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Review

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Endoscopy-assisted percutaneous repair of Achilles tendon rupture

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ABSTRACT

While the Achilles tendon (AT) is the strongest and thickest tendon in the human body, it is also the most common tendon to rupture. It begins near the middle of the calf and is the conjoint tendon of the gastrocnemius and soleus muscles. Though numerous non-operative and operative methods have been described, there is no universal agreement about optimal management strategy of acute, total AT rupture. Since endoscopy-assisted percutaneous AT repair allows direct visualization of the synovia and protects the paratenon, which is important in the biological healing of the AT, this technique is a reasonable treatment option in AT rupture. Aim of this review was to discuss details of endoscopy-assisted percutaneous repair of Achilles tendon rupture and present experience.

Keywords: Achilles; endoscopy; percutaneous repair.

Introduction

Achilles is the strongest tendon beginning near the middle of the calf and is the conjoint tendon of the gastrocnemius and soleus muscles. The calcaneal insertion is specialized and designed to aid the dissipation of stress from the tendon to the calcaneum. The insertion is crescent shaped and has significant medial and lateral projections. It has a high capacity to withstand tensional forces created by the movements of the human body.[1,2] Achilles tendon (AT) ruptures are reported as the third most frequent major tendon rupture, following rotator cuff and quadriceps ruptures.[3,4]

The blood supply of the tendon is from the musculotendinous junction, vessels in surrounding connective tissue, and the osteotendinous junction. The vascular territories can be simply classified into three sections, with the midsection supplied by the peroneal artery, and the proximal and distal sections supplied by the posterior tibial artery. This leaves a relatively hypovascular area in the mid portion of the tendon where most problems occur.[1]

Despite numerous non-operative (casting or functional bracing) and operative methods, optimal treatment of AT ruptures remains controversial, and management is still determined by the preferences of the surgeon and the patient. Cast immobilization, a conservative treatment, may

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lead to elongation of the tendon with reduced strength of the calf muscles and in a high rate of re-ruptures, with an incidence up to 37%.[5–7] Similarly, open surgical repair of the Achilles tendon also includes potential problems such as joint stiffness, muscle atrophy, adhesions, deep venous thrombosis due to prolonged immobilization after surgical repair, and infection, scarification, algodystrophy, and particularly wound breakdown.[8–11] In order to avoid complications, percutaneous tendon repair technique has become popular in recent years. The advantages of the operative and conservative methods are combined in minimally invasive percutaneous repair technique. However, percutaneous repair technique involves major disadvantages such as barely having no direct visualization of the tendon ends and complications of the sural nerve entrapment. Therefore, some authors started to perform percutaneous repair of the Achilles tendon under endoscopic control and published their promising results with less complication rates.[11] It provides a great opportunity to visualize three different joint spaces, knee, ankle, and subtalar joints during the procedure, if necessary.

Indications and Contraindications of Percutaneous Repair

Patients were selected for percutaneous repair if the following criteria were fulfilled:

1. Closed rupture

2. No previous surgery of effected Achilles tendon

3. Complete rupture in the tendinous portion within the last 7–10 days

Contraindications can be listed as:

1. Open ruptures

2. Previous Achilles tendon or ankle joint surgery

3. Inadequate distal tendon stump (<2 cm)

4. Systemic diseases (diabetes mellitus, RA, SLE, and etc.) (relative contraindication)

The optimal treatment period is 7-10 days after acute total rupture. This technique is also useful for bilateral injuries.

