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Research Article

# Innovative usage of percutaneous repair technique for acute Achilles tendon rupture in diabetic patients

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## Statistics

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## Abstract

**Introduction:** Infection following open Achilles tendon surgery in diabetic patients is a devastating complication and often leads to poor outcomes. Percutaneous repair of Achilles tendon rupture avoids possible complications of open repair. Our purpose was to evaluate the clinical and functional outcomes of patients treated with percutaneous repair technique for acute Achilles tendon rupture.

**Methods:** This retrospective study included 24 patients with complete acute Achilles tendon rupture and type 2 diabetes mellitus treated with ultrasound-guided percutaneous repair. Clinical evaluation was performed using the American Orthopaedic Foot and ankle society (AOFAS) score, time to single heel raise and other scores. All patients were followed up for a mean of 14-16 months.

**Results:** For patients throughout follow up, there were no signs of infection, the mean (AOFAS) score was 94.83 and all patients were able to single heel raise after 1 year of surgery.

USG and MRI showed satisfactory healing of the Achilles in all patients in 3-4 months.

All patients had a nearly full range of ankle movement recovery at the latest follow up. There was neither infection nor re-rupture observed during the follow-up period.

**Conclusion:** Innovative percutaneous repair technique is safe, with a low rate of complications in diabetic patients. This technique neither avoids the possible complications of open surgery with neither infection nor re-ruptures as vascular supply is not disturbed in the percutaneous repair technique.

**Keywords:** Achilles tendon; rupture in diabetic patients; re-rupture; infection

## INTRODUCTION

Achilles tendon rupture is a common ankle injury that involves usually overweight men and women aged between 30 to 70 years [1]. Due to a sudden increase in the tension on the tendon these injuries are very common in this particular age group. Common causes for these injuries are

- Recreational sports activities especially those that involve jumping
- Falling from height
- Stepping into a hole

Surgical and conservative treatments are both employed to treat Achilles tendon Rupture, but surgeons prefer to operate to improve early ankle movement. However, there is still an argument over the best treatment for Achilles tendon rupture.

Exposure to prolonged hyperglycemia can affect the tendon and causes degeneration of the tendon. Open surgical treatment poses the risk of infection. Diabetes has been found to increase the risk of wound complications [2]. It is estimated that there is an infection rate of more than 10% with open treatment. Deep infection is a devastating complication that can delay rehabilitation and often results in poor clinical outcomes.

To overcome the complications of open treatment, minimally invasive techniques have been developed. Ultrasound-guided percutaneous repair of Achilles tendon repair was performed to reduce the complications of open repair [3-5].

The purpose of this study is to evaluate the functional and clinical outcomes of diabetic patients who have undergone percutaneous repair for acute Achilles tendon rupture.

## MATERIAL AND METHODS

This retrospective study included a total of 24 patients diagnosed with acute rupture of Achilles tendon and type 2 diabetes mellitus were treated with ultrasound-guided percutaneous repair between May 2019 and December 2020

## INCLUSION CRITERIA

- Patients who are already diagnosed and newly diagnosed with type 2 diabetes mellitus, irrespective of the gender in the age group of 30 -70 years,
- complete rupture if Achilles tendon of not more than 1-month duration with intact skin and intact sensation of the affected limb

## EXCLUSION CRITERIA

- Chronic rupture exceeding a 1-month duration
- sensory impairment of the affected limb
- bony avulsion of calcaneum tuberosity
- history of recent local corticosteroid injection
- Re-rupture of the Achilles tendon.
- Patients with uncontrollable blood sugar levels
- Patients with peripheral vascular disease

There were 16 men and 8 women with a mean age of 49.7 years with a sex ratio of 3:1. All patients had a complete rupture of the Achilles tendon with a gap less than 40mm, located 30-70 mm proximal to the calcaneum insertion.

Mean distance of Achilles tendon rupture from the calcaneal attachment was 47.6 mm and mean gap of rupture was 22.9 mm.

The percutaneous tendon repair was done within a mean of 6.5 days after the injury once the patient's Blood sugar levels were under control. Patients were followed for 14 months-16 months and were assessed clinically and using imaging studies.

Demographics of the patients are described in Tables 1-3.

