

Original Research Article

Comparative analysis of the functional outcome of absorbable and non-absorbable suture material used in management of acute Achilles tendon rupture

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ABSTRACT

Background: Achilles tendon rupture is one of the most common tendon injuries in the adult population. The injury commonly occurs in middle-aged adults. Patients with acute rupture often present with sudden onset of pain at the site of injury and experience difficulty with ankle plantar flexion compared to the normal side. In most cases, patients report a sensation similar to being kicked in the lower leg. Achilles tendon rupture causes significant pain and disability. This study assessed the comparative analysis and functional outcomes of acute Achilles tendon rupture managed by polydioxanone (PDS) (absorbable) suture and polyester (non-absorbable) suture. We prospectively studied acute Achilles tendon rupture in patients over a 1 and ½ year period and reviewed functional outcomes and complications.

Methods: Forty-nine patients with acute Achilles tendon rupture were included, with a minimum follow-up period of six months. We used the Boyden score to assess outcomes and complications between the two groups repaired by and polyester (Ethibond), respectively.

Results: In our study, all 26 patients (100%) in the PDS (absorbable) group had good or excellent results based on the Boyden clinical assessment, whereas only 13 patients in the polyester repair group had good or excellent results.

Conclusions: Patients treated with the non-absorbable polyester (Ethibond) suture material for repair had a higher incidence of infection and foreign body granulomas. Surgical repair with the absorbable suture PDS is superior to polyester, as it results in significantly lower postoperative wound complications and higher patient Boyden scores. However, studies with larger sample sizes are recommended.

Keywords: Tendoachilles, Polydioxanone, Polyester suture, Boyden score

INTRODUCTION

The tendo-Achilles rupture is the most common tendon injuries in the adult population. The incidence of these injuries is increasing as the middle-aged population continues to engage in physically demanding activities to earn their livelihood (from 2 per 100,000 in 1986 to 10 per 100,000 in 2010 and approximately 18 per 100,000 at present).¹ Achilles tendon rupture generally occurs after sports-related trauma and is usually seen in middle-aged athletes.² However, in our region (north India), the

majority of cases result from falls in the commode (Indian toilet seat injuries). Clinically, diagnosis is made based on characteristic history and examination findings, including a palpable gap and a positive Thompson test. Primary open repair of acute Achilles tendon rupture is a common procedure with generally good outcomes; however, several complications such as foreign body granulomas and infections can occur postoperatively.^{3,4}

In Achilles tendon repairs, as in the rest of the world, we initially used nonabsorbable sutures in most cases. This is

because suture materials need to be strong enough to withstand the forces at the rupture site, ensuring strong tendon healing and a good rehabilitation period.⁵

However, in many operated cases, we found that nonabsorbable suture material caused complications such as infection, granuloma formation, fibrosis, and triggering due to suture-induced tissue stimulation. To overcome these complications, we began using PDS (absorbable suture).

Absorbable suture materials have shown the highest holding capacities in animal models, according to some studies.^{6,7} Moreover, because they are absorbed from the repair site, they reduce the risk of foreign body reaction.⁸ Therefore, we compared the functional and clinical results of Achilles tendon open repairs using nonabsorbable and absorbable suture materials.

METHODS

A prospective study was conducted in the Department of Orthopaedics, Government Medical College and Hospital, Doda, between January 2021 and August 2022. Forty-nine patients with acute Achilles tendon rupture who underwent open surgical repair were included in the study. Patients were followed up for a period of six months to one year. Informed consent was obtained from all patients, and ethical clearance was secured prior to the study.

Inclusion criteria

Patients with isolated traumatic Achilles tendon rupture with minimum follow up upto 6 months after surgery and open TA injuries were included.

Exclusion criteria

Patients with delayed diagnosed TA rupture (over two weeks after injury), previous injury to the same tendon, systemic diseases like diabetes mellitus or neurovascular disease and severe tendinosis and degeneration of tendo-Achilles that required adjunctive procedures were excluded.

Surgical technique

The study included 49 ankles in 49 patients. Initially, patients exclusively underwent Achilles tendon repair with nonabsorbable braided polyester suture 'Ethibond' (Group A). Gradually, Achilles tendon open repair was performed using absorbable braided 'PDS' suture (Group B) to assess the functional and clinical results, including complications after surgery with the two different suture materials. After preoperative assessment, patients underwent the operative procedure within two days.

All procedures were performed with the patient in the prone position under spinal anesthesia, using an above-knee tourniquet. A 6-8 cm longitudinal incision was made

on the medial aspect of the Achilles tendon. After incising and retracting the paratenon and mesotenon, the ruptured tendon ends were exposed. The Achilles tendon was repaired using the following suture materials: PDS (No. 2 PDS II) and polyester (no. 5. Ethibond). The Krackow suture technique was used in all cases (Figure 1). An epitendinous repair was also performed, as it adds tensile strength to the repair and reduces the rate of gap formation. The paratenon was repaired, and the skin was closed. In group A, Krackow sutures with no. 5 Ethibond were used to repair the tendon ends, while in group B, PDS II was used (Figure 1). Supplementation of the repair site was done with interrupted 3-0 Vicryl (polygalactin) sutures in both groups. The paratenon was sutured with 3-0 vicryl, and skin closure was done using interrupted 3-0 polyamide sutures.



