

Abstract objectives:
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ABSTRACTObjectives: Rupture of Achilles tendon is a relatively infrequent but serious injury.

Although many surgeons favor a formal operative approach to secure the best possible repair, controversy still exists over the best appropriate treatment method. The purpose of this study is to evaluate the clinical results of percutaneous suturing technique of Achilles tendon. Design Setting, and Patients: Twenty-two patients, with a complete and fresh Achilles tendon rupture treated by the percutaneous suturing prospectively analyzed. The minor and major complications, duration of surgery, American Foot and Ankle Society scores, patients' return to their previous activity levels, presence of any associated complaints, final range of motion and satisfaction levels were evaluated.

Main Outcome Measure: Percutaneously repaired Achilles tendon outcomeResults: None of the patients had a major complication. Two patients had an adhesion of the scar tissue and one patient had a suture granuloma and one patient had a sural nerve neuropraxia. The average follow-up and duration of operation after skin incision was 17. 7 months and 28 minutes, respectively. Mean AOFAS score was 95.

3. None of the patients had a weakness or footwear limitations. All patients except one were very satisfied. The mean time lost from work was six weeks. The average active range of ankle motion of the affected limbs was 18. 30 for dorsiflexion and 47. 1o for plantar flexion. Conclusions: The percutaneous repair technique of the Achilles tendon rupture is a safe and simple method

with low incidence of complications and has comparable clinical results with open repair.

INTRODUCTIONRupture of Achilles tendon is a relatively infrequent but serious injury that affects the plantar flexion mechanism of the ankle joint. 1 The rupture of the Achilles tendon during amateur or professional sport-related activities is becoming more frequent, as is the request for treatments that enable the fastest possible recovery. There has been considerable debate regarding the best treatment alternative of acute ruptures of the Achilles tendon2.

Many surgeons favor a formal operative approach to secure the best possible repair with the least chance of reruptured and possibility of early functional treatment. 3-5 Some surgeons advocate conservative treatment because of surgical repair may also be associated with a significant complication rate and high cost. 6-8 Percutaneous suturing, first described by Ma and Griffith9 may combine the advantages of both methods and reported good results in eighteen patients. This method alone enables immediate mobilization with an early load bearing, preserves the blood supply of the paratenon, benefits from the motion which accelerates repair, without the well known complications produced both by the non- operative and by open surgical treatments. The purpose of this study is to evaluate the clinical results of percutaneous suturing technique of Achilles tendon ruptures. The main focus is to evaluate clinical outcome, return to preinjury daily activities with work and the risk of complications rate. **MATERIALS AND METHOD**STwenty-two patients, with a complete and fresh Achilles tendon rupture treated by the

percutaneous suturing technique between September 2003-April 2005 were analyzed in our institution.

There were no bilateral ruptures. Closed, complete and acute (<3 weeks) tendon ruptures were included in this study. On the other hand, late tendon ruptures (> 3 weeks), ruptures with skin lesions and reruptures were excluded. For all the patients, data regarding age, sex, mechanism of tendon rupture, presence of a recognized medical risk factor (ie. chronic renal failure, history of steroid administration, floroquinolone usage, autoimmune inflammatory disease, gout, diabetes mellitus and hyperparathyroidism) were recorded.

The diagnosis of achilles tendon rupture was made with clinical examination and X-ray findings of avulsion from the superior pole of the calcaneus. Magnetic resonance imaging was used to confirm the diagnosis in 2 patients. All patients were treated within 36 hours by two orthopedic surgeons and the duration of operations were recorded. In the postoperative period, all patients were discharged to home 24 hours after surgery. Surgical Procedure: The procedure was performed under spinal anesthesia and a tourniquet was placed around the proximal part of the thigh. Patients were placed prone on the operating table and the involved leg was prepared and draped in the usual manner.

