OSTEOLOGY OF THE DISTAL CLAVICLE IN THE ELITE ROCK CLIMBER

A CASE REPORT

HYUNG LAE CHO, M. D., JUNG HOEI KU, M. D., JIN WAN KIM, M. D., CHOON KEY LEE, M. D. and SU HAN AN, M. D.

Abstract

Rock Climbing has become increasingly popular recently. It needs repetitive high-torque movements in gaining the ascent of rock faces often in steep overhanging positions, so the upper limb injuries are common and it is the major site of overuse syndrome. Osteolysis of the distal clavicle is very infrequent, its etiology and pathogenesis are poorly understood, but may be related to overuse. We report a case of the osteolysis of distal clavicle in an elite rock climber. The diagnosis was based on no history of shoulder trauma, positive plain radiographs, positive joint scintigraphy and MRI. Using this case, we discuss the possible pathogenic mechanism especially relating to this sport, differential diagnosis and treatment options for the osteolysis of the distal clavicle.

(key word : Distal clavicle, osteolysis, distal clavicle resection, rock climber)

Rock climbing has become increasingly popular in the past decade and its standards have undergone an evolution in the past 10 years. However, the increased participation exposes a greater number of climbers to potential injury. Improvements in protection techniques and the quality of climbing equipment mean that the old problems of broken bones have been replaced by a new set of overuse injury. The combination of repetitive climbing and the excessive weight-bearing demands of the sport result in cumulative trauma to the upper limbs1). The hands are used as tools for the ascent, with much of the climber’s weight placed upon the fingers and also distributed through the wrist, elbow and shoulders.

Osteolysis of the distal clavicle is a pathologic process involving resorption of the distal clavicle and is an uncommon cause of shoulder pain that can occur after acute injury or repetitive microtrauma such as weight lifting but its etiology and pathogenesis are poorly understood2).

We experienced a case of osteolysis of the distal clavicle in the elite rock climber man and report the possible pathogenic mechanism especially relating to this special sport as well as differential diagnosis and treatment options for the osteolysis of the distal clavicle.

CASE REPORT

A 37-year-old male rock climber complained pain in the left shoulder for about one year. He had about 10-year career of natural rock climbing, and one or two times climbing per week. There was no history of trauma to the shoulder either at work or during his sports activity. The pain was dull in nature even in rest, persistent in night and aggravated by climbing. Pain persisted after the patient received oral analgesic and the shoulder was immobilized with a sling.

Physical examination revealed point tenderness of the left acromioclavicular (AC) joint and restriction in the terminal range of shoulder abduction. The cross-chest maneuver elicited pain. There were no evidences of dislocation, instability or local infection signs such as redness or swelling. Laboratory investigations were normal including calcium, phosphorus, alkaline phosphatase, rheumatoid factor and C reactive protein.

Department of Orthopedic Surgery, Good Samsun hospital, 193-5 Jurye-dong, Sasang-gu, Busan, Korea
Radiographs showed that the left AC joint space was wider than the right one and cortical irregularity and subchondral cysts in the distal part of the clavicle (Figs. 1A and 1B). T2-weighted MRI study demonstrated increased signal intensity within the distal clavicle with a small amount of fluid surrounding the clavicle and within the AC joint (Figs. 1C and 1D). Joint scintigraphy showed increased activity in the distal part of the clavicle (Fig. 1E). AC joint aspiration and culture were done, but the results were negative.

Conservative treatment of rest, steroid injection and analgesics for 5 months failed to elicit significant relief of his symptoms. Because of the persistent pain, surgery was performed. After diagnostic arthroscopy of the shoulder, the acromioclavicular
joint was exposed by 3 cm longitudinal incision, and the distal end of the clavicle was resected with a margin of 1 cm. The cartilage of the clavicle had disappeared, and the bone of the distal clavicle was replaced by granulation tissue. The AC joint was filled with meniscus and granulation tissue. A microsection revealed that there were no cartilage layer on the distal clavicle, many inflammatory cells in the bone marrow with occasional multinuclear giant cells and moderate proliferation synovium adherent to the surface of the clavicle (Figs. 2-A and 2-B). Bacterial culture of the specimen showed negative results.