Surgical Technique

The operation was performed on the patients in prone position under local infiltration anesthesia. Tourniquet was not used. Before starting the procedure, the rupture site was marked. Later, to minimize local bleeding to the palpated gap proximally (about 5 cm) and distally (about 4 cm), the skin, subcutaneous tissues, and peri-tendon were infiltrated with 20–50 mL 0.9% saline solution with local anesthetic (1% Citanest® 5 mL + 0.5% Marcaine® 5 mL) around the eight planned stab wounds, four medial and four lateral to the tendon, distributed evenly, proximally and distally to the rupture. These puncture holes were later enlarged andused for needle entry. Special attention was paid to the area lateral to the Achilles tendon, especially proximally, where the sural nerve lies close to and crosses the Achilles tendon. The patient was prompted to report any paresthesia or pain in the area of distribution of the sural nerve at any time during the injection of local anaesthetic or procedure. If reported, the puncture site was shifted 0.5–1 cm toward the midline. The injured foot was positioned in approximately 15° of plantar flexion. The tendon and paratenon were examined with a 30° scope via the distal medial incision. After the level of the rupture was determined, the continuity of the surrounding tissues together with their consistency and vascularization was evaluated. The torn ends of the Achilles tendons were inspected, and, if necessary, manipulated with in the paratenon.

A biopsy of the ruptured area had to be performed routinely in patients. Afterwards, two medial and two midline lateral incisions of 1 cm each were inflicted on the proximal and the distal of the rupture level followed by suturing starting from the proximal through modified Bunnell technique using PDS No. 5. The sutures were tied in a manner to end in the proximal lateral end at the ankle 90° of neutral position. This procedure had to be repeated once or twice. Attention had to be paid to check the 90° position on the ruptured side after prompting the patients to set the foot to neutral 90° throughout suture fastening. After fastening the sutures, the patient was instructed to activate the ankle motions while the knee was in 90° position.

No drainage was used. The skin stab incisions were closed with Steri-Strips and a walking brace with the ankle in neutralposition was applied for at least 3 weeks.

Endoscopic Evaluation of Achilles Tendon Ruptures

In terms of evaluation, the characteristics of tendons surrounding paratenon and tendon are noted and divided into 2 grades (Figures 1, 2):

Grade I reveals an intact paratenon with Achilles tendon rupture and Grade II reveals rupture at both the paratenon and the Achilles tendon.

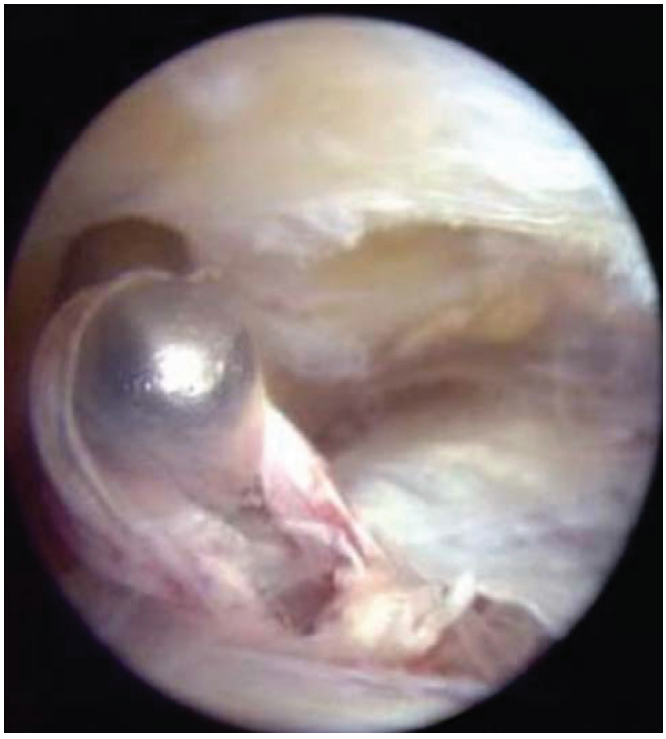

Figure 1. The view reveals an arthroscopic evaluation of Grade 1 Achilles tendon rupture.

