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Original Research Article

Achilles Tendon Rupture with Lower Extremity Dysfunction: Is Percutaneous Repair Excellent than Surgical Closure; Study on Modernized District Hospital in Bangladesh

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Abstract: ***Background:*** Compared to percutaneous surgery, open repair of Achilles tendon rupture has been associated with a greater rate of wound complications. On the other hand, percutaneous repair has been related to a greater risk of rerupture and sural nerve injury in several investigations. ***Purposes:*** As far as function and cosmesis were concerned, we compared the two types of repairs in the following ways: (1) muscular strength and ankle ROM; (2) calf and ankle perimeter; (3) single heel rise tests and work return. ***Methods:*** A multicentered based non-randomized quasi-experimental prospective study was performed in Joypurhat 250 bed District Hospital, Rajshahi, Bangladesh, from June 2019 to December 2020. Percutaneous Achilles tendon repair was performed on 17 patients, while open Achilles' tendon repair was performed on 15 of the 32 surgically treated patients. As a result of this, all patients followed a standardized rehabilitation protocol. The minimum follow-up was six months (mean, 18 months; range, 6–48 months). ***Results:*** There were no significant differences in calf and ankle circumference or in plantar flexor strength across groups. Patients who underwent open versus percutaneous repair had a lengthier return-to-work period (5.6 months versus 2.8 months). The open repair group's mean scar length was higher (9.5 cm versus 2.9 cm). Those in the percutaneous group had a more attractive look than those in the other groups. In the open repair group, two wound complications and one rerupture were discovered. An individual in the percutaneous repair group had an incident of deep vein thrombosis. Within six months of surgery, all problems had happened. Patients with nerve damage were not found during our study. ***Conclusions:*** Percutaneous repair is functionally equivalent to open repair, but it is more aesthetically pleasing, has fewer wound problems and does not appear to raise the risk of rerupture.

Keywords: Tendon Achilles Rupture, Surgical closure, Reconstructive surgery, Percutaneous Repair.

INTRODUCTION

Acute rupture of the Achilles tendon is a frequent occurrence [1]. North American populations have an incidence rate of 5.5 to 9.9 ruptures per 100,000 individuals, while European populations have six to 18 ruptures per 100,000 persons [2]. Men in their third or fourth decade of life are more likely to develop them and are more likely to be on the left side. In sports, the majority of ruptures occur [3]. According to Moller *et al*. [4], increasing participation in sports may be contributing to an increase in the incidence of this disease.

The optimum technique for treating acute Achilles tendon ruptures is still a matter of debate; open or percutaneous repairs can be performed [5]. Opioid therapy appears to be more common than nonoperative treatments, according to the medical literature [6]. Nonoperative therapy is linked to significant rerupture rates (9.8 %–12.6 %) [7]. Protracted duration of cast immobility that contributes to tight ankles and weak calf muscles [8]. A lower rate of rerupture and an earlier return to pre-injury activities have been associated with surgical repair [9]. Other complications,

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as scar adhesion, wound infection, and the formation of keloid cells, as well as patient dissatisfaction with the appearance of the scar, have been linked to the procedure [10].

As it concerns complications, percutaneous repair appears to have a low rate [11]. When repairing Achilles' tendons, percutaneously, the tendon is less thick than when repairing them openly, resulting in improved cosmesis. Many studies have shown that the risk of rerupture following percutaneous repair is significantly greater than that following open surgery, with rates ranging from 3-10 percent. Sural nerve damage using percutaneous procedures is reported to vary from 3% to 18%, with prolonged pain and even the necessity for formal surgical exploration in some patients [12]. Both of these techniques have been employed for patient care at our facility, although at varying points in time [13]. Open surgery was the standard of care for acute Achilles tendon ruptures until 2006 when the Amlang *et al*. [14] approach of percutaneous repair replaced it as the treatment of choice.

Ankle mobility, plantarflexion strength, single heel rises tests, and returns to work were assessed in pilot research to compare the two repairs. We found no significant difference between the two in terms of cosmesis (scar length, aesthetic look).

PATIENTS AND METHODS

A multicentered-based, non-randomized quasi-experimental prospective study was performed in Joypurhat 250 bed District Hospital, Rajshahi, Bangladesh, from June 2019 to December 2020. A total of 32 patients (58%), 28 males and four women, with a mean age of 40 years (23–57 years), were included in our research. A total number of patients, 15, underwent an open repair, while 17 had a percutaneous repair. The minimum follow-up was six months (mean, 18 months; range, 6–48 months). Recalled patients were examined for this investigation. Achilles tendon ruptures that required immediate open surgery were all performed here.

