



## Reduced length of stay with minimally invasive repair of ruptured achilles tendon

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Minimally invasive techniques to repair ruptured achilles tendons have been developed to enhance recovery following tendon repair and decrease wound complications associated with open repair. We investigated outcomes of minimally invasive and open repair of acutely ruptured achilles tendons at our institution.

We compared all cases of achilles tendon repair at our department, using open techniques and minimally invasive techniques with the Achillon device, over a two year period. Length of stay and operating time was recorded, as were any complication rates, including tendon re-rupture. Post-operatively functional outcome questionnaires were sent to all patients.

In total 39 patients underwent open repair and 26 underwent minimally invasive repair. Length of stay was significantly shorter in the minimally invasive group, with 58% of minimally invasive cases performed as a day case, compared to 31.1% of open cases ( $p = 0.02$ ). There was no difference in complication rates, including re-rupture, or functional outcome scores.

Minimally invasive repair of ruptured achilles tendons results in reduced length of stay, compared to open repair. There is no evidence of weaker tendon repairs with minimally invasive techniques. Overall functional outcomes between both groups appear similar.

**Level of Evidence : III.**

**Keywords :** achilles tendon rupture ; minimally invasive tendon repair ; achillon device ; open tendon repair.

## INTRODUCTION

The incidence of achilles tendon rupture is approximately 18 per 100'000 and is increasing, possibly due to increased popularity of sporting activities amongst the general population (1,11,14). Rupture is associated with long periods off work and sporting activities, with many patients not able to return to the same level of sport as prior to their injury (6,11,16).

Treatment can be either conservative, with immobilisation in plaster cast or functional bracing, or involve surgical repair. Conservative treatment avoids some of the complications associated with surgery but has a significantly increased risk of tendon re-rupture compared to operative treatment (10, 11,16,17). Surgical treatment has therefore increasingly become the treatment of choice, particularly in young, healthy and active individuals (6,20).

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Wound problems after surgery are however, relatively common, due to the poor vascularity of the skin in that region of the body (1,3). Complications associated with operative achilles tendon repair, can occur in up to a third of patients and include delayed wound healing, wound infection, scar adhesion and sural nerve injury (16).

Percutaneous repair techniques have been developed to reduce the risk of wound problems but these have however, been associated with a relatively high incidence of sural nerve injury (1,8,12). Recently new minimally invasive repair techniques have been developed, which have showed reduced complications and faster rehabilitation (4,16). These techniques can avoid sural nerve injury, by pulling sutures beneath the paratenon, therefore preventing entrapment of the nerve (1). There is however, some concern that the strength of repair may be inferior to a standard open repair (1).

We therefore investigated minimally invasive repair of ruptured achilles tendons and compared it to a standard open repair.

## METHODS

We retrospectively reviewed all surgical repairs of acutely ruptured achilles tendons in our department over a two year period, 1st October 2010 to 31st October 2012. The patient's case notes were reviewed and demographic data, type of repair (open or minimally invasive with Achillon device) and complications were recorded.

Surgery was performed in both groups in the prone position, under general anaesthesia with a tourniquet. Open surgical repair was performed using a longitudinal incision to fully expose the paratenon and tendon and then surgical repair using either a modified Kessler or Krakow suture technique. Minimally invasive repair was performed using a small transverse incision at the level of the tendon rupture and then using the Achillon device (Intega Life Sciences Corporation, Plainsboro, NJ), following a standard technique as previously described (4).

Rehabilitation in the open repair group consisted in the majority of patients with immobilisation in a plaster cast in an equinus position for two weeks and then subsequent mobilisation in an aircast boot with wedges. The wedges were then gradually removed over a seven week period according to a standard rehabilitation regime.

In contrast all patients in the minimally invasive group were immediately placed into an aircast boot post-

operatively with wedges and allowed immediate weight bearing. These patients then followed the same rehabilitation protocol as the open repair group.

Post-operatively patients were followed up at the outpatient clinic at regular intervals up until four months, at which point most patients were discharged.

Patient were subsequently sent a functional questionnaire (The Achilles Tendon Total Rupture Score) (18) to complete to assess post-operative recovery.

Statistical analysis was performed using the Mann Whitney U-test for non-parametric data and Fisher's exact test for categorical variables.

## RESULTS

In total 26 patients underwent minimally invasive repair and 39 patients underwent open repair of their ruptured achilles tendon. All patients underwent surgery within two weeks of injuring their tendon.

Gender ratios were similar in both groups with a predominance of male patients. In the minimally invasive group 85% of patients were male and 15% were female whereas in the open repair group 82% of patients were male and 18% were female ( $p = 1.0$ ).

The median age of patients was also similar in both groups, being 40.5 years in the minimally invasive group (IQR 23.25) and 44 years in the open repair group (IQR 11.5) ( $p > 0.1$ ).

The average operating time was slightly shorter in the minimally invasive group but this did not reach statistical significance. The median operating time was 30 minutes in the minimally invasive group (IQR 1) and 35 minutes in the open repair group (IQR = 12) ( $p = 0.06$ ).

