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Original Research

Minimally Invasive Achilles Tendon Stripping for the Management of Tendinopathy of the Main Body of the Achilles Tendon

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ABSTRACT

Achilles tendinopathy is a common cause of disability. New nerves fibers grow from the paratenon into the Achilles tendon, and they could play a central role in the development of pain. We report the results of minimally invasive Achilles tendon stripping for Achilles tendinopathy in 47 active patients. The Victorian Institute of Sports Assessment-Achilles questionnaire score improved from 53.8 preoperatively to 85.3 postoperatively ($p < .001$). After a mean follow-up period of 40.5 months, 41 patients had resumed sporting activities at an average of 3.5 months postoperatively. A sural nerve injury was recorded in 5 patients (10.6%), and all 5 complications occurred during the first 12 cases. As a result, the technique was slightly modified, and no sural nerve neuropathy was observed subsequently. One superficial infection (2.1%) was recorded. Minimally invasive Achilles tendon stripping seems to be an effective, technically simple, and inexpensive treatment of Achilles tendinopathy. Further randomized controlled trials involving more patients are needed to confirm these outcomes.

Achilles tendinopathy is considered the result of a failed healing response, leading to changes in the structure of the tendon fibers after overuse or metabolic impairment (1–6). The origin of pain in tendinopathy of the main body of the Achilles tendon is, however, controversial (7–9). Abnormal neoinnervation often accompanies the neovascularization and is thought to play a central role in the development of pain (10–13). Management of Achilles tendinopathy is first conservative, and different treatments such as nonsteroidal antiinflammatory drugs, physical therapy, rest, training modification, taping, cryotherapy, shock wave therapy, hyperthermia, and various peritendinous injections have been used with different results. However, the management of Achilles tendinopathy lacks evidence-based support, because few treatment modalities have been investigated in randomized controlled trials. Therefore, patients are at risk of long-term morbidity with unpredictable clinical outcomes. Good results have been reported with eccentric exercise (3,6), although the mechanism of action is not completely understood (6). Mechanical conditioning and destruction of neovessels and nerves after eccentric training might be the reason for the improvement in pain (10). Other management modalities, aiming at eliminating neovascularization include sclerosing (14) and high-volume injections (15). Neovessels can be easily detected using ultrasonography and, therefore, can be targeted for injection. However, no clear evidence has shown that it is the vessels that cause the pain, and it has been proposed that it is the adjacent neonerves that are the real issue (7,8). Approximately 25% of patients do not respond to conservative management (16), and they need surgery. Traditional open surgery aims at debridement of the tendinopathic tissue (8), and it has been associated with a high rate (10%) of wound complications (3,17). Furthermore, whether pathologic tissue is the cause of pain is still debated, because the tendon fibers might have no nerve endings (9). Minimally invasive surgical techniques have been developed, with the

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aim of removing the neural tissue close to the Achilles tendon and, thus, resulting in denervation (18,19). The senior author (N.M.) developed a minimally invasive stripping technique that aims to remove the neovessels and accompanying nerves that form the pathologic portion of the Achilles tendon (5).

In the present study, we tested the hypothesis that minimally invasive Achilles tendon stripping would improve symptoms and functional outcomes with a low complication rate.

Patients and Methods

A total of 47 consecutive athletic patients (36 males and 11 females), with a mean age of 35 ± 9.5 (range 25 to 58) years underwent minimally invasive Achilles tendon stripping for mid-portion Achilles tendinopathy after failed conservative treatment. The mean period between the beginning of symptoms and surgical treatment was 12.3 ± 9.5 (range 6 to 22) months. All 47 patients were actively engaged in sports (Table 1). All surgeries were performed by the senior author (N.M.) or under his supervision.

Surgical Technique

Surgery was performed with the patient prone, under local anesthesia by direct injection (10mL of 1% lignocaine with adrenalin and 10 mL of 0.5% bupivacaine), and as an outpatient procedure. Four small (0.5-cm) longitudinal skin incisions, in line with the Achilles tendon, were made using a no. 11 scalpel blade. Two proximal incisions were made just medially and laterally to the origin of the tendon and two distal incisions at the level of the calcaneal insertion of the tendon. A mosquito clamp was inserted through the proximal incisions (Fig. 1) to free the peritendinous adhesions. A no. 1 unmounted Ethibond (Ethicon, Somerville, NJ) suture thread was doubled up and passed transversely through the 2 proximal incisions, ensuring that it was anterior to the Achilles tendon, at the interface between the tendon and the Kager fat pad. In the original technique, the suture thread was retrieved distally, posteriorly to the Achilles tendon, to form an inverted U. After the first 12 patients, the configuration was changed such that the unmounted Ethibond suture was first passed transversely through the 2 proximal stab wounds (Fig. 2) and then retrieved distally in an X fashion. In practice, a suture retriever was inserted from the distal lateral stab wound to the proximal medial stab wound (Fig. 3). Next, after the unmounted Ethibond suture had been brought out of the distal lateral stab wound, the retriever was inserted from the distal medial stab wound to the proximal lateral stab wound (Fig. 4) to repeat the process. After the unmounted Ethibond suture had been retrieved from the distal medial and lateral stab wounds, a gentle seesaw motion was applied (similar to using a Gigli saw around bone), and the Ethibond suture was gently advanced over the interface between the Achilles tendon and the Kager fat pad (Fig. 5). The tendon was thus stripped and freed from the Kager triangle fatty tissue. The stab wounds can be left open (20) or can be closed in standard fashion. A standard Mepore (Molnlycke Health Care, Gothenburg, Sweden) dressing was applied.

