



Original Article

Evaluation of the Result of Surgical Repair of Open Achilles Tendon Injuries by Pulling Down of The Proximal Tendon

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Abstract

Introduction: In this series, we used five parameters according to the Juhana Leppilahti Modified scoring system to assess final outcome of surgical repair of open achilles tendon repair : the ability to stand on affected tiptoe unsupported, range of motion of affected side of the ankle, power of plantar flexion, calf muscle wasting.

Methods: The study was designed as a prospective experimental study conducted at Rajshahi Medical College Hospital and one private hospital of Rajshahi from January 2006 to December 2019. The study was carried out on 50 patients irrespective of age and sex. Pulling down the proximal tendon was the operative procedure. Follow-up was undertaken at the private chamber, the outpatient department and in the orthopedic ward.

Result: Among 50 patients, 38(76%) were male, and 12(24%) were female. The mean delay of repair was 6 hours 7 minutes, with a standard deviation ± 2.362 minutes. The mean age was 30.02 years with $SD \pm 7.7$. In our study, median level of cut was 3.0 cm proximal to the insertion of tendon Achilles and where the interquartile range was 2.5 to 3.5 cm. The mean follow-up period was six months with a standard deviation of 2.37. Common complications were superficial skin infection in four cases (37%), mild swelling in four cases (36%), ugly scar in two cases (18%), and wound gap in one case (9%). In our study, no major complications occurred, but minor complications like superficial skin infection and delayed wound healing were effectively dealt with an oral antibiotic with no long-term sequelae.

At 16 weeks of follow-up, among 50 patients, 90% (45) can stand on affected tip toes unsupported, around 4 cases (8%) cannot stand on tiptoes of affected foot can't support but able to stand on affected foot with unsupported. Around 2% (1 case) failed to stand on the affected foot without support due to severe infection and wound gap. The eventual outcomes were excellent in 28 cases (56%), good in 16 cases (32%), fair in 4 cases (8%), and poor in 2 cases (4%). In this study, satisfactory result was obtained after immediate repair of acute open tendon Achilles tendon injury cases. According to Juhana Leppilahti Modified Score at 95% confidence interval, satisfactory outcome was 78.99% to 97.00%.

Conclusion: Early repair of open tendo Achilles injuries, complete or partial, provided an effective outcome, which was comparable with the result described in others.

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Introduction

Ruptured of the Achilles tendon was first described by Ambroise pare in 1575 and was reported in the literature in 1633.¹ After the 1920s, the use of the operative treatment increased, primarily because of reports by Abrahamsen.² Quenu and Stoiannvitch³ who advocated surgical repair, based on accumulated cases from the literature. Surgery has become the accepted treatment of Achilles tendon rupture. This period was characterized by a statement such as "Patients with a ruptured of the Achilles tendon should be operated on and should be operated on without delay."¹

Hippocrates view of rupture of the calcaneal tendon was that this tendon, if bruises or cut, Causes the most acute fevers, induces choking, deranges the mind and at length brings death.⁴

In 2002, in a systemic review and meta-analysis, Bhandari et al.⁵ pooled the results of 448 patients randomized to either operative or non-operative treatment following Achilles tendon rupture and reported a relative risk or re-rupture of 0.32 (95% confidence interval (CI), 0.14 to 0.71) in favor of surgical repair. A regiment for functional treatment after repair of the Achilles tendon was first described by Marti and Weber.⁶ These authors removed the plaster cast for four, five, or six days and instructed the patients in active range of motion exercise for the ankle and knee. After the motion of the ankle had almost returned to normal, a below-the-knee plaster cast was worn for six to eight weeks, and the patient was allowed progressive weight-bearing. Since the late 1980s, some new regimens involving early motion have been reported.⁷ All of these regimens had satisfactory results without an increase in the rate of failure or a substantial elongation of the tendon.⁸