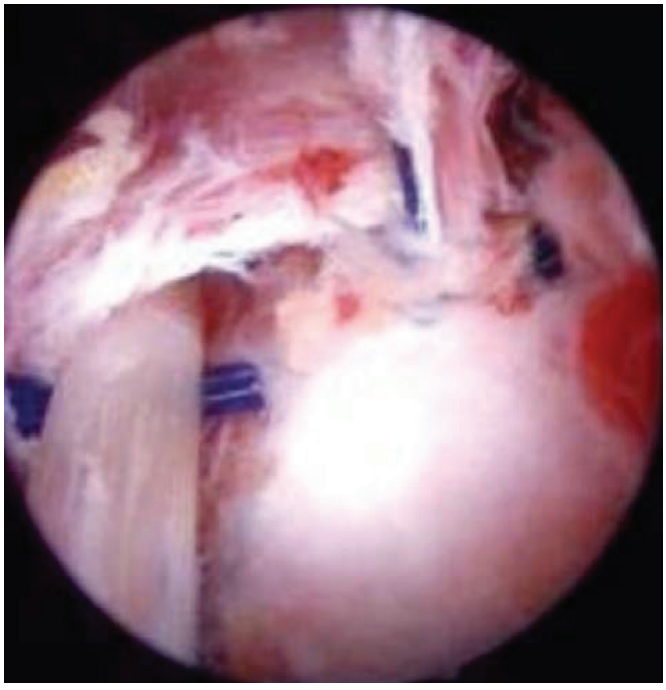

Figure 2. The arthroscopic view demonstrates Grade 2 Achilles tendon rupture, sutures and reinforcement with plantaris tendon.

Rehabilitation

The early active rehabilitation protocol of walking by putting on weight as can be tolerated without brace, splint or special shoe was started on the first day after surgery. Neuromuscular exercises for the ankle and lower extremity were performed on the first sixth to eighth weeks, and resistance and gentle-active stretching exercises were already initiated until the sixth or eighth week after surgery. A sports-specific rehabilitation program was designed for the patients on the third or fourth month of the surgery.[12]

Follow-up and Clinical Evaluation

During follow-up, measuring the calf diameter of the injured and uninjured side, examining the ankle range of motion with goniometry, and performing a detailed neurological examination focused on sural nerve are recommended. As suggested by Kitaoka et al., we are assessing other factors more specific to the repairment of an Achilles tendon rupture, namely, the strength of ankle plantar flexion with the patient standing on tiptoe, the ability to perform repeated toe raises and single limb hopping, and the neurological status of the foot.[13] For single-limb hopping, patients are asked to hop as many times as possible until they cannot lift their toe off the floor. We note the integrity of the paratenon of Achilles tendon and subgroup.

Hacettepe Experience

Sixty-two patients (58 males, 4 females, and mean age 32) were treated by percutaneous suturing with modified Bunnel technique under endoscopic control within 10 days after acute total rupture. Physiotherapy was initiated immediately after the operation and patients were encouraged to weight-bearing ambulation with a walking bracemoon boot as tolerated. Full weight-bearing was allowed at least three weeks after surgery without a brace. The procedure was tolerated in all patients. There were no significant ROM limitation observed. Two patients experienced transient hypoesthesia in the region of sural nerve that spontaneously resolved in 6 months. Fifty-nine patients (95%) including professional athletes returned to their previous sportive activities, while 18 of them (29%) had some minor complaints. The interval between injury, returning to daily activities, and rehabilitation training was 11.7 weeks (10–13 weeks). At the latest follow-up (mean: 46 months; range: 12–78 months), all the patients had satisfactory results with a mean American Orthopedic Foot and Ankle Society's ankle-hindfoot score of 94.6. No re-ruptures, deep venous thrombosis, or wound problems occurred.[12]

For the last one year, we have been injecting platelet-rich plasma to stimulate the biologic repair process at the end

of the suturing process. We believe the advantage of biological stimulation after mechanical repair. However, we do not have enough evidence supporting our belief yet. Therefore, it is an issue that should be further investigated and evaluated with long-term results.

Conclusion

Endoscopy-assisted percutaneous suturing of the Achilles tendon under "infiltrative" anesthesia with this current technique is a rational alternative for the treatment of acute total Achilles tendon rupture in both athletes and individuals. This technique resulted in a cosmetic wound appearance, endurability to early-active mobilization and satisfactory clinical recovery without any severe complications, but calf atrophy seems to be the major disadvantage of this procedure. Furthermore, this procedure protects the paratenon and thus blood supplies of the tendon and enhances biologic recovery. In addition, direct visualization and manipulation of the tendon ends provide a precise apposition of the ruptured tendon, thus diminishing the handicaps of the single percutaneous techniques.

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