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Reattachment using the suture bridge augmentation for Achilles tendon avulsion fracture with osteoporotic bony fragment

Byung-Ki Cho*, Ji-Kang Park, Seung-Myung Choi

Department of Orthopaedic Surgery, College of Medicine, Chungbuk National University, Cheongju, Republic of Korea

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ABSTRACT

Although avulsion fractures of the calcaneal tuberosity are rare injuries, these can be a challenging problem with frequent complications, such as loss of reduction and soft tissue problem. Anatomical reduction and internal fixation are indicated to avoid these pitfalls and to restore function of the triceps surae. However, the best fixation device and operative technique are still controversial. A case that achieved satisfactory clinical outcome through a reattachment technique using the suture bridge augmentation for Achilles tendon avulsion fracture with osteoporotic bony fragment is presented.

1. Introduction

Avulsion fractures of the calcaneal tuberosity are rare injuries, as they account for only 1.3–2.7% of calcaneal fractures [1]. Due to their rarity, little regarding the pathophysiology of these fractures has been revealed. Traditional intra-articular calcaneal fractures are caused by high energy trauma, whereas avulsion fractures of the calcaneal tuberosity are recognized as an insufficiency fracture, which are usually extra-articular and often appear without a history of significant trauma [2]. These injuries have a peak incidence in elderly patients with decreased bone mineral density (BMD) and are associated with systemic chronic comorbidities, such as diabetes with neuropathy or renal disease, rheumatoid arthritis [2,3]. Avulsion fractures of the calcaneal tuberosity are known to have frequent complications, such as loss of reduction and soft tissue problems (delayed wound healing or skin necrosis, wound infection, and skin irritation) [3]. The reasons for loss of fixation include poor bone quality (low BMD) which are related to medical comorbidities, and the inherent characteristics of a comminuted fracture with thin cortical portion. The tendency for proximal and posterior displacement of bony fragment caused by the pull-out tension of the triceps surae makes the treatment for these fractures more difficult. Maintaining reduction can be quite challenging and may result in failure of fixation. In addition, displaced bony fragments with increase pressure on the overlying skin can cause soft tissue complications and secondary surgery [3,4]. Thus, anatomical reduction and internal fixation are indicated to avoid these pitfalls and to restore function of the triceps surae. However, there is still no general consensus on the best operative technique. The rarity of this fracture pattern makes a prospective randomized study including the larger cohort difficult.

Suture bridge augmentation using suture-tape (Achilles SpeedBridge®, Arthrex) described in current study is an advanced variant of the reattachment technique using suture anchors, originally performed as a rotator cuff repair technique in the shoulder joint. Suture bridge technique has been demonstrated to increase the area of compression and the fixation strength compared with using screws or anchors alone [5]. Many authors have reported that the suture bridge technique minimizes gap formation at the bone-tendon repair site, distributes the forces to be concentrated at the suture anchor, and has torsional resistance, allowing early rehabilitation [6,7]. The advantages of the suture bridge technique were also applied for Achilles tendon surgery, and biomechanical excellence was demonstrated [8,9]. Recently, a clinical usefulness of this technique for insertional Achilles tendinosis or Achilles tendon repair has been reported [10–13]. As such, the authors of this manscript thought that the suture bridge technique could be applied to surgical treatment for Achilles tendon avulsion fracture. This technique may have also the minimal risk regarding soft tissue problems caused by a prominent screw head or bulky metal construct. The purpose of this report is to describe an augmentation procedure using the suture bridge technique for Achilles tendon avulsion fracture with osteoporotic bony fragment in an elderly patient.

2. Case report

A 76-year-old male visited our emergency room with walking

* Corresponding author at: Department of Orthopaedic Surgery, Chungbuk National University Hospital, 62, Gaesin-dong, Seowon-gu, Cheongju, Chungbuk 28644, Republic of Korea. Fax: +82 43 274 8719.
E-mail address: titanick25@naver.com (B.-K. Cho).

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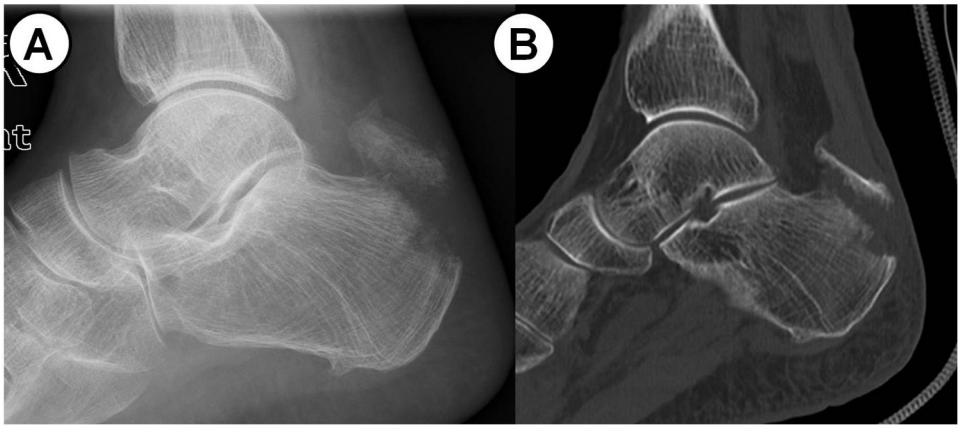

Fig. 1. (A) Preoperative radiograph shows a displaced avulsion fragment of the calcaneal tuberosity. (B) Preoperative CT scan shows a limited bone stock with a shell of thin cortical bone.