Skin incisions marked medial and lateral sides of the tendon. Special attention was paid to the lateral aspect of the Achilles complex, particularly proximal, where the sural nerve lies adjacent to and crosses the Achilles

tendon. Because of proximal lateral incision was made slightly medial. The medial and lateral incisions were made first at the sides of the rupture following proximal and distal incisions. After the skin has been incised, the 'Modified Kessler' technique by number 5 of Ethibond (Ethicon Inc. US.) suture was used from the 3 medial and 3 mid lateral incisions.

From the lateral side, the needle is passed through the middle incision then through the tendon substance to exit at the proximal incision and passed transversely across the tendon then exit at the proximal medial side. The needle was reintroduced from proximal medial side and taken out through the middle medial incision. It was then introduced into the same incision and the distal stump of the tendon was captured with the suture. The free ends of sutures were held by a haemostat clamp so the sutures were not catching skin and subcutaneous tissue.

A second suture was passed in the same fashion. The ankle was then placed in plantar flexion while the sutures were tied. After several sutures were passed and tied, the skin incisions were closed. Postoperative Treatment and Follow-upPatients were followed up regularly at ten days, 3, 4, 5, 6 and 8 weeks postoperatively.

Complications were divided into two groups: major complications including rerupture, deep infection, necrosis of the skin, deep venous thrombosis and permanent equines position of the foot and minor complications including superficial infection, delayed wound healing, adhesion of the scar and disturbances of sensibility. A physiotherapist working as a member of the

orthopedic team ensured adherence to a standardized rehabilitation protocol. This program was divided into three distinct stages and a functional orthoses was used for eight weeks postoperatively.

For the first three weeks, patients were allowed partial weight-bearing with the ankle orthosis locked in 30° of plantar flexion. After three weeks, plantar flexion was decreased 10 degrees at every week gradually. The goal was to reach a neutral ankle position at the end of the five-week.

At 6 weeks postoperatively, full weight-bearing was allowed with continuous use of the orthosis locked with the ankle in neutral position. At the end of eight weeks, the immobilization was ended with clinical confirmation of the healed tendon including Thompson test, neurologic status and ability to perform repeated toe raises with both legs. Then, patients were allowed to walk without orthoses and they started range of motion exercises.

Final Follow-upAt the final follow-up, patients were assessed by using the ankle-hindfoot scale of the rating system developed by the American Foot and Ankle Society (AOFAS). In addition, we evaluated patients' return to their previous activity levels and the presence of any associated complaints including pain, stiffness, subjective calf muscle weakness and footwear limitations. The patients' satisfactions were also analyzed. The ankle range of motion (ROM) was determined with the patients recumbent using a goniometer and the neutral-zero method with the maximum dorsal flexion considered to be 20 degrees and plantar flexion to be 50 degrees.

RESULTSThere were 21 males and 1 female patient with an average age of

36 (range: 27-45). The right leg was injured in 15 and the left in 7 cases.

There were no additional risk factors.

All patients had a low energy trauma including amateur sporting activities as the main cause of injury. None of the patients had a major complication. Two patients had an adhesion of the scar tissue. They have no complaint and a secondary surgery was not performed for these adhesions. One patient had a suture granuloma.

This patient had undergone a second surgery five months postoperatively and the suture knots were excised. One patient had a sural nerve hypoesthesia confirmed by electromyelography and after 3 months; he had a complete recovery without any secondary surgery. The average follow-up and duration of operation after skin incision was 17. 7 months (range: 12-25 months) and 28 minutes (range: 15-60 minutes), respectively. In the final evaluation, the mean AOFAS score was 95. 3 (range: 48-100). One patient had a severe pain and one had a mild stiffness. None of the patients had a weakness or footwear limitations.

All patients except one with minor reservations were very satisfied. The Thompson test was negative in all patients and all were able to rise on their tiptoes on both legs simultaneously. Eleven patients who had been working before the injury returned to their full preinjury level of employment. The length of time before returning to sports activity ranged from 4 to 6 months after surgery.