The mean length of stay was however significantly shorter in the minimally invasive group, 0.5 days (SD 0.8) compared to 0.8 days (SD 0.6) in the open repair group ( $p < 0.05$ ).

There was also a significantly greater proportion of patients who had surgery performed as a day case in the minimally invasive group, 15 patients (58%) in the minimally invasive group, compared to 12 patients (31.1%) in the open repair group ( $p = 0.02$ ).

Complications included 15.4% superficial wound infection and 7.7% sural nerve injury in the minimally invasive group and 7.7% superficial wound

Table I. — Complication rates

Complication	Minimally invasive repair (n = 26)	Open repair (n = 39)
Sural nerve injury	2 (7.7%)	3 (7.7%)
Superficial wound infection	3 (15%)	3 (7.7%)

infection and 7.7% sural nerve injury in the open repair group. The superficial wound infections all resolved with oral antibiotics and local wound care. There were no cases of deep wound infection or tendon re-rupture in either group.

The total complication rate was not significantly different between groups, 26.9% in the minimally invasive group and 28.2% in the open group ( $p = 1.0$ ).

Post-operative functional outcome assessments were completed by 19 patients in the minimally invasive group and 25 patients in the open repair group. These were not significantly different, being 44.7 in the minimally invasive group and 33.6 in the open repair group ( $p = 0.08$ ). The median time post-operatively that the functional assessment was performed was 15 months in the minimally invasive group (IQR 10) and 16 months in the open repair group (IQR 9) ( $p > 0.1$ ).

Post-hoc power analysis of the study has however, indicated that the study is under powered (power = 0.42) and that functional outcome data on a minimum of 55 patients would be required to demonstrate a significant difference in outcome.

## DISCUSSION

Minimally invasive repair of the achilles tendon has been shown to result in faster recovery and less post-operative pain in comparison to open repair (2,4). In our study we demonstrated reduced length of hospital stay in patients treated with a minimally invasive technique and with a greater proportion of patients able to be discharged home the same day, which is consistent with previous reports using this technique (4). This has obvious cost-saving implications for healthcare provision as well as for patient general satisfaction.

Post-operative pain has been reported as a significant complication of standard open repair of

ruptured achilles tendons and this was also the reason that most patients had a delayed discharge in our open repair cohort (4).

One of the concerns with minimally invasive achilles tendon repair is that the strength of the repair achieved may be inferior to standard open repair (1). It was however reassuring in our study that there were no cases of tendon re-rupture which suggests that the quality of repair achieved with the Achillon device is good.

Previous reports have suggested that some of the complications associated with open achilles tendon repair, particularly wound problems, can be reduced by minimally invasive surgery.

In a study by Aktas *et al* (1) the complication rate was 35% in the open surgery group and 5% in the minimally invasive group with no cases of re-rupture or sural nerve injury.

Similarly in a study by Bhattacharya *et al* (4) there were five cases of superficial wound infection and two cases of deep wound infection in the open surgery group but none in the minimally invasive group.

In contrast our study did not demonstrate any difference in complication rates between groups. The rate of superficial wound infection was actually slightly higher in our minimally invasive repair group although this was not statistically significant. One possible explanation for this is that all the patients in the minimally invasive group were placed into an aircast boot and mobilised immediately post-operatively, whereas in the open surgery group the majority of patients were placed into equinus cast for two weeks initially which may have helped the wounds to heal.

Another previously reported benefit of the Achillon device is the reduced risk of sural nerve injury in comparison to percutaneous repair (16). This is because the inner legs of the device are passed inside the paratenon and sutures are passed from an

Table II. — Length of stay

Complication	Minimally invasive repair (n = 26)	Open repair (n = 39)
Daycase	15 (58%)*	12 (31%)
Average length of stay (days)	0.5*	0.8

\* statistically significant difference.

extracutaneous to a peritendinous position, preventing a lasso injury of the nerve (1).

In our study however, two patients in the minimally invasive group complained of altered sensation in the sural nerve distribution post-operatively. This may have possibly occurred by damage to the nerve while passing the sutures through the device, which has previously been reported if multiple passes of sutures are required (5).

Previous studies comparing minimally invasive tendon repair and open repair have demonstrated faster returns to normal walking and stair climbing and fast returns to usual activities (6).

In our study we used the total achilles tendon score to assess functional outcome after surgery. This is a validated score for specific assessment of achilles tendon function as oppose to generic foot and ankle assessment (18). Our results did not however, demonstrate any statistically significant difference between the two groups, which suggests that the functional outcome can be equally as good in the long term with open surgery, as well as with minimally invasive techniques.

Limitations of the study include the fact that data was collected retrospectively and also that the rehabilitation strategies were often different between the two cohorts, which limited comparison to a certain extent. In addition we were only able to collect functional outcome data on approximately two thirds of all patients which may have also prevented us from demonstrating a significant difference between the two treatment strategies, as is corroborated by our post-hoc power analysis results.

## CONCLUSIONS

Treatment of achilles tendon rupture with a minimally invasive technique using the Achillon device resulted in reduced length of hospital stay and an

increased proportion of patients discharged on the same day following surgery, in comparison to standard open repair. There was however no difference in complication rates or post-operative functional outcome.

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