ORIGINAL ARTICLE

Evaluation of Clinical and Functional Outcome of Percutaneous Tendoachilis Repair by Ethibond Versus Mersiline Tap

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Abstract

Background: ***Achilles tendon ruptures are frequent injuries that require surgical repair to achieve optimal recovery. Percutaneous repair is becoming increasingly favored as a noninvasive and straightforward procedure.***

Aim and objectives: ***To compare and evaluate the function, the efficiency, safety, and clinical outcomes of percutaneous repair of acute Achilles via Ethibond and Mersilene tape.***

Patients and methods: ***This retrospective study was conducted on 20 patients diagnosed with acute Achilles tendon rupture, who were repaired either with Ethibond suture repair or Mersilene tape fixation in each of the two groups.***

Results: ***The study participants were monitored for a minimum of one year. Both (ATRS) M group 90.8 ± 5.22, E group 91.8 ± 8.22 (AOFAS) M 93.9 ± 2.37, E 94.9 ± 8.37 scores were employed for the final assessment. Adverse events in each group were documented. One case had a wound infection in the Merseilene tape group, while a sural nerve neuropraxia case was noted in the Ethibond repair group. No significant differences in outcomes have occurred between the two Achilles tendon repair techniques. However, the Ethibond cohort demonstrated a lower incidence of postoperative complications and accelerated return-to-work rates.***

Conclusion: ***Percutaneous repair of Achilles tendon rupture by Ethibond suture revealed superior effectiveness with outcomes equivalent to or surpassing those achieved with Merseilen tape.***

Keywords: Achilles tendon rupture; percutaneous repair; Ethibond; Mersiline tap

1. Introduction

The Achilles tendon is the primary plantar flexor of the ankle joint, and it is considered the strongest and largest tendon in the body,[1] playing a critical role in enabling activities such as walking, running, and jumping. The Achilles tendon rupture commonly occurs in the third to fourth decade of life, especially in males during sports activities .[2] It causes significant functional impairment if not treated appropriately. Historically, treatment options have included both surgical and non-surgical approaches, with surgical repair being favored for active patients due to its lower re-rupture rates and faster recovery .[3]

Achilles tendon percutaneous repair has recently emerged as a less invasive alternative to traditional open surgery. It comes with several potential advantages, including reduced operative time, lower infection rates, and quicker postoperative recovery. However, determining the suture material used in percutaneous repair is critical for optimizing clinical outcomes. Two common materials have been used in tendon repair (Ethibond and Mersilene tape), each with distinct biomechanical properties that affect the procedure's success .[4]

Ethibond[5], a non-absorbable polyester suture, is widely preferred for soft tissue repair due to its high tensile strength and reliability. Mersilene tape, on the other hand, is a broader, non-absorbable tape that provides a larger surface area for tendon repair, potentially offering superior resistance to tendon re-rupture (figure 1). Despite the widespread use of these materials, there is limited evidence directly comparing their effectiveness in percutaneous Achilles tendon repair .[5]

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The key goal of repairing acute Achilles tendon rupture is to restore the triceps surae's anatomical length through re-approximation of the Achilles tendon torn ends to restore the normal biomechanics around the ankle joint. This can be done by preserving the blood supply of the Achilles tendon, avoiding tendon substance damage to maintain functionality, and protecting the adjacent vital structures .[3]

The aim of the study is to compare the effectiveness, safety, and clinical outcomes of using two distinct materials (Ethibond and Mersilene tape) in acute Achilles tendon ruptures repaired by percutaneous technique.

2. Patients and methods

A retrospective study of twenty participants undergoing percutaneous repair for acute Achilles tendon rupture by Ethibond or merseline tap, treated between January 2021 and January 2023.

Inclusion criteria: cases were from 10 to 60 years old, and the research involved a consecutive series of cases presented by acute Achilles tendon rupture, confirmed by clinical inspection (e.g., positive Thompson test) and imaging (MRI). The patients presented within 1 to 2 weeks, a specific time frame after the injury, such as ensuring that the rupture is still in the acute phase.

Exclusion criteria: Patients presenting with a rupture older than 2-3 weeks, indicating a chronic condition.Individuals who had prior surgery or significant injury to the Achilles tendon on the same side.

These patients were reviewed and assessed for full history taking (personal history, complaint and its duration, patient age, gender, side, Injury mechanism, time since injury, and severity of the rupture). Clinically, none of the patients could actively perform plantar flexion at the ankle, and a palpable defect was detected in the distal portion of the tendon. The Thompson test, performed by squeezing the calf, yielded positive results in every case. To detect potential fractures, plain anteroposterior and lateral radiographs of the ankle were obtained. MRI was done for preoperative assessment of the tendon, site, and gap at the tear site (Figure 2).