The mean time lost from work was six weeks (range: 4-8 weeks). The average active range of ankle motion of the affected limbs was 18. 3o for dorsiflexion (range 15-20 degrees) and 47. 1o (range 40-50) for plantar flexionDISCUSSIONThe Achilles tendon is formed by the merging of the tendons of gastrocnemius and soleus and it is the thickest and strongest tendon in the human body. Acute achilles tendon ruptures occur most commonly in males in their third and fourth decades and the left side is more commonly ruptured than the right one.

10 The mechanisms of injury include sudden unexpected dorsiflexion of the foot. Although the pathological pathway is not fully understood¹¹, a number of risk factors have been proposed including excessive usage of oral or topical corticosteroids¹², fluoroquinolone antibiotics¹³, exercise-induced hyperthermia¹⁴ and mechanical abnormalities of the foot¹⁵. In our study, no risk factors have been detected in the patients' history. Treatment of achilles tendon ruptures can be broadly classified into operative and non-operative methods. Operative treatment methods are open or percutaneous tendon repair and the non-operative treatment methods are cast immobilisation or functional bracing. The most popular treatment alternative in the literature is the open surgical repair^{3, 16}, however, studies comparing surgical versus conservative treatment have reported higher costs and higher complication rates with surgical repair^{3, 16}, including wound necrosis and deep infection up to 1, 7%. ^{4, 16} On the other hand, with conservative treatment, as the ruptured tendon ends continue to gap, the tendon often heals in a lengthened position with the loss of normal tone. ^{17, 18} This leads to a

weaker musculature and contributes to a high incidence of reruptures with conservative management.

3, 4, 19 For this reason, we prefer operative management for Achilles tendon ruptures including late ruptures. Although there are numerous studies in the literature comparing the two operative treatment alternatives^{5, 8, 16, 17, 19}, controversy still exists over the best appropriate treatment method. In a recent study by Rippstein et al²⁰, a mini-open technique was introduced with better clinical results than both of open and percutaneous methods, advocating that, the minimal invasive approach had less adhesions, better adaptation of tendon stumps and fewer rate of rerupture. But, in the literature, in contrast to authors who prefer conservative treatment^{7, 8}, most authors prefer traditional open surgical repair with early function and lower re-rupture rates. ^{1, 13, 16} Percutaneous suturing, first described by Ma and Griffith⁹, may combine the advantages of both methods. ¹ In a study by Lim et al²¹, sixty-six patients with a closed rupture of Achilles tendons were analyzed in two different groups comparing open and percutaneous repair with a minimum 6 months of follow-up. As a conclusion, percutaneous repair was advocated on the basis of the low rate of complications and improved cosmetic appearance. In a similiar study by Cretnik et al²², 132 patiens who were treated with percutaneous repair compared with 105 patients who were treated with open repair.

There were significantly fewer major complications in the group of percutaneous repairs in comparison with the group of open repairs (4. 5% vs 12. 4%) and although there were slightly more reruptures and sural nerve

injuries in the percutaneous group, this was not statistically significant. In our study, we prefer the percutaneous management for the Achilles tendon ruptures, as we believe that it is less invasive, and has a low incidence of complications than both open repair and conservative management. Complications after percutaneous repair of the Achilles tendon can be broadly divided into two groups: major and minor complications. Of these complications, the mostly debated ones are the rerupture of the repaired tendon and the disturbances of sensibility due to a Sural nerve injury. The rate of reruptures after conservative treatment has been reported since the introduction of the percutaneous method.

2 In the literature, the rerupture rates as high as 17. 7% following nonoperative management has been mentioned. 23 For this reason, it was stated that the surgical management was the better treatment option.