24 Patients were clinically examined and found to have a palpable tendon gap, positive Thompson test, positive mantles test and loss of

**Table 1.** Age Distribution

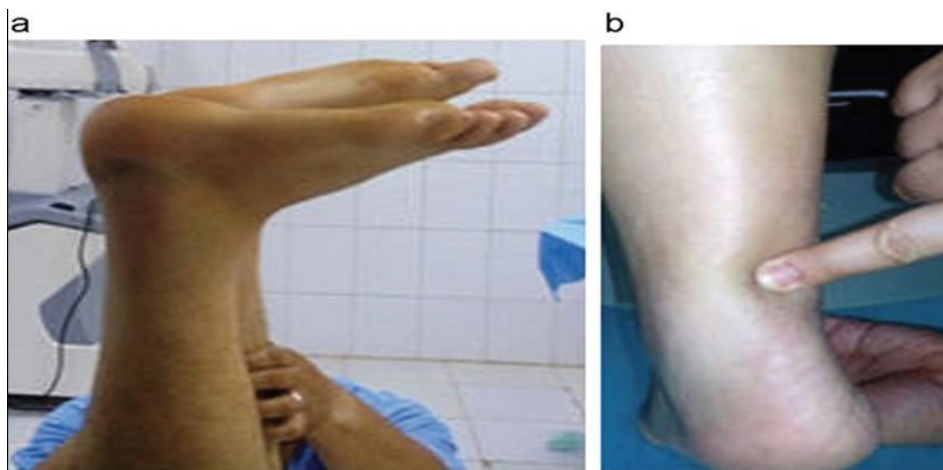
| Age in Years       | Cases | Percentage |
|--------------------|-------|------------|
| Less than 40 years | 4     | 16.6       |
| 41-50 years        | 8     | 33.33      |
| 51-60 years        | 5     | 20.8       |
| 61-70 years        | 7     | 29.1       |

**Table 2.** Sex Distribution

| Sex    | Cases | Percentage |
|--------|-------|------------|
| Male   | 16    | 0.6666     |
| Female | 8     | 0.3333     |

**Table 3.** Side of Achilles Tendon Rupture

| Side  | Cases | Percentage |
|-------|-------|------------|
| Right | 12    | 0.5        |
| Left  | 12    | 0.5        |



**Fig. 1.** Palpable tendon gap and positive Matles test

plantar flexion in the affected ankle and unable to walk on toes on the affected side (Figure 1).

The diagnosis was confirmed by radiological evaluation (MRI/USG) in our facility for all patients (Figure 2).

### SURGICAL TECHNIQUE OF PERCUTANEOUS REPAIR OF ACHILLES TENDON RUPTURE

All patients underwent surgery with blood sugar levels in control and spinal Anesthesia was given. Patients were placed in a prone position with free ankle and foot for easily mobilization. Tourniquet was not used.

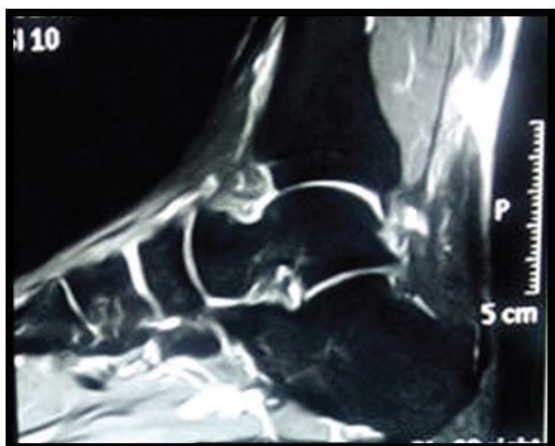


Fig. 2. Sagittal MRI section showing tendo Achilles tear



Fig. 3. Materials required for the repair



After detecting the site of rupture, skin incision markings were marked along the posterior aspect of the Achilles tendon. Leg and foot were prepared and draped.

### MATERIALS REQUIRED

Needles-16G, stainless steel, needleless-short and long, Sutures-ethibond (5-0) and ethilon (3-0) (Figure 3).

The entire procedure is carried out under ultrasound and radiograph guidance to ensure proper anastomosis of ruptured ends of the tendon and to avoid Neurovascular injury [6].

Over the posterior aspect of the tendon, 4-5 cm above the proximal ruptured end of the tendon, a 16G needle is passed from medial to lateral through the tendon and ethibond is passed through the 16G needle (Figure 4).

Then two 16G needles are passed obliquely inferior to superior through the tendon and ethibond is passed through the needles. This similar technique is followed again till the proximal end of the tendon is held firmly with ethibond and the proximal end of the ruptured tendon is pulled down to the distal part. Then the needles are passed through the distal part with the similar technique that was followed in the proximal part of the ruptured tendon (Figure 5). Keep the ankle in plantar flexion till you get an approximation of ruptured ends of the tendon (checked under ultrasound).

Keeping the ankle in plantar flexion, drill bit (2.7 mm) is passed through the calcaneum medial to lateral, and 16G needle is passed through the drill hole and lateral end of ethibond is passed through the needle (laterally to medially) so that both the free ends of ethibond are placed medially.

After ensuring the approximation of ruptured ends of tendon, free ends of ethibond are tied and the knot is buried underneath the skin, if necessary skin sutures are applied.

Hold the limb in plantar flexion and apply pop cast after aseptic dressing of the wound, pop should be moulded along the course of the Achilles tendon.