Recent reports in the literature have favored operative treatment of an acute rupture of the Achilles tendon. In a retrospective study of 314 patients who had undergone open repair between 1980 and 1991, Winter et al.⁹ Noted that nine patients had delayed wound healing, ten had deep wound infection requiring additional operative

treatment, and two had a sinus necessitating debridement and closure. In the report by Cetti et al.¹⁰ on open repair in fifty-six of 111 patients, 4% had deep wound infection, 2% had delayed healing, 10% had adhesion of scar tissue, and 12% had disturbance of sensation. Although Nystrom and Holmlund¹¹ reported that separation of the AT ends followed a biphasic course, with an initial separation of the AT ends followed a biphasic course, with an initial separation in the interval 0 to 7 days, no separation on 8 to 12 days and late separation in 22 to 35 days, the present elongation curves first rose and then slowly fell in both groups. After 06 weeks, the AT preserved its length or even shortened a little in the early motion group. Cetti et al.¹² showed that patients treated postoperatively for six weeks with a mobile cast were able to resume sports activities sooner than those treated for the same length of time with a below-knee with the ankle in a 20-degree equine position for six weeks. Rantanen et al.¹³ Reported good results obtained by Achilles rupture treatment using early postoperative immobilization of the ankle in a neutral position, but no controlled comparisons with other regimens have been reported. Since the late 1980s, There has been a trend toward functional postoperative treatment, which has been reported to be well-tolerated, safe, and effective in a compliant, well-motivated patient. In a meta-analysis by Khan et al.¹⁴ there ruptured rates were estimated at 3.5% and 12.6% in surgically and non-surgically treated patients, respectively. Other authors have pointed out that surgical treatment is associated with a higher rate of other complications, such as infections, wound problems, nerve injuries, and adhesion after surgery. Early weight-bearing and mobilization with or without surgical treatment are suggested to produce the best result, provided that the tendons end is in contact.¹⁵

Materials and Methods

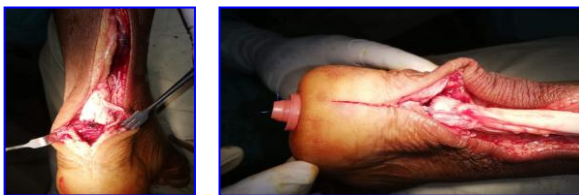
The study was designed as a prospective experimental study conducted at Rajshahi Medical College Hospital and private hospital of Rajshahi from January 2006 to December 2019. The study was carried out on 50 patients irrespective of age and sex.

Operative technique

After appropriate preoperative counseling and discussion with the patient or the patient's guardian about the merits and demerits of the surgical procedure, written informed consent was taken.

After admission, tetanus prophylaxis was administered to all patients. Oral Cefuroxime 500 mg, 12 hourly, and flucloxacillin 500 mg were administered six hourly for two weeks. If needed, antibiotic changes according to the culture sensitivity report. The operation is performed under local anesthesia in the prone position. Then, a thorough surgical bath was performed with normal saline solution and soap. Aseptic surgical cleansing was performed with a mixture of Hexiscrub, povidone-iodine, hydrogen peroxide, and normal saline. Finally, the wound was washed with 4 to 5 liters of normal saline solution, and a swab was taken for culture and sensitivity testing. After a surgical bath tourniquet was applied to the thigh, the wound was then painted with an antiseptic solution, especially povidone-iodine, and a proper draping was done.

A longitudinal incision was made parallel and medial or lateral to the tendon Achilles. The sural nerve located on the lateral side of the Achilles tendon should be preserved. The paratenon was then opened longitudinally, and the Allis tissue forceps were inserted, and the cut proximal end of the tendon was clamped. The application of sustained gentle traction brought this tendon into view. The number one prolene suture material was used. Suture material was passed through the proximal tendon about 3 cm from the cutting margin.



The average and parallel closures of the stitch went distally through the distal ligament. For spike, it was fixed with 3-0. Cutaneous closure

was performed with prolene. The best surgical result requires an excellent surgical technique, respecting the contraindications, and for appropriate selection of patients. After tendon repair, the anterior slab of the short leg was held with the knee flexed 40 degrees, and the ankle flexed 10 degrees in the gravity equinus position. Isometric quadriceps exercise and finger movement was recommended. The patients were discharged on the 1st postoperative day and were recommended to walk with a pair of crutches without load.

Postoperative follow-up

All patients were asked to come to the hospital for regular follow-up according to the following protocol. The follow-up varies from 6 months to 12 months. At all follow-up visits, the patient was asked about any symptoms, looked for a sign of infection, and after plaster removal, examined clinically to assess the power of plantar flexion, calf muscle wasting, and range of movement of ankle and knee of the affected limb.