Figure 1: TA repair with Ethibond by Krackow technique.

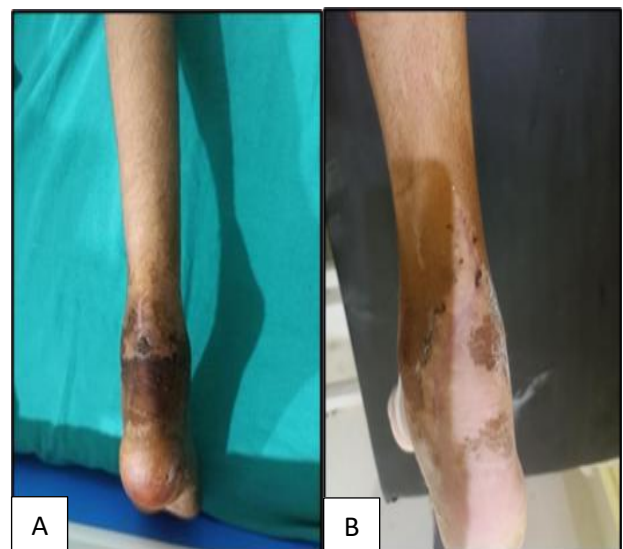


Figure 2 (A and B): Post-operative pictures of TA repair by ethibond and PDS respectively.



Figure 3: Wound infection due to deep sinus formation.

Postoperative management

Postoperatively, a below-knee cast was applied to all patients in both groups, with the foot positioned in gravity equinus. Sutures were removed after 2-3 weeks. Patients were called for follow-up visits in the OPD at 2, 4, and 6 weeks. At each visit, the cast was removed, and the wound was examined. On consecutive visits, gradual correction of the equinus position was made by adjusting the cast toward neutral. At 4 weeks, walking was gradually resumed with partial weight-bearing on the affected side while the cast was still in place. After 6 weeks, a short leg walking cast was applied with the foot in the plantigrade position, and full weight-bearing was allowed. One month later, the cast was removed, and gentle active range of motion exercises were started, along with isometric ankle and knee strengthening exercises. In the final rehabilitation stage, patients were encouraged to continue physiotherapy, including proprioceptive exercises combined with a general strengthening program. Patients were allowed to walk with normal shoes. Three months after surgery, routine activities of daily living were permitted.

The functional outcome of the Achilles tendon repair was assessed using the Boyden score (Table 1). This score is based on clinical factors such as pain, activity limitation, footwear restrictions, and patient satisfaction. The assessment was done in the hospital OPD at 6 months.

Table 1: Boyden assessment.

Status	Feature
Excellent	No pain, no limitation of activity, no footwear restriction, satisfied with surgery
Good	Mild occasional pain, limitation to recreational activities but not to daily activities, no footwear restriction, satisfied with surgery with minor reservation
Fair	Mild to moderate pain, limitation of recreational and daily activities, moderate footwear restriction, major reservation on surgery results
Poor	Moderate to severe pain, limitation of daily and recreational activities, severe footwear restriction, dissatisfaction or re rupture

Statistical analysis

To compare the outcomes of the two suture materials used in Achilles tendon repair, SPSS software was utilized for hypothesis testing. The chi-square test of independence was applied to compare outcome variables between the two groups. A p value of less than 0.05 was considered statistically significant.

RESULTS

Our study included 32 male and 17 female patients. Group A had 23 patients with a mean age of 40.9 years (range 20-57 years), while group B had 26 patients with a mean age of 35 years (range 20-57 years). The mean follow-up period was 8 months (range 6-12 months) in group A and 7.5 months (range 6-12 months) in group B. Time from injury to operation was within 48 hours for both groups. The two groups were homogeneous with no significant

differences in factors listed in Table 3. Causes of injury included falls in the commode (toilet seat injury) in 24 patients (48.9%), pillion riding accidents in 15 patients (30.6%), and falls from height or road traffic accidents in 10 patients (20.4%). Functional and clinical results are summarized in Table 3. All 26 patients (100%) in the PDS group showed good or excellent outcomes based on Boyden's clinical assessment, while only 13 patients in the polyester repair group achieved similar results. All patients returned to their previous activities of daily living. Postoperative complications are detailed in Table 4. The absorbable suture group (PDS) had fewer complications (7.69%) compared to the nonabsorbable suture group (Polyester) which had 26.08%. Deep infection occurred in 4 patients in the nonabsorbable suture group, and superficial infection occurred in 2 patients in the absorbable suture group. All deep infections were successfully treated with debridement and antibiotics, with

no residual deficits. Additionally, 2 cases of foreign body reaction were observed in the nonabsorbable suture group.

Table 2: Patients characteristics.

General information		Mean /percentage
Age (in years)		39 (20-57)
Sex	Male	32
	Female	17
Mechanism of injury	Indian toilet seat injury	24
	Pillion rider	15
	Fall from height, road traffic accidents	10
Time to operation		2 days
Group A		Polyester (Ethibond)
Group B		PDS

Table 3: Functional outcome achieved in present study as per Boyden assessment.