The incision was centered over the gap, slightly medialized, and avoided the sural nerve in all cases. The paratendon was opened, and the fault was found. An end-to-end Kessler suture with two strands of Number 2 FiberWire1 (Arthrex Inc, Naples, FL) was used to repair the tendon. According to Amlang *et al.* [15], the percutaneous method was conducted in all patients. A tiny incision was created 2 centimeters before the gap to do the procedure. Using two strands of Number 2 FiberWire1, the distal end of the tools was brought proximally and sutured after the crural fascia was opened.

One day following surgery, all patients received a brief leg cast and were released from the hospital. Cast removal wound revision and stitch removal were all part of the initial post-surgery check-up. A foot and ankle specialist at our institution was assigned to supervise all participants of this trial once they had been screened. If they had any difficulties or wound issues, they were referred back to the surgeon.

The cast and stitches were removed three to six weeks after surgery, and patients could resume their normal activities. Passive stretching exercises were prescribed for all patients by a physiotherapist. A 1-cm heel lift and neuromuscular control activities (wobble board and star excursion balancing) were done six to nine weeks after surgery. We began complete weight-bearing and concentric muscle strengthening in bipedal support at the end of the 9 weeks. Eccentric muscle strengthening in unipedal support and advanced neuromuscular control activities were introduced to patients at 12 weeks (plyometric training: squat jumps and single-leg hop). In most cases, patients may return to work after nine to 12 weeks and resume sports activities after 15 weeks following surgery.

Between six and 48 months after surgery, all of our patients were visited and examined by two qualified foot and ankle surgeons at our hospital (HH, LLS). We looked at the following: In this study, we gathered data on the ROM of the ankle, as well as the length of the scar and how long it took for the patient to return to work and sports after surgery. We also looked at the patient's subjective evaluation of the scar's cosmetic appearance. We found it was excellent, good, regular, or bad, depending on how the patient felt about it.

Table-1: In both groups, functional parameters were evaluated.

Parameter	**Open repair group (n = 15)**			**Percutaneous repair group (n = 17)**		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Muscle strength (N)	144	85	195	120	55	200
Dorsal flexion (°)	15	5	30	15	5	30
Plantar flexion (°)	40	30	50	40	25	50
Ankle perimeter (cm)	24.2	21.5	28	23.2	21	28
Calf perimeter (cm)	39	34.5	41.5	39	34.5	42
Single heel raising test	18.5	3	20	17.6	3	20
Time to work return (months)	5.6	3	30	2.8	2	7

Table-2: Results in terms of aesthetics

Parameter	Open repair group (n = 15)	Percutaneous repair group (n = 17)
Scar length (cm)		
Mean	9	2.8
Maximum	19.5	3.2
Minimum	6	2.3
Cosmetic appearance rating (number of patients)		
Excellent	3	9
Good	8	8
Regular	3	0
Bad	1	0

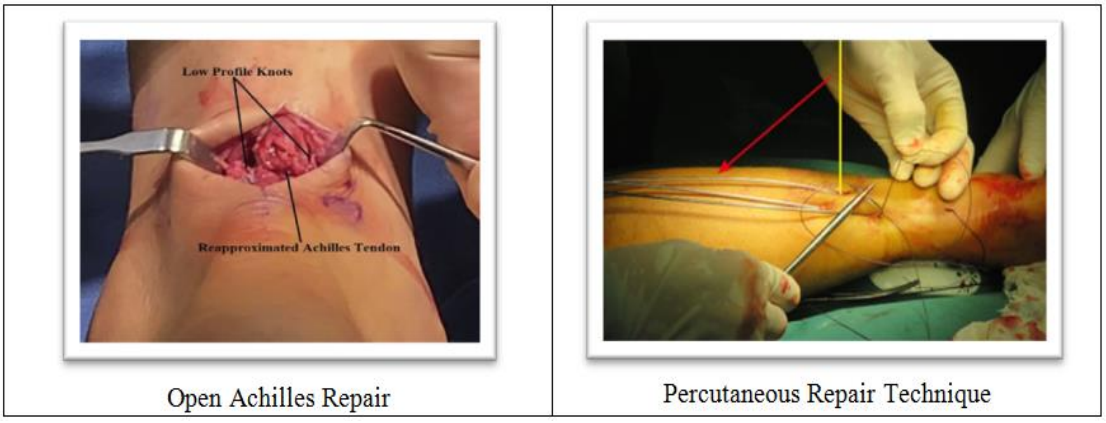
Table-3: Complications following surgery

