of the lateral one-third of the clavicle following reverse total shoulder arthroplasty. We experienced a rare case of a 64-year-old woman with non-traumatic clavicle fracture following reverse total shoulder arthroplasty. With the use of non-surgical treatments, good treatment outcomes were obtained. 

Little is known about the actual cause of the clavicle fracture. To date, however, several hypotheses have been proposed, as detailed below.

Firstly, the clavicle fracture might occur as a result of its preoperative erosion or insufficiency. In other words, the glenohumeral joint becomes unstable, causing the upward movement of the humeral head in cases of irreparable rotator cuff tear, which eventually leads to the erosion of the acromion. In cases when the subscapularis muscle is intact, the erosion occurs in the posterior region, possibly involving the scapular spine. Conversely, in cases when the functions of the subscapularis muscle are impaired due to its tear, the erosion occurs in the anterior region, possibly involving the clavicle. In the current case, on preoperative radiographs, the patient had findings that are suggestive of the acetabularization of the acromial arch. Despite lack of a notable presence of the lesions in the clavicle, the patient had findings that are suggestive of complete rupture and fatty degeneration of the subscapularis muscle on preoperative magnetic resonance imaging scans. This indicates that there is a possibility that the erosion might also occur in the clavicle.

Secondly, the clavicle fracture might occur as a result of the stress arising from the clavicle at time of surgery. In our series, surgical operations were performed via a deltopectoral approach. To obtain the visual field and to maintain it in the narrow, tight glenohumeral joint, the adjacent muscles including the deltoid were retracted with the use of a Hohmann retractor. This might weaken the clavicle due to the wear following the retraction of the deltoid muscle.

Thirdly, the clavicle fracture might occur as a result of overtensioning of the deltoid muscle during reverse total shoulder arthroplasty. It is generally known that the middle and anterior belly of the deltoid muscle are mainly involved in the generation of the force during the abduction and flexion of the reverse shoulder. As shown in the current case, the humeral length was increased by 26.8 mm, and the center of the rotation of the reverse shoulder was medially shifted by 17.0 mm. The tension of the deltoid muscle is increased as a result of the excessive lengthening of the humerus. Furthermore, with the medialization of the center of the rotation, the lever arm of the deltoid muscle is substantially increased. Thus, loads on the origin of the deltoid muscle are increased. This explains the possibility that the patient might develop fracture accompanied by pain in the clavicle at postoperative Week 3, when the patient began to perform flexion and abduction. This is plausible because the patient had a notable presence of the fracture on follow-up radiographs taken at postoperative Week 6.

In our case, the patient presented with the pain in the clavicle area and had a worsening of it during the joint movement. Therefore, surgeons should consider the possibility of clavicle fracture in patients presenting with pain in the clavicle area which worsens.

Conflicts of Interest: No conflicts declared.

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