Patients are randomized into two groups for percutaneous Achilles tendon repair using either Ethibond or Mersilene tape. The surgical procedure is performed by experienced surgeons using standardized percutaneous techniques. Outcomes measured include functional recovery (range of motion, muscle strength), complication rates (re-rupture rates, infections, sural nerve damage, and other postoperative issues), and postoperative pain. Follow-up assessments are conducted at regular intervals to monitor recovery and tendon integrity.

Surgical technique: All procedures were done while the patient was in a prone position. To support the leg, a cushion was positioned beneath it, aiding in optimal tendon alignment while minimizing excessive plantar flexion and avoiding over-tightening. Prior to surgery, a first-generation cephalosporin antibiotic was administered no later than 60 minutes before tourniquet application. The tourniquet was inflated only after complete limb exsanguination.

Three longitudinal incisions were made on either side of the proximal tendon segment, followed by two additional parallel incisions near the distal portion. Ethibond or Mersilene tape sutures, threaded into needles, were utilized for the repair (figure 3). The surgical procedure involved passing a transverse suture through the first proximal slit, then weaving it diagonally through the second and third proximal slits in a crossed manner. The sutures were then interlaced across the gap to secure the distal tendon segment, following a similar crisscross pattern through the distal slits. After tensioning the repair, the sutures were secured above the calcaneus while maintaining the foot in a plantar-flexed position. The subcutaneous layer was meticulously approximated, and the skin was closed using non-absorbable sutures (Figure 4).

Figure 1. Mersilene tape

Figure 2. (a,b): MRI ankle coronal and sagittal, Achilles tendon grade II complete tear 6cm from the insertion with gap and mild retraction as described with periarticular soft tissue and subcutaneous contusion.

Figure 3. (a): Intraoperative photo 3 Skin longitudinal incisions were made on either side of the proximal tendon segment, followed by two additional parallel incisions near the distal portion (b): the sutures were crisscrossed through the wound gap to reattach the proximal and distal parts of the tendon

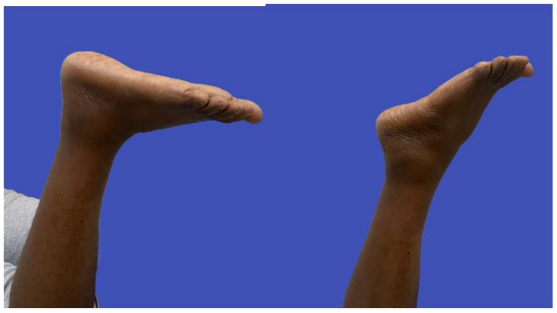

Figure 4. (a,b): Ankle dorsiflexion and plantar flexion at final follow-up.

Postoperative protocol

All participants received four weeks of immobilization using a below-knee casting technique, maintaining the ankle in full plantar flexion. The surgical wounds were debrided of sutures at the two-week postoperative mark. Upon cast removal at the four-week interval, a supervised physical therapy regimen commenced immediately. A consistent, evidence-based rehabilitation program was implemented uniformly across the study cohort. Clinical monitoring continued for a minimum duration of 18 months for each case. Structured evaluations occurred at predetermined intervals (1, 3, 6, and 12 months postoperatively (Figure 5). The final assessment incorporated the Achilles Tendon Rupture Score (ATRS) and the American Orthopaedic Foot and Ankle Society (AOFAS) to quantify functional recovery outcomes .[6]

3. Results

Our study comprised twenty pateints, equally divided between Ethibond suture (E group) (n=10) and Mersilene tape (M group) (n=10) percutaneous repair groups. Postoperative monitoring was maintained for a minimum duration of twelve months for all subjects. The cohort ranged from 10 to 60 years old, with a male predominance (n=16). Right-sided injuries occurred in 10 cases (n=10). Etiologies included sports-related ruptures (n=6), traumatic falls (n=8), and sharp object injuries (n=2). Rupture characteristics showed closed acute presentations in 12 cases and open acute injuries in 8 cases ,stay time in hospital (days) was in M group 1.8± 0.51 and E group 1.1 ± 0.51 (Table 1).