The patient was seen for follow-up on the third postoperative day and examined for any signs of infection. The patient was advised to continue with the quadriceps and hamstring strengthening exercise and walk with the pair of crutches. Patients were brought in for the second visit in the 14th pod. The stitches were removed, and the below anterior knee slab changed to below-knee plaster cast with the ankle in equinus gravity position for four weeks. Exercises to strengthen the quadriceps, knee movement, and hip movement within the active range of motion were recommended to patients. Patients were also advised to walk on crutches without weight-bearing. When an infection occurs, a swab is taken for culture, and antibiotic changes according to the sensitivity of the culture.

The patient was advised to dress regularly until the infection cleared. The patients have come for 3rd visit at six weeks. At that time, plaster was changed to below the knee plaster in the neutral position for another four weeks. The patients were advised to continue the exercise and to walk on crutches without bearing weight. Then after ten weeks, the cast was removed when the patients

came for the fourth visit. The patient was advised to walk in a 2-inch high-heeled shoe and on crutches for an additional 2 to 4 weeks. Manual therapy such as mobilization of the soft tissue to decrease edema, cross friction massage to the scar, soft tissue mobilization technique to the plantar fascia and flexor hallucis longus, mobilization of the ankle to the subtalar joint was recommended and the talocrural joint. Therapeutic quadriceps strengthening exercise, knee movement, ankle tube exercise was recommended for ankle joint dorsiflexion, plantar flexion, inversion, and eversion. Patients also recommend towel curl, towel sweep for weight-bearing, or partial weight bearing on the affected foot, as tolerated, along with bilateral standing heel raise exercises. The patients were advised not to jump or run. Patients came for the 5th visit at 12 weeks. The patients were then recommended to bear full weight with the affected limb without the aid of walking aid. Patients were advised to do manual therapy in

conjunction with therapeutic exercises such as standing calf stretch, balance exercise, Swiss ball knee and gluteal strengthening exercise, and elastic tube side step exercise along with heel raise exercises with single-leg standing. The patient arrived at the final visit at 16 weeks. At that time, the final assessment of patient outcomes was performed according to the Juhana Leppilahti scoring system. Subsequent visits with an interval of 3 months were recommended until satisfactory functional improvement of the injured leg was achieved. Jumping, running, or lifting weights was allowed after six months.

Outcome assessment after primary repair according to the Juhana Leppilahti scoring system :

90 points and more - Excellent result from 75 to 89 points –Good

From 60 to 74 points – Fair Less than 60 points – Poor

Results

The study was carried out over a 14-year period (i.e., Jan 1, 2006, to Dec 31, 2019) in the Department of Orthopedics, RMCH, and Private Hospitals of Rajshahi. The patients were followed up in OPD orthopedic surgery and routine indoor orthopedic surgery and in a private chamber. Within the period, 50 patients were prospectively selected for the study. This method of operation was to pull down the proximal tendon.

This prospective experimental study was carried out to evaluate the outcome of an early repaired tendon injury by pulling down the proximal tendon. The objectives of the study are to know the common cause of the cut injury, the incidence of age and sex, the level of injury, and propose the treatment of these cases in a comfortable, economical and convenient way for the patient.

This chapter describes the results and subsequent observations of the study in detail.

Table 3.1: Age and sex distribution of study stakeholders

Age	Male		Sex		Total Percentage	Mean * SD
	Number	Percentage	Female Number	Female Percentage		
12-25	8	66.0	4	34.0	100%	
26-35	20	77.0	6	33.0	100%	
36-45	10	83.0	2	17.0	100%	30.02
Total	38	76%	12	24%	100%	7.71

Among 50 patients, 38(76.0%) were male, and 12(24.0%) were female. The mean age was 30.02 years with a standard deviation of ± 7.71 .

Table 3.2: Distribution of the study patients on the basis of causes of injury (n=50)

Causes of injury	Number of patients	Percentage
Broken toilet pan	25	50.0
Sharp weapon	15	30.0
Machinery	10	20.0

Table 3.2 shows 50% injury was due to sharp edge of broken toilet pan following slip on Indian type of toilet pan.

