**Original Article**

Early, active rehabilitation following mini-open repair of Achilles tendon rupture: a prospective study

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Objective: To assess the use of a supervised active rehabilitation program following repair of acute Achilles tendon ruptures using a minimally invasive suture system.

Methods: We performed a prospective study on 46 patients undergoing surgical repair of acute Achilles tendon ruptures using the Achillon suture system. All patients began a supervised active rehabilitation program from 2 weeks postoperatively. Patients were placed in a range of motion brace fixed at 20° equinus for 2 weeks to allow wound healing followed by active movement from neutral to full plantar flexion for 4 weeks.

Results: At a minimum follow up of 12 months there were no re-ruptures. All patients were able to return to their previous sporting activities by 6 months post operation. The average American Orthopaedic Foot and Ankle Society (AOFAS) score at 6 months was 98, with 42 patients having excellent and four patients good Leppilahiti scores. The average time to return to work was 22 days. One patient had a superficial wound infection which settled with 5 days of oral antibiotics. Two patients had altered sensation in the distribution of the sural nerve which settled spontaneously within 3 months.

Conclusion: The Achillon suture system appears to allow a safe early active rehabilitation program and achieves a high rate of success. Further evaluation is necessary with regard to potential damage to the sural nerve.

Surgical repair of acute Achilles tendon ruptures is associated with improved calf strength on Cybex testing and reduced tendon lengthening, and may have a smaller re-rupture rate than non-operative management. The 1–5% incidence of delayed wound healing and 0.4–2% incidence of wound breakdown and necrosis following open repair may be reduced by using a percutaneous technique. However, damage to the sural nerve is a well recognised complication of the percutaneous methods for Achilles tendon repair. Mini-open techniques have been described to avoid the sural nerve with a three incision technique described by Webb and Bannister and a single incision technique using the Achillon device being reported more recently.

The advantages and risks of early motion following tendon repair have been well documented. Experimental models have demonstrated that early motion of sutured tendons accelerates the return of tensile strength to the repair and that this restricted range of motion may be safely started at the end of fibroplasia. Early motion is recommended following tendon repairs to prevent formation of adhesions. Recent evidence suggests that the same applies for repairs to Achilles tendon ruptures. However, there is concern as to whether active rehabilitation of such patients following mini-open techniques will lead to wound problems or an increased re-rupture rate.

The purpose of this study was to establish whether mini-open repair of acute spontaneous Achilles ruptures combined with an early active rehabilitation program provides rapid postoperative recovery without unacceptable wound problems or rates of re-rupture.

Methods

Following ethical committee approval, 46 consecutive patients who had sustained a spontaneous rupture of the Achilles tendon underwent operative repair using the Achillon suture system (fig 1). The subjects were 31 men and 15 women with a mean age of 40 years (range 22–69). The injury occurred while playing basketball/netball (19), tennis (13), soccer/rugby (8), or squash (5), or was due to a fall (1). The mean time from rupture to repair was 7 days (range 1–42).

The repair was performed under general anaesthetic in 44 patients and local anaesthetic in two patients using 0.5% bupivacaine with 1:200 000 epinephrine. The patient was positioned prone on the operating table without a tourniquet. The proximal end of the tendon rupture was palpated and a 2 cm horizontal skin incision made 1 cm distal to this point (fig 2A,B). The paratenon was incised longitudinally and a single incision technique using the Achillon device being reported more recently was followed using the Achillon suture system. The tendon repair was performed using three No 1 monocryl sutures (fig 3A,B). The paratenon was closed using 2/0 monocryl and the skin closed with sub-cuticular 4/0 monocryl.

A range of motion brace was applied with the ankle in 20° equinus. The patient was encouraged to elevate the leg during

Figure 1 Achillon device.
the following 2 weeks. At 2 weeks the wound was inspected, the brace was adjusted to allow free movement of the ankle up to plantigrade, and an active physiotherapy programme commenced. At 6 weeks the brace was discarded. Jogging was restricted until 3 months postoperatively and running/ jumping sports until 6 months.

Patients were reviewed postoperatively at 2 and 6 weeks, and 3, 6, and 12 months. Problems with wound healing and symptoms of sural nerve injury were noted (fig 4). Times of return to work, jogging, and previous sports were recorded. The American Orthopaedic Foot and Ankle Society (AOFAS) and Leppilahdi scores were assessed at 3 and 6 months postoperatively. The maximum AOFAS and Leppilahdi scores were each 100. The overall results for the Leppilahdi score were expressed as excellent (90–100), good (75–89), fair (60–74), and poor (<60).