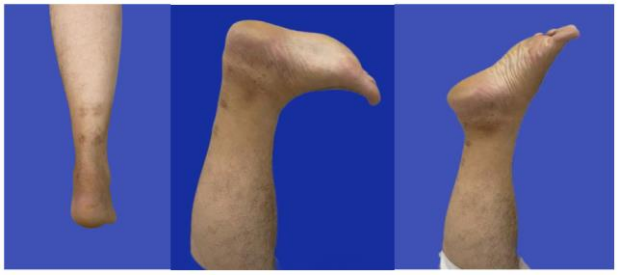

Figure 5. (a,b,c): postoperative healing of three longitudinal skin incision. postoperative ankle motion dorsiflexion and planterflexion.

Patients has been repaired by Ethibond returned to work after an average of 9.9 ± 2.47 weeks, while those with Mersilene tape repair required approximately 10.9 ± 2.47 weeks. By the final follow-up, all cases had fully resumed their regular routines without complications.

Table 1. Baseline demographic and clinical characteristics of the studied cases.

VARIABLE	MERSILINE (N=10)	ETHIBOND (N=10)	P-VALUE
AGE (YEARS), MEAN ± SD	39.6 ± 9.79	35.9 ± 9.8	0.41
GENDER, N(%) MALES FEMALES	8 (80%) 2 (20%)	 8 (80%) 2 (20%)	p=1.0
SIDE, N(%) RIGHT SIDE LEFT SIDE	 5 (50%) 5 (50%)	 7 (70%) 3 (30%)	 p=0.64
MECHANISM OF INJURY, N(%) SPORT FALLING RTA DIRECT FORCE SHARP OBJECT	 4 (40%) 3 (30%) 2 (20%) 1 (10%) 0 (0%)	 5 (50%) 3 (30%) 0 (0%) 1 (10%) 1 (10%)	 p=0.53
FOLLOW UP (WEEKS), MEAN ± SD	20 ± 2.58	17.4 ± 3.2	p=0.6

Data were presented as frequency (percentage), or mean ± SD. Student t, Chi-square, Fischer exact and Monte Carlo tests were applied.

The Mersilene tape repair group experienced two complications: a single wound infection case and a single instance of delayed wound healing, both occurring in diabetic patients. These cases resolved successfully with antibiotic therapy and regular dressings, achieving full recovery without sequelae. Notably, neither group exhibited skin necrosis, wound fistulae, sural nerve damage, or tendon re-rupture during the study period. At the final follow-up, all participants underwent functional evaluation using ATRS. The ATRS (M group 90.8 ± 5.22, E group 91.8 ± 5.22) and AOFAS (M group 93.9 ± 2.37, E group 94.9 ± 2.37) yielded nearly comparable outcomes for the two groups (Table 2)

Table 2. Comparison of the patients' outcome between the mersiline and ethibond groups

VARIABLE	MERSILINE (N=10)	ETHIBOND (N=10)	P-VALUE
STAY TIME IN HOSPITAL (DAYS), MEAN ± SD	1.1 ± 0.51	1.3 ± 0.51	
TIME UNTIL RETURN TO WORK (WEEKS), MEAN ± SD	10.9 ± 2.47	9.9 ± 2.47	p=1.0
			p=1.0
INFECTION, N(%)			
PRESENT	1 (10%)		p=1.0
ABSENT	9 (90%)	0 (0%)	
		10 (100%)	
SURAL NERVE INJURY, N(%)			
PRESENT	1 (10%)	0 (0%)	
ABSENT	9 (90%)	10 (100%)	p=1.0
ATRS, MEAN ± SD	90.8 ± 5.22	91.8 ± 8.22	p=1.0
AOFAS ANKLE-HIND FOOT SCALE, MEAN ± SD	93.9 ± 2.37	94.9 ± 8.37	p=1.0

Data were presented as frequency (percentage), or mean ± SD. Student t and Fischer exact were applied, ATRS: achilles tendon rupture score, AOFAS: American Orthopaedic Foot and Ankle Society.

Statistical analysis

Numerical data were described using; mean ± standard deviation (S.D). Non-numerical data were described using frequency and percentage. Student t-test (t): was used to assess the statistical significance of the difference between two study group means. Chi-Square, Fisher exact and Monte Carlo tests were used to examine the relationship between qualitative variables. Chi-Square test (x2) was used to compare two or more groups. Fisher Exact test (FET) was used as a correction for the Chi-Square test when more than 20 % of cells had a count less than 5 in (2*2) tables. Monte-Carlo test (MC) was used as a correction for the Chi-Square test when more than 20% of cells had a count less than 5 in tables (>2*2). A p-value is considered significant if <0.05 at the confidence interval of 95%.

