



2023

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How to Cite This Article

Farrag, Abd-ELHakeem Abdullah; Akl, Mohammed Nasr; and Ahmed, Aktham Amin (2023) "Comparison between Percutaneous and Open Repair in Acute Tendon Achilles Rupture in Active Young Patients," *Al-Azhar International Medical Journal*: Vol. 4: Iss. 4, Article 18.

DOI: <https://doi.org/10.58675/2682-339X.1728>

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Comparison Between Percutaneous and Open Repair in Acute Tendon Achilles Rupture in Active Young Patients

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Abstract

Background: The Achilles tendon is the strongest and most often torn tendon in the human body and it is known that this rupture rate is rising in the third or fourth decade of life and it affects males more frequently. The majority of ruptures happen when doing sports.

Aim: To compare between percutaneous and open repair of acute Achilles tendon rupture in active young patients who want to go back to resume activity following the repair.

Patients and methods: 30 participants were included in this prospective comparative research and randomly assigned to groups A and B. (each consists of 15 patients). While group A got percutaneous repair, group B had open repair. Hospitals affiliated with Al-Azhar University were the study's site (Al-Hussien University Hospital) as well as Zagazig General Hospital. The duration of the study was eighteen months.

Result: No statistically substantial variation was detected between the two techniques as regard functional results (full weight-bearing, return to activity, muscle strength, and AOFAS score) at last follow-up. However, patients in the percutaneous group were able to achieve significantly larger degrees of ankle plantar flexion compared with the open group.

Conclusion: At the long-term checkup, there is no variation between percutaneous and open Achilles tendon repairs. Although both groups had functionally equivalent results, open surgery of the Achilles tendon was linked with more wound problems.

Keywords: Achilles tendon rupture, Open repair, Percutaneous repair

1. Introduction

The Achilles tendon is the strongest and the most often torn tendon in the human body. The tendon rupture affects males more frequently. The majority of ruptures happen while practicing sports. The incidence may be rising since more people are participating in recreational sports activity.¹

The best course of action for treating an acute Achilles tendon rupture is not universally accepted and sometimes may be based on the surgeon or the

patient's preferences. Literature reports are ambiguous or sometimes contradicting. There are now four main kinds of interventions: two forms of surgical repair, (1) open, or (2) minimally invasive procedures, and two types of nonoperative conservative management, (3) simple immobilization, or (4) functional bracing.^{2,3}

Infection, adhesions, and issues with wound healing such as suture reactions, hematoma development, incisional neuromas, and granulomatous reaction have all been linked to open surgery, which has also been linked to greater costs and a higher chance of various complications.⁴

Accepted 6 November 2022.
Available online 18 August 2023

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<https://doi.org/10.58675/2682-339X.1728>

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Many studies were done to achieve a definite optimum therapy for acute Achilles tendon rupture but no conclusive result was given. Moreover, no studies were done to detect the efficacy of different surgical methods of repair for the young active patients who will resume their activity postoperatively.⁵

2. Patients and methods

On 30 patients with an acute tendon Achilles rupture, this prospective comparison research was carried out at the hospitals affiliated with Al-Azhar University (Al-Hussien University Hospital) as well as Zagazig General Hospital.

Patients were split into two groups randomly: group A (15 patients): was managed by a percutaneous repair. Group B (15 patients): was managed by open repair.

2.1. Inclusion criteria

Young active patients aged from 15 to 40 years old, presented with acute Achilles tendon rupture at Zone 2 of the tendon, isolated Achilles tendon injury, first time injury, closed ruptures.

2.2. Exclusion criteria

Poly trauma patients and/or associated ipsilateral fractures, open ruptures, comorbid disease (DM, diabetes mellitus), patients who intend to stop practicing exercises.

2.3. Methods

All patients included in the study were subjected to the following:

2.4. Detailed history taking including

Personal history (Name, age and sex), Personal habits (Smoking), time of trauma, mood of trauma, medical comorbidities as (DM, Rheumatoid ... etc.) and past history of previous operative procedure.

2.5. General examination

Vital signs (Temperature, pulse rate, blood pressure, and respiration rate) and signs of (Jaundice, cyanosis, pallor, and enlarged lymph nodes).

2.6. Investigations

Liver performance tests (aspartate aminotransferase (AST), alanine transaminase (ALT), alkaline

phosphatase (ALP), serum bilirubin, serum albumin, Prothrombin time, and international normalized ratio (I.N.R)), serum creatinine and complete blood count (CBC).

2.7. Subjective assessment through

Patient satisfaction was tested through a questionnaire with a scale from 1 to 5 given to every patient asking for their satisfaction about both function of the limb and cosmetic look as following: highly satisfied, moderately satisfied, neither satisfied nor dissatisfied, highly dissatisfied.