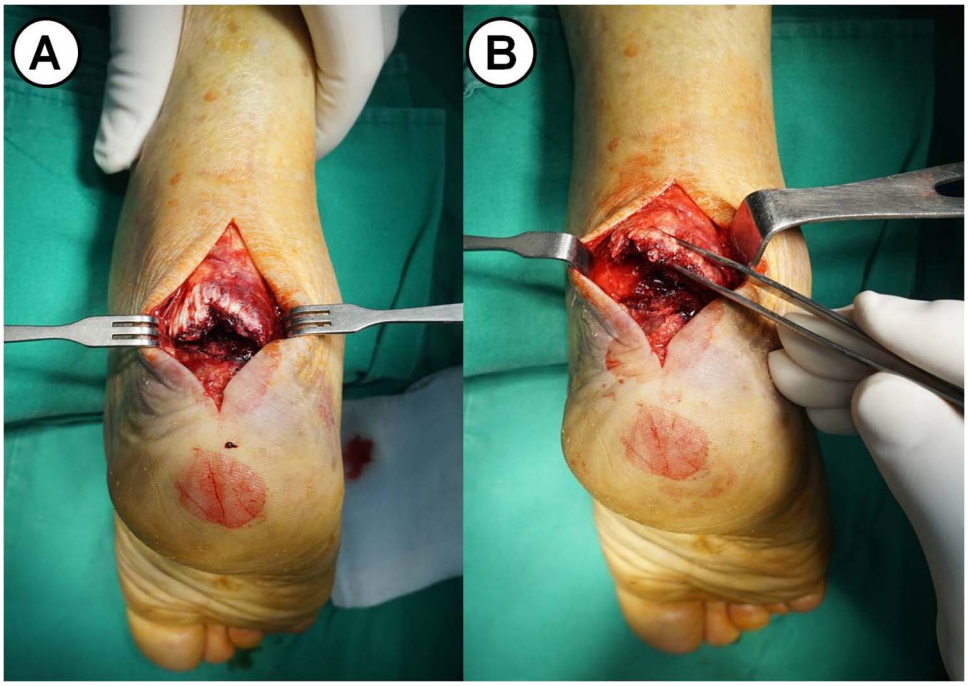

Fig. 2. Intraoperative photographs show (A) an avulsion fracture at insertion site of Achilles tendon, (B) a bone fragment (held with forceps) displaced by the pull-out tension of the triceps surae muscle.

difficulty and pain in his right ankle after slip down injury while descending stairs. On physical examination, a tender bony prominence was palpated at 3 cm proximal area of the calcaneal tuberosity and plantarflexion power of the ankle was very weak. Plane radiographs and CT scan showed a displaced avulsion fragment of the calcaneal tuberosity which had a limited bone stock with a shell of thin cortical bone (Fig. 1). The patient had osteoporosis and type-2 diabetes with a mild renal disease on review of the past medical history. He was active in daily and occupational (farmer) activities. Operation was performed within 24 h from injury, to prevent soft tissue problems caused by a displaced bony fragment. Under spinal anesthesia, the patient was placed in the prone position with a thigh tourniquet. A 5 cm sized longitudinal midline incision was made in manner placing fracture site to the center. After longitudinal division of the paratenon and exposure of the calcaneal tuberosity were performed, the displaced fragment was anatomically reduced by maximal plantarflexion of the ankle (Fig. 2). Two Kirschner wires were inserted (from supero-posterior to infero-anterior) for provisional fixation maintaining the reduction of fragment. A 2.7 mm drill bit was used to create holes for 2 proximal row anchors about 5 mm proximal to the proximal edge of the fracture line, just anterior to the Achilles tendon. The holes were placed 2 cm apart. Subsequently, distal holes were placed about 5 mm distally from the distal edge of the avulsed bone fragment (Fig. 3). Two SwiveLock® biocomposite suture anchors (3.5 mm in diameter; Arthrex, Naples, FL, USA) and 2-strands of FiberWire® suture-tape (Arthrex, Naples, FL, USA) were inserted into the 2 proximal holes, respectively. The suture-tapes from each anchor were passed through two small holes made in Achilles tendon just proximal to its insertion, from ventral to dorsal side of Achilles tendon. Without tying knots, one limb of each suture-tape was gathered in crossing configuration (Fig. 4). While maintaining the ankle joint in full plantarflexion and maximum tension of suture-tapes, two knotless anchors (SwiveLock®) were inserted into the distal hole, respectively. The remnants of suture-tape were cut out level with the knotless suture anchors. The ends of K-wires were bent and directed to the plantar side to avoid irritation (Fig. 5). The range of motion of the ankle joint and stability of avulsed fragment were checked with the fluoroscopic examination. Then, paratenon and skin were closed. The operation time for this reattachment procedure was approximately 20 min (Fig. 6). Immobilization using short leg cast with the ankle held in a 20° of plantarflexion and nonweight-bearing ambulation with