On contrary, in a study by Wallace et al. 2, the results of 140 patients with complete rupture of Achilles tendon who had been treated with nonoperative regimen was analyzed and only three patients had a complete rerupture in the an avarage of 2. 9 years follow-up period. As a conclusion, the authors stated that the results of their nonoperative treatment were better than the published results of operative repair.

But, for the percutaneous technique, protocols of the original Ma and Griffith recommend an 8-week of immobilization period postoperatively. For this reason, to prevent the reruptures after percutaneous repair, full weight bearing and sports activities during the first 10 weeks after surgery is not

recommended¹. But, in our study, we had no reruptures as we had strictly maintained our rehabilitation program with a partial weight bearing for 6 weeks with the usage of the functional orthosis for eight weeks. The disturbances of sensibility due to a sural nerve injury can occur in this region with all treatment methods including conservative one. In a study by Cetti et al. ¹⁶, one hundred eleven patients with acute rupture of the Achilles tendon were analyzed and the sural nerve injury was reported up to 12% in open repair and 1.8% in nonsurgical treatment. For the percutaneous repair, reports of sural nerve injury vary significantly from 0% to 60%.

9, ²⁴ The incisions made on the lateral aspect of the Achilles tendon in the original technique endanger the sural nerve. In a cadaver study by Hockenbury et al. ²⁴, the sural nerve had been trapped by the proximal suture in three out of five specimens repaired using this technique.

To prevent this complication, modifications of the original Ma and Griffith technique have been studied in the literature. ¹ Cretnik et al. ¹, reported 4.5% sural nerve injury with their modified technique including the use of local anesthesia for monitoring any neural complaints and positioning of the proximal lateral incisions as medial to the tendon edge as possible. In another study by Webb et al. ⁴, the repair was carried out for 27 patients using three midline stab incisions over the posterior aspect of the tendon and there were no injuries to the sural nerve. In our study, although we used the original technique, we had only one case of sural nerve injury. This may be due to the medialization of the proximal incisions as close to the tendon as possible.

The ankle range of motion has been reported following both surgical and nonsurgical management of Achilles tendon rupture. 25 In a study by Leppilahti et al. 26, 101 patients who had repair of Achilles tendon rupture were analyzed in an average follow-up of 3 years and a new clinical scoring system, including subjective assessment of symptoms and evaluation of ankle range of motion and isokinetic measurement of ankle plantar flexion and dorsiflexion strengths was presented. As a conclusion, the authors stated that, gender, body weight, height, period between rupture and operation, surgeon, rupture site, operative method, complications, and thickness, width, and area of the Achilles tendon at followup were not related significantly to the outcome including range of motion. Similar changes in the range of motion have been reported by the other studies^{2, 25}, following both surgical and nonsurgical management, and it was concluded that, there could be a standard consequence of the injury, regardless of the treatment. In our study, the operative treatment did not affect the range of motion postoperatively as the average range was found to be in the normal limits of a healthy ankle joint.

As a conclusion, the percutaneous repair technique of the Achilles tendon rupture is a safe and simple method with low incidence of complications and has comparable clinical results with open repair. REFERENCES Cretnik A, Kosanovic M, Smrkolj V. Percutaneous suturing of the ruptured Achilles tendon under local anesthesia. J Foot Ankle Surg. 2004; 43: 72-81. Wallace RG, Traynor IE, Kernohan WG, et al. Combined conservative and orthotic management of acute ruptures of the Achilles tendon. J Bone Joint Surg Am.

2004; 86: 1198-1202. Carter TR, Fowler PJ, Blokker C. Functional postoperative treatment of Achilles tendon repair.

Am J Sports Med. 1992; 20: 459-462. Webb JM, Bannister GC. Percutaneous repair of the ruptured tendon Achillis.

J Bone Joint Surg. 1999; 81: 877-880. Lo IK, Kirkley A, Nonweiler B, et al.

Operative versus nonoperative treatment of acute Achilles tendon ruptures: a quantitative review. Clin J Sport Med. 1997; 7: 207-211. Lea RB, Smith L. Non-surgical treatment of tendon Achillis ruptures. J Bone Joint Surg. 1972; 54: 1398-1407.