Group	Wound dehiscence	Rerupture	Deep venous thrombosis
Open	2	1	0
Percutaneous	0	0	1

RESULTS

We found that the two groups performed similarly (Table 1). The average muscular strength was higher in open-repaired individuals (147 N versus 120 N). Ankle dorsal and plantar flexion was comparable in both groups (408). For both groups, the mean calf and ankle perimeters were the same. Open-repair patients had a longer return-to-work time (5.6 months) than percutaneous-repair patients (4.2 months) (2.8 months). There was a maximum of 30 months for one patient in the open repair group who had wound issues and required surgical treatment with a soleus flap and augmentation with a flexor hallucis longus tendon to return to work after 3 months. It took a patient in the percutaneous repair group just two months to be able to return to work in the absence of any weight-bearing on the operated side.

The open repair group had a scar length of 9.5 cm, whereas the percutaneous repair group had a scar length of 2.9 cm (Table 2). The patient with wound problems who needed soleus flap and augmentation had the greatest incision (19.5 cm). Patients in the percutaneous repair group (nine) were more likely to describe the aesthetic appearance as excellent than those in the percutaneous repair group (three) (Table 2). In both groups, the incision was rated as excellent by a similar number of patients. In the percutaneous repair group, there were no regular or poor appearance evaluations.



Open Achilles Repair | Percutaneous Repair Technique

The open repair group was responsible for three of the four postoperative problems (Table 3). There were two wound complications and one relapse in this group. The same patient had both a rupture and wound dehiscence. The flexor hallucis longus tendon had to be surgically grafted and transposed in this patient. A patient with dehiscence who was treated medically had another problem. One deep venous thrombosis of the calf was reported in the percutaneous repair group. After receiving medical attention, the patient was able to be discharged with no more issues. In both groups, all of the problems occurred within six months following surgery.

DISCUSSION

Treatment of Achilles tendon ruptures is a complex issue; surgery has been preferred over nonoperative therapy during the past two decades [16] because it has been associated with decreased rerupture rates [17]. A greater incidence of rerupture and damage of the sural nerve is related to open repair than the per-cutaneous repair approach. Which has

been increasingly used over open repair in recent years [18]. Both surgical techniques were compared in terms of their short-term outcomes, cosmesis, and complications.

A multicentered-based, non-randomized quasi-experimental prospective study was performed in Joypurhat 250 bed District Hospital, Rajshahi, Bangladesh, from June 2019 to December 2020. We recognize the limits of our research. We could not conduct a statistical analysis that would adjust for potential confounding variables due to the small number of patients. Consequently, this is a preliminary investigation. As a result, we saw many patients (42 %) drop out of the study. Patients who suffered ruptures or other problems might influence our findings. For the final three patients, we conducted a brief follow-up. No issues were found in any of the three patients contacted by phone one year following their operation. For the fourth time, our assessment of one's physical attractiveness was not founded on a scientifically established metric.

To both patients and doctors, the postoperative function is critical. Both groups of patients had identical results on tests, including the single heel-rise test, which looked at ankle ROM, calf and ankle perimeter, and their calf and ankle perimeter. On average, the open repair group had somewhat more muscular strength than the percutaneous repair group (147 N versus 121 N). Percutaneous repair patients were able to return to work more quickly (2.8 months versus 5.6 months). Because the percutaneous repair affects less soft tissue, a quicker recovery time may be expected following surgery. As with percutaneous correction [19], similar findings have been observed. Gorschewsky *et al*. [11] found that 66 patients after percutaneous repair had an adequate function, with identical values of muscle strength and range of motion for the left and right ankles in 65 patients. The strength and range of motion in one patient's ankles have been reduced due to rerupture. Biomechanical results of open surgery and percutaneous repair of the plantar flexor muscle-tendon unit were compared in prospective research, including 20 patients, 10 of whom underwent open surgery and 10 who underwent percutaneous repair. As evaluated by the American Orthopaedic Foot and Ankle Society (AOFAS) scale, Aktas and Kocaoglu [19] found no significant difference between the two procedures in 40 patients. There were no changes in isokinetic or SF-12 assessments between the open and percutaneous groups; according to Gigante *et al*. [20], the ankle circumference was higher in the percutaneous group.