RESULTS
All 46 patients completed the study. There were no re-ruptures. One wound had a superficial infection which was diagnosed on the sixth postoperative day. It responded to 5 days of oral antibiotics and healed without further complication. However, the active rehabilitation of this patient was delayed until the third week postoperatively as a precaution to allow the wound to fully heal.

Two patients experienced paraesthesia in the distribution of the sural nerve and had tingling in this region on tapping the skin over the Achillon needle puncture sites distal and lateral to the skin incision. Both of these patients had inappropriate positioning of two sutures which missed the holes in the Achillon device in the distal tendon stump on the first attempt. This is easily recognised intra-operatively and both patients had the sutures repositioned, therefore having a total of five passes of a needle through the skin distal to the wound rather than the usual three. All symptoms settled spontaneously by 3 months.

All patients had full dorsiflexion of the ankle by 3 months and all were able to return to their previous sporting activities by 6 months. The mean interval from operation to return to work was 22 days (range 4–77). The mean AOFAS score was 95.8 at 3 months (range 85–100) and 98.4 at 6 months (range 95–100). The mean Leppilahdi score was 86 at 3 months (range 60–90) with 12 patients scoring excellent, 28 good, and 6 fair. At 6 months the mean Leppilahdi score was 96 (range 82–100) with 42 patients scoring excellent and

Figure 2 (A) Identifying level. (B) Skin incision.

Figure 3 (A) Passing needle. (B) Sutures in situ prior to removal of introducer.

Figure 4 Scar at 3 months.
not stressing the device during suture placement as the plastic may bend, mal-aligning the holes. This problem is not reported in the study by the originator of the Achillon as the device was originally manufactured in metal and so could not bend. Although the Achillon avoids a “lassoing” injury to the sural nerve, this study raises the question of whether the sural nerve is at risk of permanent damage directly from needle placement.

This prospective study supports the use of a supervised active rehabilitation program from 2 weeks postoperatively. This results in a rapid return to both work and recreational activities without an associated increase in wound problems or re-ruptures. The use of a horizontal incision gives an excellent cosmetic result without impairing placement of the sutures. Further evaluation of the Achillon suture system is required in order to assess the true risk to the sural nerve from needle placement.

**What this study adds**

Repair of acute Achilles tendon ruptures using the Achillon suture system followed by a supervised active rehabilitation program produces excellent results and a rapid return to work.

**What is already known on this topic**

The incidence of delayed wound healing and wound breakdown and necrosis following open surgical repair of acute Achilles tendon ruptures may be reduced by using a percutaneous technique. However, damage to the sural nerve is a well recognised complication of the percutaneous methods for Achilles tendon repair.

**DISCUSSION**

The early introduction of an active rehabilitation programme described in this series of patients appears to provide a rapid return to social and occupational activities. We encouraged patients to return to work once the wound had been inspected at 2 weeks and wound healing without complication had been confirmed. The time interval for return to work was dependent upon several factors, including the type of work required (for example, labouring v sedentary office work). However, an average of 22 days in this series compares favourably with the 6–13 weeks reported in the literature.7 16–17

The mini-open incision and postoperative rehabilitation program observed in this study does not appear to be associated with an increased risk of wound breakdown. The one patient in whom a wound problem was encountered was satisfactorily treated with antibiotics for 5 days and at 6 months did not appear to have any functional impairment with an AOFAS score of 100 and an excellent Leppilahti score. A recent publication has demonstrated that skin perfusion over the Achilles tendon is maximal with 20° plantar flexion.1 We therefore ensured that patients remained in 20° equinus for 2 weeks postoperatively before beginning mobilisation to plantigrade.

We believe that the small horizontal incision used in this study aids wound healing and reduces the risk of major wound breakdown previously observed with longitudinal incisions in this area. We were initially concerned about difficulty in making a horizontal incision at the correct level. However, the optimum site for such an incision was found to be 1 cm distal to the proximal stump. This is usually easily palpated and allows the proximal stump to be drawn distally by tissue clamps. The distal stump may be brought to the level of the incision by plantarflexing the ankle. Such an incision did not appear to make it more difficult to use the instrumentation.

The two patients in whom there was paraesthesia in the distribution of the sural nerve had undergone five passes of the needle through the skin distally due to incorrect placement of a suture. This highlights the importance of

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**REFERENCES**

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