Boyden score	Polyester group (%)	PDS group (%)
Excellent	9 (39.13)	20 (76.9)
Good	4 (17.39)	6 (23.08)
Fair	10 (43.48)	0
Poor	0	0
Total	23 (100)	26 (100)

Table 4: Complications.

Complications	Ethibond group (%)	PDS group (%)
None	17 (73.91)	24 (92.31)
Superficial wound infection	0	2 (7.69)
Deep wound infection	4 (17.39)	0
Re-rupture	0	0
Foreign body reaction	2 (8.69)	0
Total	6 (26.09)	2 (7.69)

DISCUSSION

Achilles tendon rupture is a common injury that can significantly impair the adult population. Operative treatment of acute rupture has shown a lower re-rupture rate but is often associated with higher wound complications. Our study demonstrated that the use of non-absorbable sutures is linked to increased wound-related problems such as infections and foreign body reactions, which directly reduce patient satisfaction. This injury is frequently seen in young athletes who either begin training without adequate warm-up or resume training after a period of rest.^{9,10} Surgical repair helps restore tendon length, lowers the risk of re-rupture, and results in better

functional outcomes.¹¹⁻¹³ However, the presence of suture material in the surgical wound can adversely affect local tissues and increase susceptibility to infection. Infection risk is further heightened when unhealthy tissue, hematoma, dead space, or poor surgical technique is involved. Selecting appropriate suture material depends on factors such as the injury and wound characteristics, tissue type, host factors (local and systemic patient condition), and the properties of different sutures.

In the literatures, most authors have reported good results of open repair of acute Achilles tendon rupture. However, wound complications of this surgical treatment were reported as 13%.³ Major risk factors include age, gender, timing of surgery, BMI, smoking, diabetes, and steroid use; importantly, suture materials themselves have been implicated in wound problems.^{14,15} Nonabsorbable sutures are commonly used in Achilles tendon repair, and our study focused on comparing outcomes based on suture type. In choosing sutures for Achilles repair, tensile strength, knot-holding ability, biocompatibility, ease of handling, and complication rates should be considered. Nonabsorbable sutures are favored for their handling, biocompatibility, and minimal strength loss after knotting, but they may cause early suture reactions, deep infections, knot irritation, and delayed foreign body reactions.^{5,8} Absorbable sutures may avoid long-term foreign body complications but maintaining adequate tensile strength during healing remains challenging, as they degrade over time. To address these drawbacks of nonabsorbable sutures, absorbable suture materials have been increasingly considered for Achilles tendon repair.⁷

PDS suture is a synthetic monofilament PDS suture that is absorbable and retains its strength longer than many other absorbable sutures. It is absorbed by hydrolysis, fully dissolving within 180-210 days. PDS passes easily through tissue, causing minimal trauma, and retains 74% of its tensile strength at 2 weeks, 50% at 4 weeks, and 25% at 6 weeks. In contrast, polyester (Ethibond) sutures are non-absorbable synthetic braided multifilament sutures made of polyethylene terephthalate. The main advantages of PDS are its absorbability and monofilament structure, which reduces long-term foreign body reactions like excessive fibrosis that can impair tendon gliding.¹⁶ Wada et al found that among suture types, PDS II had the highest tendon-holding capacity, while polyester had the lowest.¹⁶ Tendon holding capacity is the key factor determining repair strength. Yildirim et al also confirmed PDS II as having the highest tendon-holding strength among tested sutures.⁷ Gebauer et al advocated using absorbable sutures for Achilles tendon repair.¹⁷ Literature suggests monofilament sutures cause fewer infections than multifilament sutures due to less bacterial bioadherence and better phagocytic cell access.¹⁸ In our study, no re-ruptures occurred, though literature reports a 10-12% re-rupture rate after surgery-this may be due to our smaller sample size and shorter follow-up. Limitations of our study include small sample size and uniform postoperative rehab in both groups. Nevertheless, we support the use of

absorbable sutures in Achilles tendon repair. Many studies report complications associated with nonabsorbable sutures: Kim et al described knot irritation from bulkiness of nonabsorbable Ethibond sutures, and chronic deep sinus formation has also been reported.^{19,20} These authors recommend routine use of absorbable sutures. Mohd et al in a case series, successfully used PDS with a novel simple repair technique.²¹ Case reports also document foreign body granulomatous reactions linked to nonabsorbable Ethibond sutures.¹⁵ Thus, choosing the right suture material is important for minimizing complications, and absorbable sutures appear to be a good option due to their lower risk of suture reactions.

Limitations

Small sample size and short-term follow-up. Only one type of nonabsorbable (No. 5 polyester) and absorbable (PDS) suture was used.

CONCLUSION

In our study, patients treated with the nonabsorbable suture (Ethibond) had a higher incidence of infection and foreign body granulomas. Surgical repair using the absorbable PDS suture proved superior, with significantly fewer postoperative wound complications and better patient outcomes as measured by Boyden scores. However, larger studies are recommended to further assess and compare these suture materials.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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