Hold the limb in plantar flexion and apply pop cast after aseptic dressing of the wound, pop should be moulded along the course of the Achilles tendon. The average time of percutaneous repair of Achilles tendon rupture was 20 minutes (15 min-30 min). The period of hospitalisation was 1-2 days (Figure 6).



Fig. 4. Intra operative images describing the surgical technique





Fig .5. The intraoperative images describing the surgical technique in distal part of ruptured tendon

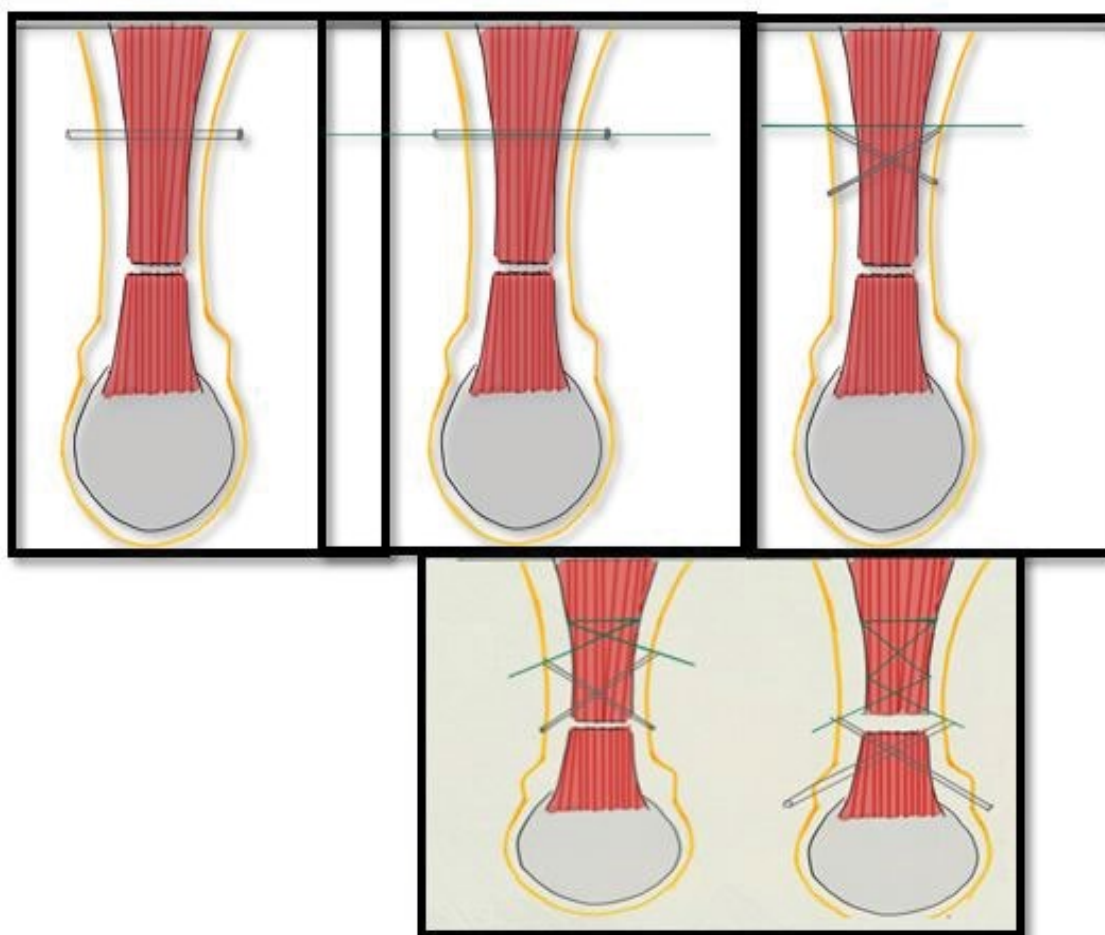


Fig.6. Schematic representation of percutaneous repair technique

## POSTOPERATIVE CARE AND REHABILITATION

All the patients were on a strict diabetic diet, medication throughout the course and still continued.

Immobilization was done for two weeks in the anterior below-knee cast in plantar flexion for 6 weeks.

After 6 weeks, gradual protected weight-bearing, gradual increase in

ankle range of motion, and calf strengthening and stretching exercise were initiated. Routine clinical follow-up was performed. After 3-4 months patients are asked to resume full and normal daily activities. MRI was done at 3 months for all patients and the clinical follow up was completed at 6, 9, 12, 14 months.

## EVALUATION METHODS

Clinical evaluation was done using American Orthopaedic Foot And

Ankle Society Score (AOFAS) ankle-hind foot (0-100) consists of nine items scored together for a total of 100 points, which are distributed over three categories: pain (40 points), functions (50 points) and alignment (10 points)

Achilles tendon total rupture score (ATRS, 0-100), and the single heel-raise test were recorded.