Doctor satisfaction through the same scale given to both the surgeon and other orthopedic surgeons.

2.8. Operative management

Intraoperative settings were the same regarding the two techniques. Thigh tourniquet was applied in the two techniques for hemostasis 2 g. of ceftriaxone was given intravenously for all patients by the time of the induction of the anesthesia. Patient position: prone position. Type of anesthesia: spinal anesthesia.

2.9. Surgical methods used in the study

2.9.1. Percutaneous surgical repair (modified Ma and Griffith)

A longitudinal incision of 2 cm was made directly over the rupture site. The proximal and distal tendon stumps were located. Four incisions of 1 cm were made 6 cm above the rupture site, 2 cm medially and laterally of the dorsal midline. Dissection to the soleus fascia was made in order to avoid the sural nerve. Two incisions of 1 cm were made medially and laterally to the distal stump of Achilles tendon. A straight needle holding the surgical thread was inserted through the incisions made around the proximal stump from the lateral side towards the medial side passing through the stump itself exiting from the core of the stump at the rupture site. The same is done through the distal stump. While pulling the two intratendinous strings distally, the stumps of the ruptured tendon were approximated. The strings through the distal and the proximal stump are tied and buried making the two stumps in close contact. Ethipond 5 is the surgical thread used. The paratenon was closed with Vicryl 2.0 thread and the skin with Prolene 0 thread. The 1 cm incisions were closed using simple interrupted sutures. Below-knee cast was applied in the equines position of the ankle for two weeks; the sutures are removed after two weeks. Then a below-knee cast was applied for two weeks in neutral

position of the ankle, lastly a below-knee walking cast is applied for another two weeks.

2.9.2. Open surgical repair (krackow technique)

Although lateral and central incisions have been suggested, the medial border of the Achilles tendon is commonly followed by a 6- to 8 cm longitudinal incision. The plantaris may be readily reached, the sural nerve is avoided, and postoperative skin breakdown is reduced by medial insertion. The fat and subcutaneous tissue were separated until they reached the crural fascia that covers the tendon. It was carefully avoided to damage the skin. In order to reveal and get close to the tendon ends, the ankle was plantar flexed. Without debridement, the tendon ends may be approximated and left alone. To reveal the tendon ends, the paratenon may need to be split even more. Sutures that were disrupted were used to strengthen the final repair. The foot placement must correspond to the other side (resting equinus). Over tightening and the need for advancement may result from excessive debridement. After tendon repair, the paratenon layer should be closed to decrease skin tension and avoid adhesions. Ethipond 5 is the surgical thread used. The paratenon was closed with Vicryl 2.0 thread and the skin with Prolene 0 thread. A below-knee cast was applied in the equines position of the ankle for two weeks; the sutures are removed after two weeks. Then a below –knee cast was applied for two weeks in neutral position of the ankle, lastly a below-knee walking cast is applied for another two weeks.

3. Results

A total of 30 patients (15 patients in each group) were enrolled in our study. All patients were followed up to a minimum of 6 months. As in Table 1, there was no statistically substantial variation was found between groups as regard baseline demographics, including age, gender, mechanism of trauma, side of injury, time to surgical repair, and follow-up duration.

As shown in Table 2, group A demonstrated significantly better aesthetic results in comparison with group B as regards scar length and cosmetic appearance.

As demonstrated in Table 3, no statistically substantial variation was detected between the two techniques as regard functional results (full weight-bearing, return to activity, muscle strength, and AOFAS score) at last follow-up. However, patients in the percutaneous group were able to achieve significantly larger degrees of ankle plantar flexion compared with the open group.

Table 1. Comparing demographic data between groups.

	Group A (n = 15)	Group B (n = 15)	P value
Age (years) ^c	27.5 ± 7.2	26.5 ± 8.8	0.754 ^a
BMI (kg/m ²) ^c	26.5 ± 3.2	25.6 ± 2.7	0.435 ^a
Sex ^d			0.666 ^b
Male	12 (80)	11 (73)	
Female	3 (20)	4 (27)	
Mechanism of Trauma ^d			0.874 ^b
Falling from height	3 (20)	4 (27)	
Sports injury	12 (80)	11 (73)	
Injured Side ^d			0.690 ^b
Right	10 (67)	11 (73)	
Left	5 (33)	4 (27)	
Time to Surgery (hours) ^c	28.7 ± 12.1	28.5 ± 10.3	0.962 ^a
Follow-up period (months) ^c	14.4 ± 4.1	14.9 ± 5.1	0.784 ^a

BMI, Body mass index.

^a Independent sample *t*-test.