4. Discussion

The Achilles tendon is frequently injured due to sports-related injuries or cuts from sharp objects .[7] Acute ruptures typically result from either direct trauma (such as lacerations) or indirect forces (like sudden movements during athletic activities). Additionally, spontaneous ruptures can occur in individuals with underlying conditions, including autoimmune disorders, infections, connective tissue diseases, and chronic inflammation .[8]

The primary goal in managing acute Achilles tendon rupture is to reduce complications, optimize recovery, and achieve favorable long-term functional and clinical results. Effective treatment aims to minimize morbidity while ensuring patient satisfaction upon follow-up.

Amlang et al,[9] developed a percutaneous approach for repairing acute Achilles tendon ruptures. However, this method was still associated with an elevated incidence of recurrent tendon ruptures and sural nerve injuries .[10-12]

While percutaneous repair reduces wound-related complications, it carries a substantial risk of sural nerve injury, with reported rates reaching 16.7% .[13,14] Also, an increased rate (2.9%) of nerve injury has been reported with percutaneous repair .[5]

This study evaluated the functional results and complication rates comparing two suture materials in percutaneous Achilles tendon repair. Our findings demonstrate that Ethibond suture repairs offered distinct advantages, including minimal tissue trauma, faster recovery times, and lower rates of wound infection, delayed healing, and scarring. In contrast, Mersilene tape repairs showed higher rates of wound complications, prolonged recovery periods, and delayed return to normal activities. During the initial 12-month follow-up, these differences were clinically significant. However, at the two-year evaluation, both techniques demonstrated comparable functional outcomes with equally high patient satisfaction rates. Notably, we observed transient sural nerve neuropraxia in some cases (resolving within 3 months), but no instances of tendon re-rupture occurred during the study period.

There were limitations of the previous study to be concerned with comparing these techniques of percutaneous Achilles tendon repair that exist.

Karabinas et al,[15] performed surgery on 34 patients suffering from acute ruptures of the Achilles tendon, employing both open and percutaneous techniques. He reported that the group treated with the percutaneous repair method exhibited superior cosmetic outcomes.

Gigante et al.[16] demonstrated that repairing acute Achilles tendon ruptures using either method was both safe and effective when combined with an identical rehabilitation protocol.

Lim et al.[17] treated 66 patients with acute Achilles tendon ruptures and observed three instances of wound puckering along with one case of rerupture in the group that underwent percutaneous repair.

According to Henrıquez et al.[18] the functional outcomes of percutaneous and open Achilles tendon repair were comparable. The percutaneous approach offered advantages such as improved cosmetic results, fewer wound-related complications, and no noticeable rise in re-rupture risk. Although both procedures (open and percutaneous repair) were effective in treating acute Achilles tendon rupture, the percutaneous repair was linked to fewer wound complications. Despite this, both methods had the same long-term functional outcomes.

Gigante et al.[16] the range of motion of the ankle joint remains in both groups without difference or delay, particularly the dorsiflexion angle, aligning with prior research findings 5. In the current study, final assessments revealed comparable ankle range of motion (ROM) in patients treated with either Ethibond or Mersilene tape, with no significant difference in the ankle's range of motion (dorsiflexion and plantar flexion).

According to prior research[19] findings, the AOFAS ranged between 96.3 and 96.8 following percutaneous repair and between 96.1 and 98.7 following open surgery .[20] Our findings also revealed no differences in the clinical function scores (ATRS, AOFAS score) between the two groups at the final assessment. Our study revealed that only a single case was documented, presented by skin desquamation with no bacterial infection having emerged. These findings align with a systematic review by Li et al.[19] which demonstrated substantially reduced infection rates following percutaneous procedures versus open surgical approaches.

Several significant limitations should be considered when interpreting our findings.

The study comprised significantly more male than female participants; hence, it is unclear whether sex-related differences are present between the two procedures.

Randomized controlled trials may be the optimal method to detect the best surgical method to manage acute rupture of the Achilles tendon.

In addition, the relatively small patient population in this study increases the potential effects on overall results.

A key limitation of our study is the small sample size, which prevented the performance of statistical analysis.

4. Conclusion

There is no significant difference between etibond and merseiline tape on the percutaneous repair of the Achilles tendon at the long-term follow-up. The two groups exhibited comparable functional outcomes. Nevertheless, the Ethibond sutures were linked to fewer wound complications than Merseiline tape. We advise repair of the Achilles tendon by Ethibond as it was linked to fewer wound complications and better cosmetic appearance compared to Mersilene tape.

Disclosure

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Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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