Patients were allowed to walk with weightbearing as tolerated postoperatively. After 2 weeks, the dressing was removed, and physiotherapy was begun, focusing on proprioception, plantarflexion of the ankle, inversion, and eversion.

Outcomes Assessment

The outcomes were assessed by comparing the Victorian Institute of Sports Assessment-Achilles (VISA-A) questionnaire scores (21), calf circumference, and strength of the affected and contralateral (control) legs preoperatively and at the last follow-up examination. The time to return to sports, incidence of complications, and need for further surgical procedures were recorded. All the patients were prospectively followed postoperatively in outpatient clinics for ≥24 (mean 40.5 ± 7.4, range 24 to 52) months.

Table 1
Sports activities of the patients

Sports	Patients [n (%)]
Running/trekking	14 (29.79)
Soccer	12 (25.53)
Rugby	7 (14.89)
Tennis/squash	7 (14.89)
Gymnasium	5 (10.64)
Golf	2 (4.26)
Total	47 (100)

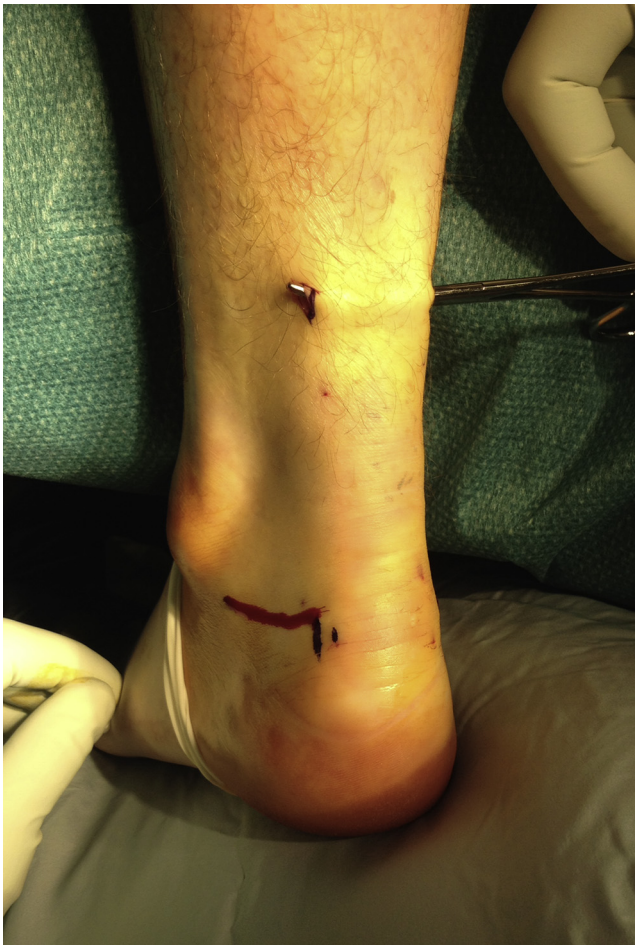

Fig. 1. Four small longitudinal incisions were performed, and a mosquito clamp was inserted through the 2 proximal stab incisions. The mosquito clamp is at the interface between the Achilles tendon and Kager triangle.

Statistical Analysis

Differences between the preoperative and postoperative outcomes were tested using the Student *t* test. A *p* value $< .05$ was considered statistically significant. Statistical analysis was performed using SPSS, version 16.0, software (IBM Corp., Armonk, NY).

Results

The mean average VISA-A questionnaire score improved from 53.8 ± 7.9 (range 41 to 69) preoperatively to 85.3 ± 6.7 (range 72 to 94) at the final follow-up examination ($p < .001$). The calf circumference was similar between the affected and nonaffected legs both before surgery and at the final follow-up evaluation. We did not find statistically significant improvements in the operated leg at the final follow-up examination ($p = .92$; Table 2). Regarding calf strength, we found statistically significant improvement in the operated leg at the final follow-up examination ($p = .031$), with no statistically significant differences found between the operated and control legs ($p = .63$).

Of the 47 patients, 6 (12.8%) did not return to sports activities (3 patients had played soccer, 2 had been runners, and 1 had played squash). They were all young male patients (mean age 31.8 ± 6.8, range 25 to 42 years). The remaining 41 patients had returned to sports after an average of 3.5 ± 0.6 (range 2 to 5) months. Of these 41 patients, 6 stated that they had returned to a lower level of sports activities compared with before their injury. Five patients (10.6%) developed sural nerve paresthesia, with two requiring surgical