^b Chi-square test χ^2 .

^c Data are shown as mean ± standard deviation.

^d Data are shown as numbers (percentage).

As illustrated in Fig. 1, a total of seven (47%) and 10 (67%) patients developed at least one post-operative complication in group A and group B, respectively. No statistically substantial variation was detected in the overall complication rates between groups (Chi-square test χ^2 , $P = 0.269$).

4. Discussion

Rupture of the acute Achilles tendon happens often. According to statistics, there are between 5.5 and 9.9 ruptures/100 000 persons in North America and between 6 and 18/100 000 in communities in Europe, depending on the demographic under study. In the third or fourth decade of life, and more often on the left side Mansfield and colleagues.⁶

As regard demographic data, there no statistically substantial variation between groups was discovered regarding baseline demographics, including age, gender, mechanism of trauma, side of injury, time to surgical repair, and follow-up duration.

Table 2. Comparing aesthetic results between groups.

	Group A (n = 15)	Group B (n = 15)	P value
Scar Length (cm) ^c	2.8 ± 0.4	11.7 ± 4.5	0.000 ^a
Cosmetic Appearance ^d			0.012 ^b
Excellent	11 (73)	3 (20)	
Good	4 (27)	6 (40)	
Regular	0 (0)	5 (33)	
Bad	0 (0)	1 (7)	

^a Independent sample *t*-test.

^b Chi-square test χ^2 .

^c Data as mean ± standard deviation.

^d Data as number (%).

Table 3. Comparing functional outcomes between groups.

	Group A (n = 15)	Group B (n = 15)	P value ^e
Time to Full Weight-Bearing (weeks) ^c	7.1 ± 1.1	7.9 ± 1.4	0.074 ^a
Return to Activity ^d			0.666 ^b
Yes	12 (80)	11 (73)	
No	3 (20)	4 (27)	
Time to Return to Activity (months) ^c	5.3 ± 0.7	5.9 ± 0.9	0.066 ^a
Muscle Strength ^d			0.166 ^b
Grade V	8 (53)	3 (20)	
Grade IV	4 (27)	7 (47)	
Grade III	3 (20)	5 (33)	
Plantar Flexion (degrees) ^c			
Injured side	42.3 ± 5	35.3 ± 2.8	0.000 ^a
Uninjured side	42.1 ± 4.7	44.7 ± 2.3	0.065 ^a
P value ^f	0.882 ^a	0.000 ^a	
Dorsal Flexion (degrees) ^c			
Injured side	24.9 ± 2.9	23.1 ± 2.4	0.079 ^a
Uninjured side	25.3 ± 2.7	23.3 ± 2.6	0.054 ^a
P value ^f	0.747 ^a	0.830 ^a	
AOFAS Score (points) ^c	92.5 ± 5.7	89.7 ± 5.6	0.195 ^a

AOFAS, American Orthopedic Foot & Ankle Society.

^a Independent sample *t*-test.

^b Chi-square test χ^2 .

^c Data as mean ± standard deviation.

^d Data as number (percentage).

^e Comparison between group A and group B.

^f Comparison between injured and uninjured sides within each group.

Our findings were corroborated by Hosny and colleagues,⁷ as they revealed that 20 patients were included. 10 patients each had surgical repair and 10 underwent percutaneous repair. All patients were followed-up for at least one year. Age ranged from 10 to 60 years. Mechanism of injury was sharp objects in 15 patients, rupture Achilles tendon while practicing sports in three patients and two patients had injury due to falling from height. 17 patients were male. In 12 instances, the right foot was impacted. Three instances had a closed acute Achilles tendon rupture compared with 17 cases with an open rupture. Age, sex, trauma mechanism,

and side of damage did not significantly vary across the groups under study.

Similarly, Schrinner and colleagues,⁸ conducted surgical revisions of closed acute Achilles tendon ruptures on 146 patients in our institution, 75 of whom had open suturing from 2009 to 2012, and 71 of whom got percutaneous suturing utilizing Dresden equipment. Regarding age, sex, and the side of the injury, there was no statistically substantial variation between the groups that were examined.