Our study demonstrated a significant variation in the length and appearance of scars (cosmesis). Percutaneous repair patients had shorter incisions (2.9 cm versus 9.4 cm). Patients are more likely to accept the smaller incision and avoid wound problems as a result. Percutaneous repair has an excellent visual appearance grade because of these features. According to previous research, patients prefer the percutaneous method's look, even though no objective evaluation of this issue was conducted in those investigations [21].

Table-4: Overview of the current state of knowledge

Study	Surgery	Number of cases	Results
Haji *et al*. [18]	Percutaneous (Ma-Griffith modified) versus open	108	No statistical difference in complications
Maes and Copin [22]	Percutaneous (Tenolig)	124	High rate of rerupture and sural nerve lesions
Majewski *et al*. [23]	Percutaneous (exposed versus no exposed sural nerve)	84	18% sural nerve lesions in no exposed group
Lim *et al*. [24]	Percutaneous (Ma-Griffith) versus open	66	More infective wound complications in open group
Aktas and Kocaoglu [19]	Percutaneous (Achillon) versus open	40	Lower complications in percutaneous surgery
Gigante *et al*. [20]	Open versus percutaneous (Tenolig)	40	No difference in complications
Henrı' quez *et al*. [25]	Percutaneous (Amlang) versus open	32	No sural nerve injury in both groups; higher wound complications in open surgery

The two strategies have been associated with various problems, as detailed by various writers (Table 4). When it comes to open surgery, wound problems are frequently mentioned as a drawback. Compared to the nonoperative group, Carden *et al.* [26] found an incidence of 17 percent problems in the open surgically treated group. There were seven wound infections (21%), two adhesions (6%), and three occurrences of wound puckering (9%) in the open repair group, according to Lim *et al*. [24], who conducted prospective research on 66 patients to compare open and percutaneous repair approaches. Two incidences of delayed wound healing were described by Gigante *et al*. [9]. Patients who had open surgery were twice as likely to have wound problems as those who underwent percutaneous repair. One patient had surgery after wound dehiscence occurred in two other patients. As a result of the Achilles tendons weakly vascularized

skin and the incision length, open surgery is associated with a more significant risk of wound complications [20] than percutaneous surgery.

The percutaneous procedure has a known complication called rupture, documented at varying rates in the literature. There was 10% rerupture in 124 patients treated with the percutaneous approach, according to Maes and Copin [22] (Tenolig1; Smith and Nephew, Memphis, TN). A lack of proper apposition of the tendon ends and delayed healing were cited as possible reasons. All three researchers reported 3 percent or higher rates, with the highest rate coming from Haji *et al*. [18] reporting rates of 2.6% and 3.2%, respectively. However, we detected no ruptures in our percutaneous repair group, and we considered our findings to be consistent with those published in the literature [27]. Sural nerve damage is another common side effect of the percutaneous technique [23]. Four of the 38 patients who underwent a modified Ma-Griffith surgery were found to have sural nerve lesions, compared to 1.4 percent of the 70 patients who underwent an open repair. 5.2 percent of 124 patients operated on using the percutaneous approach were found to have the same condition. In contrast, Lim *et al*. [24] found one case of chronic paresthesia in the sural nerve region.

Due to the absence of vision during surgery, this condition may be associated with nerve injury. An analysis of 84 patients who had undergone percutaneous surgery was performed by Majewski *et al*. [23]. A total of 38 individuals had their sural nerve exposed, whereas the sural nerve was not exposed in 46 other patients. A total of 18% of the lesions were found in the second category. There were no sural nerve lesions in the 62 ruptures operated on by Amlang *et al*. [14]. Following the findings of Amlang *et al.* [28], we did not uncover any evidence of sural nerve damage in our investigation. To prevent damaging the sural nerve, we utilized a paramedial incision and deepened the suture to the muscle fascia. There have also been cases of DVT following an Achilles tendon rupture. Color duplex sonography was used to analyze 95 patients 8 weeks after Achilles rupture in prospective research by Nilsson-Helander *et al*. [29], which identified 32 cases of thrombosis. In 84 patients treated with the percutaneous method, Majewski *et al*. [23] found three instances. There was one patient in the percutaneous repair group who developed deep venous thrombosis.

CONCLUSION

Using the method described by Amlang *et al*. [28], percutaneous repair is a repeatable procedure that achieves the same level of function as an open repair but without the difficulties and the undesirable aesthetic look of open surgery. If you have an acute Achilles tendon rupture, we propose percutaneous surgery.

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