At the final follow-up, various parameters are used to evaluate the postoperative outcome. The parameters used are listed below

- overall satisfaction level was quantified based on visual analog scale (VAS; 0=extremely unsatisfied, 10=extremely satisfied)
- The aesthetic outcome of the surgical scar was assessed using a VAS score
- The time period after surgery when single heel raise was possible was recorded
- The difference in bilateral calf girth was assessed
- Return to the athletic ability to the pre-rupture level was evaluated
- Calf girth was measured at the thickest part of the leg, with the knees flexion at 90°

Athletic ability was classified into one of the following four groups after comparing with pre rupture level: same level, diminished level, stopped, or never participated. Lastly, complications including infection, recurrent rupture, and sural nerve injuries were evaluated. Patients return to work and complications were recorded.

## RESULTS

The follow up was done for 14-16 months. Functional outcomes were recorded at regular follow-ups post-operative for all 24 patients. AOFAS hind-foot score, ATRS, a time point when single heel raise was possible, differences in bilateral calf circumference, and recovery of athletic ability compared to a pre-rupture level were recorded. The results are shown in Tables 4-6.

Overall satisfaction level of operative outcome was significantly good (7-10) average is 8.95. The aesthetic satisfaction level of scars was very good (8-10) average is 9.29.

The time interval from repair to return to work was 7-12 weeks, with a mean time of 8.16 weeks. In our patients, no tendon re-ruptures with adequate tendon healing at 3-6 months were observed.

Deep venous thrombosis doesn't occur in our series; this is due to early mobilization in the anterior below knee slab and accelerated rehabilitation programs. There are no signs of deep infection at the surgical site in all the patients. Out of 24 patients, 1 patient had a superficial infection and it was treated completely. There are no signs of

**Table 4.** Preoperative AOFAS Score

| AOFAS scale        | Cases |
|--------------------|-------|
| Excellent (95-100) | 0     |
| Good (75-94)       | 0     |
| Fair (51-74)       | 4     |
| Poor (0-50)        | 20    |

**Table 5.** Postoperative AOFAS Score

| AOFAS scale        | Cases |
|--------------------|-------|
| Excellent (95-100) | 20    |
| Good (75-94)       | 2     |
| Fair (51-74)       | 1     |
| Poor (0-50)        | 1     |

**Table 6.** Clinical results of the 24 patients

| Evaluation methods  | Average     | Range  |
|---|-------------|--------|
| AOFAS Score (0-100)   | 93.5        | 48-100 |
| ATRS (0-100)  | 93.75       | -      |
| Single Heel Raise (after surgery (in months)                              | 4.02 months | 44350  |
| Overall Patient's Satisfaction  | 8.95        | 44476  |
| AOFAS : American orthopedic Foot and Ankle society ankle-hind foot score, |             |        |
| ATRS : Achilles tendon total rupture score                                |             |        |

**Table 7.** Complication Distribution

| Complications         | No of cases | Percentage |
|-----------------------|-------------|------------|
| Superficial infection | No          | 0          |
| Deep infection        | No          | 0          |
| Re rupture            | 1           | 4.166%     |
| Sural nerve damage    | No          | No         |

any deep infection, re-rupture, sural nerve damage. Details are shown in table 7.

## DISCUSSION

The preferred method for Achilles tendon rupture remains a topic of argument, with the evolving techniques and increasing demand of patients numerous studies have been performed comparing open repair and minimally invasive techniques.

Open repair of Achilles tendon rupture allows direct visualization and it ensures excellent approximation of ruptured ends of the tendon. But the common complication of open repair technique is wound infection [7].

Thus percutaneous repair technique of Achilles tendon rupture is proving to be a safe and promising method to repair Achilles tendon rupture, especially in diabetic patients.

The principles of the percutaneous technique consist of

- Union of ruptured ends without using a large surgical approach, thus avoiding the drainage of the local hematoma and rushing its repair.
- Avoiding damaging of tendon vascular supply

The varying anatomical course of the sural nerve makes it vulnerable to damage during percutaneous suturing of Achilles tendon rupture. The sural nerve crosses the lateral border of the Achilles tendon at variable distances from tendon insertion distally the sural nerve passes lateral to Achilles tendon insertion. To avoid the possibility of sural nerve injury the lateral half of the Achilles tendon should be spared from percutaneous sutures.

## CONCLUSION

The ultrasound-guided percutaneous technique is safe, with a low rate of complications in diabetic patients.

This technique preserves the blood supply of the tendon (because paratenon is not stripped), prevents infection and early healing of the Achilles tendon. Thus this technique is very much helpful in diabetic patients as this technique avoids the possible complications of conservative and open treatment [8-15].

## Source of funding

None

## Conflict of interest

None

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