During the first week after the surgery, his shoulder was immobilized in a sling and subsequent passive and active motion exercises were encouraged within a tolerable range. Strengthening exercise was begun at weeks from the operation by the isokinetic exercise program. At three months after the operation was performed, the patient had normal shoulder motion and no discomfort of the shoulder. He could start light indoor climbing and no evidence of osteolytic progression had been observed for one year (Fig. 3).

DISCUSSION

In rock climbing, because maximal power and endurance are required of the upper extremities, these unusual stresses appear to be associated with a unique subset of injuries to the hand and upper extremity and they are the major site of injuries and overuse syndrome. The most common injuries found in rock climber involve the wrist and hand including flexor tendon or pulley injuries, where 60% of the injuries occur. The other 40% is equally divided between the shoulder and the elbow. Shoulder problems in climbers are quite common because most climbing is done with the arms above the head.

Osteolysis of the distal clavicle is a pathologic process involving resorption of the distal clavicle frequently overlooked as a cause of shoulder pain in both acute and chronic shoulder injuries. The incidence has been increasing with the rapid growth in popularity of weight training in the past 20 years. It has been reported to occur from traumatic, atraumatic (overuse), or systemic causes.
Atraumatic or stress-induced distal clavicular osteolysis has been reported in manual laborers, weight lifters and athletes who participate in strength-training programs or in throwing activities. The exact pathogenesis is uncertain but it is most likely the result of repetitive microtrauma, leading to subchondral stress fractures with synovial hyperemia and subsequent bone resorption. Cahill reported a total of 118 cases of osteolysis in young athletes, most of whom were weight lifters, and attributed the process to repetitive loading or stress at the AC joint. He postulated that the cumulative stress placed on the acromioclavicular area eventually exceeds some physiologically tolerable threshold and causes damage. He suggested that a better term to describe this entity would be stress failure syndrome, as opposed to overuse syndrome.

In the present case, we presumed that extreme forces on the upper extremity during rock climbing caused stress failure around his shoulder and subsequent osteolytic process. Other etiologic theories of osteolysis include autonomic nerve dysfunction leading to abnormalities in blood supply, terminal nerve or vascular damage, hyperplastic synovial invasion, and ischemic necrosis.

Evolution of osteolysis of the distal clavicle is frequently indolent and may represent a diagnostic dilemma for the clinician. Prompt recognition and diagnosis of the entity are of importance and a delayed diagnosis typically results in a permanently widened AC joint with varying degrees of mechanical dysfunction and pain. Early diagnosis and treatment have been shown to successfully halt the osteolysis process in some cases and result in varying degrees of reversal and healing; however, complete reversal, with the AC joint reverting to normal dimension, has not been reported in the literature.

The clinical examination is the first line investigation. Clinical symptoms frequently present with unilateral, less commonly bilateral, dull, achy shoulder pain that arises insidiously with slow onset. Focal pain and AC swelling with or without crepitus are common features in weight lifters and athletes. Exercises such as the bench press or push-ups frequently cause acute exacerbation, along with cross-body adduction and greater than 90 degree abduction of the arm. The process is usually unilateral; however, bilateral symptoms are frequent, occurring in as many as 20%.

With regard to the routine radiographic findings of distal clavicular osteolysis, the differential diagnosis may include the various causes of bone destruction that affect the AC joint, such as septic arthritis, rheumatoid arthritis, hyperparathyroidism, scleroderma, gout, primary and metastatic neoplasms, massive osteolysis of Gorham, and corticosteroid-induced arthropathy. On MR imaging, the most common and conspicuous feature is increased T2 signal intensity located in the distal clavicle, but it is impossible to make a determination of the specificity of MR imaging for the diagnosis of this disorder.