McComis GP, Nawoczinski DA, DeHaven KE. Functional bracing for rupture of the Achilles tendon. Clinical results and analysis of ground reaction forces and temporal data. J Bone Joint Surg. 1997; 79: 1799-1808. Nistor L.

Surgical and non-surgical treatment of Achilles tendon rupture: a prospective randomized study. J Bone Joint Surg. 1981; 63: 394-399. Ma GWC, Griffith TG. Percutaneous repair of acute closed ruptured Achilles tendon: a new technique. Clin Orthop.

1977; 128: 247-255. Hattrup SJ, Johnson KA. A review of ruptures of the Achilles tendon. Foot and Ankle. 1985; 6: 34-38.

Tallon C, Maffulli N, Ewen SW. Ruptured Achilles tendons are significantly more degenerated than tendinopathic tendons. Medicine and Science in Sports and Exercise. 2001; 33: 1983-1990. Mahler F, Fritschy D.

Partial and complete ruptures of the Achilles tendon and local corticosteroid injections. British Journal of Sports Medicine. 1992; 26: 7-14. Royer RJ, Pierfitte C, Netter P.

Features of tendon disorders with fluoroquinolones. Therapie. 1994; 49: 75-6. Wilson AM, Goodship AE. Exercise-induced hyperthermia as a possible mechanism for tendon degeneration. Journal of Biomechanics. 1994; 27: 899-905.

Clement DB, Taunton JE, Smart GW. Achilles tendinitis and peritendinitis: etiology and treatment. American Journal of Sports Medicine. 1984; 12: 179-184. Cetti R, Christensen SE, Ejsted R, et al. Operative versus nonoperative treatment of Achilles tendon rupture. Am J Sports Med. 1993; 21: 791-799.

Inglis AE, Scott WN, Sculco TP, et al. Ruptures of the tendon Achilles: an objective assessment of surgical and non-surgical treatment. J Bone Joint Surg. 1976; 58: 990-999. Washburn SD, Caiozzo VJ, Wills CA, et al. Alterations in the in-vivo torque-velocity relationship after Achilles tendon rupture.

Further evidence of speed-specific impairment. Clin Orthop. 1992; 279: 237-245. Winter E, Weise K, Weller S, et al. Surgical repair of Achilles tendon rupture: comparison of surgical with conservative treatment. Arch Orthop Trauma Surg. 1998; 117: 364-367. Rippstein PF, Jung M, Assal M.

Surgical repair of acute Achilles tendon rupture using a “ mini-open” technique. Foot Ankle Clin. 2002; 7: 611-619. Lim J, Dalal R, Waseem M.

Percutaneous vs. open repair of the ruptured Achilles tendon – A prospective randomized controlled study.

Foot & Ankle International. 2001; 22: 559-568. Cretnik A, Kosanovic M, Smrkolj V.

Percutaneous versus open repair of the ruptured Achilles tendon: a comparative study. Am J Sports Med. 2005; 33: 1369-79. Krueger-Franke M, Siebert CH, Scherzer S. Surgical treatment of ruptures of the Achilles tendon: a review of long-term results. Br J Sports Med.

1995; 29: 121-125. Hockenbury RT, Johns JC. A biomechanical in vitro comparison of open versus percutaneous repair of tendon achilles. Foot Ankle. 1990; 11: 67-72.

Mortensen HM, Skov O, Jensen PE. Early motion of the ankle after operative treatment of a rupture of the Achilles tendon. A prospective, randomized clinical and radiographic study. J Bone Joint Surg Am. 1999; 81: 983-90. Leppilahti J, Forsman K, Puranen J, et al.

Outcome and prognostic factors of Achilles rupture repair using a new scoring method. Clin Orthop. 1998; 346: 152-61.