The current study showed that in the percutaneous group, the average operating time was 28.2 ± 3.6 min (range, 23–37 min). On the other

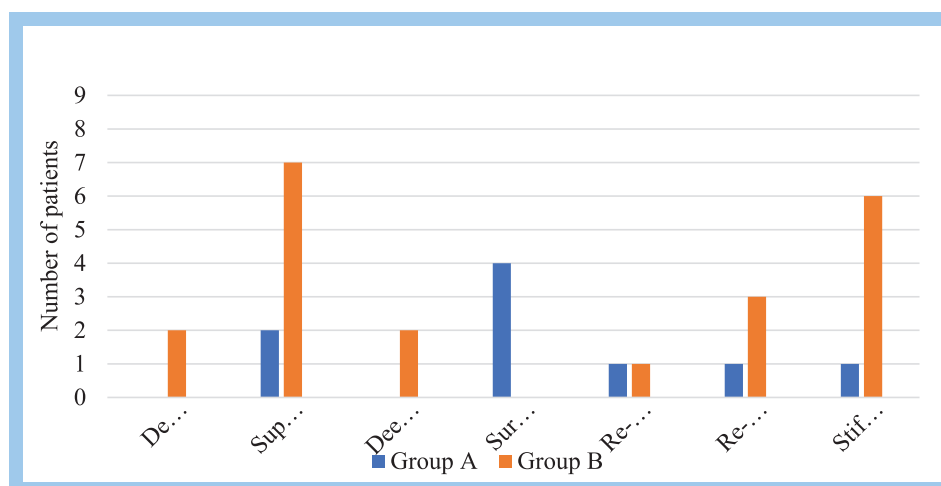


Fig. 1. Postoperative complications in groups A and B.

hand, the average operating time in the open group was 50.2 ± 8.2 min (range, 38–64 min). There was a statistically substantial variation in surgical time between groups in favor for the percutaneous group (Independent sample *t*-test, $P = 0.000$).

In accordance with our results research of Henríquez and colleagues,⁹ as they showed that the open repair group's median scar length (9.5 cm) was longer than that of the percutaneous repair group (2.9 cm). The patient who needed a soleus flap and augmentation had the greatest incision (19.5 cm), which was present. Nine patients in the percutaneous repair group, compared with three in the control group, rated the aesthetic appearance as outstanding. In both groups, a comparable number of patients rated the incision as excellent.

The present study showed that a total of seven (47%) and 10 (67%) patients developed at least one postoperative complication in group A and group B, respectively. No statistically substantial variation was detected in the overall complication rates between groups ($P = 0.269$).

Henríquez and colleagues,⁹ revealed there was no discernible variation in the complication rate between groups that was statistically substantial. Patients from the group receiving open repair had three of the four postoperative problems. In this group, there were two wound complications and one re-rupture. The same patient had a wound dehiscence and re-rupture. This patient required flexor hallucis longus tendon transposition and surgical grafting. A patient who was receiving medical treatment for a dehiscence had another problem. One incidence of deep venous thrombosis of the calf occurred in the group receiving percutaneous repair. After receiving medical care, the patient was released with no more complications. In all groups, every problem manifested before 6 months had passed after surgery.

Also, Hosny and colleagues,⁷ showed that between groups, there was no statistically substantial variation in the complication rate. Wound infection occurred in two cases while delayed skin healing occurred in one case in patients who were managed with open repair, and they were managed with antibiotics, continuous dressing and complete wound healing had been occurred with no residual complications apart from a big skin scar. These complications were not experienced in patients with percutaneous repair. Other complications as skin necrosis, wound fistula, sural nerve injury and tendon re-rupture had not been experienced throughout the study in both groups. At the last follow-up, the Achilles Tendon Rupture Score (ATRS) was administered to all patients. Results from the Achilles Tendon Rupture Score for both groups were very comparable.

Our results showed that in group A, 40% of patients were very satisfied, 40% were somewhat satisfied, 13% were neither satisfied nor dissatisfied, 7% were somewhat dissatisfied, and none were very dissatisfied. Regarding surgeon's satisfaction, they were very satisfied with 53% cases, somewhat satisfied with 40%, neither satisfied nor dissatisfied with 7%, and dissatisfied with no cases. Regarding other surgeons' satisfaction, they were very satisfied with 47% cases, somewhat satisfied with 40%, neither satisfied nor dissatisfied with 13%, and dissatisfied with no cases.

While, in the study of Karabinas and colleagues,¹⁰ The majority of patients expressed pleasure and gave their care a positive rating. One patient who had an open repair reported discomfort and dysesthesia at the skin incision and gave his procedure a fair rating. Throughout the course of this trial, no patient had further side effects such re-rupture, infection, sural neuroma, or Achilles tendonitis.

4.1. Conclusion

At the follow-up duration, there is no distinction between percutaneous and open Achilles tendon repairs. Although the functional results for both groups were the same, open surgery of the Achilles tendon was linked with more wound problems. We advise percutaneous Achilles tendon repair as it was associated with less wound complications and better cosmetic appearance compared with open Achilles tendon repair.

Consent for publication

I attest that all authors have agreed to submit the work.

Availability of data and material

Available.

Funding

No fund.

Conflict of interest

No conflicts of interest.

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