Osteolysis of the distal clavicle can be managed nonoperatively in most cases. However, controversy does exist on the course of the disease, with some authors concluding that insufficient treatment predisposes and exaggerates the osteolytic process, whereas others believe the eventual severity of bony damage is predetermined and directly related to the severity of the inciting event. Most do agree, however, that the natural course of the disease process is not that predictable and that determination of the severity of future clavicular involvement even with early intervention, is ultimately impossible. Early intervention generally will not suppress early manifestations but may result in decreased bone loss and an earlier cessation of osteolysis and clinical symptoms. Conservative treatment options should be used as long as the patient will comply, with consideration of the patient’s symptoms and functional status. Patients have been treated successfully with conservative methods by eliminating provoking activities, immobilizing the extremity, and using physiotherapeutics. Corticosteroid injections and oral anti-inflammatory agents have been used with li-
mited success. For those patients who fail conserva-
tive care or athletes who refuse to eliminate provok-
ing activities, surgical resection has proven to be a
reliable treatment of choice.

Currently, open resection and arthroscopic techni-
iques are employed in the surgical management of
osteolysis of the distal clavicle. The open resection
technique removes the pathologic articular surfaces,
creating a wide enough margin for removal of the
osteolytic process in its entirety and many authors
have reported satisfactory results with the proce-
dure for both traumatic and nontraumatic painful
entities of the AC joint\(^\text{10}\). The amount of bone that
needs to be resected has been an area of con-
troversy. Many authors have previously reported
satisfactory results with a 4 to 10 mm or similar
amount of resection in cases of atraumatic osteoly-
sis\(^\text{11}\). Arthroscopic resection for osteolysis of the
distal clavicle has also results comparable to open
excision with low morbidity, but it is technically de-
manding procedure.

Osteolysis of the distal clavicle is a very rare con-
dition and its pathogenesis is uncertain but repeti-
tive microtrauma and subsequent stress failure are
major etiological factors. Rock climbing injuries are
common in upper extremity due to cumulative
trauma and the shoulder is one of the potential risk
regions. Prevention should begin with educating
climbers on the potential risk for injury. Although
adequate rest between climbs and decreased training
when pain is first encountered would aid in allevi-
ating numerous problems, additional search directed
towards improving training, treatment and rehabi-
litation programs is warranted.

REFERENCES

1 ) Bannister, P., Poster, P. Upper limb injuries associ-
55.
2 ) Cahill, B. R. Osteolysis of the distal part of the clavic-
64, 1053–1058.
3 ) Patrick, P. Orthopedic problems in sport climbing.
4 ) Hawkins, B. J, Covey, D. C., Thiel, B. G. Distal clavicle
osteolysis unrelated to trauma, overuse, or metabolic
5 ) Cahill, B. R. Atraumatic osteolysis of the distal clavicle:
6 ) Brunet, M. E., Reynolds, M. C., Cook, S. D. Atraumatic
osteolysis of the distal clavicle: histologic evidence of
synovial pathogenesis. A case report. Orthopedics,
7 ) Gajerski, B. L., Kettner, N. W. Osteolysis of the distal clavicle:
serial improvement and normalization of
acromioclavicular joint space with conservative care.
8 ) Clarke, H. D., McCann, P. D. Acromioclavicular joint
9 ) de la Puente, R., Boutin, R. D., Theodorou, D. J.
Post-traumatic and stress-induced osteolysis of the
distal clavicle: MR imaging findings in 17 patients.
10 ) Mestan, M. A., Bassano, J. M. Posttraumatic osteolysis of
the distal clavicle: analysis of 7 cases and a review of
the literature. J. Manipulative Physiol. Ther.(2001 )
24, 356–361.
11 ) Slawski, D. P., Cahill, B. R. Atraumatic osteolysis of
the distal clavicle. Results of open surgical excision.