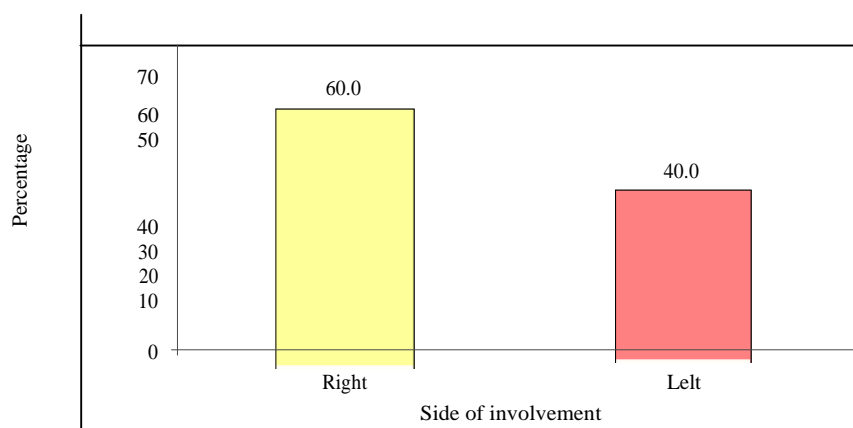


Table 3.3: Distribution of the study patients by level of cut due to acute injury (n=50)

Level of cut	Number	Percentage	Median Level of cut	Interquartile range (IQR)
2-3 cm	25		50.0	
3-4 cm	19		38.0	
4-5 cm	5		10.0	
>6 cm	1		2.0	
Total	50	100.0	3.0	2.5 to 3.5 cm

In this series median level of cut was 3.0 cm where interquartile range was 2.5 to 3.5

Table 3.4: Distribution of the study patients by treatment delay (n=50)

Delay 71	Number	Percentage	Mean delay	Standard deviation
<4 hours	4	8.0		
4-6 hours	30	60.0	6 hours	z 2.362
6-8 hours	8	16.0	7 minutes	
10-12 hours	8	16.0		
Total	50	100.0		

All the cases were operated on an emergency basis after admission through the emergency department. Most of the cases were operated on within 6 hours of injury.

The mean delay of repair was 6 hours 7 minutes, with a standard deviation of 2.362 minutes.

All the patients were advised for regular follow-up at Orthopedics outdoor or in Orthopedics indoor of RMCH. One or two visits for the initial two weeks, then regular visits at four weeks intervals up to the total return of normal daily work. The minimum and maximum follow-up periods were 5 and 16 months, respectively. The mean follow-up period was nine months with a standard deviation was 2.37.

Table 3.5: Distribution of the study patients by swab culture sensitivity (n=50)

Swab culture sensitivity	Number of patients	Percentage
E. Coli	30	60.0
Pseudomonas	3	6.0
Klebsiella	2	4.0
No growth	15	30.0

Table 3.6: Distribution of the study subjects by ankle range of motion (n=50)

Ankle range of motion	Frequency	Percentage
Normal	35	70.0
Mildly limited	13	26.0
Moderate limited	2	4.0
Total	50	100.0

Table 3.6 shows majority 35 (70.0%) patients had normal range of ankle joint, 13(26.0%) mildly and 2(4.0%) moderate range of ankle joint.

Table 3.7: Distribution of the study patients by ability to stand on affected tip toes or foot (n=50)

	Frequency	Percentage
Ability to stand on affected tip toes or foot	45	90.0
Can stand on affected tip toes cannot stand on affected toes but stand on	4	8.0
Cannot stand on affected foot unsupported	1	2.0
Total	50	100.0

Table 3.7 shows majority 45(90.0%) patients were can stand on affected tip toes, 4(8.0%) were cannot stand on affected toes but stand on and only 1(2.0%) cannot stand on affected foot unsupported.

Table 3.8: Distribution of the patients by various minor complications (n=11)

Minor complications	Number of patients	Percentage
Superficial skin		e 36.4
infection	4	36.4
Mild Swelling	4	18.2
Ugly scar	2	9.1
Wound gap	1	

Table 3.8 shows regarding minor complications, 4(36.4%) patients had superficial skin infection, 4(36.4%) had mild swelling, 2 (18.2%) had ugly scar and 1(9.1%) had wound gap.

**Table 3.9:** Comparison of ankle range of motion (Planter flexion and Dorsi flexion) between healthy and injured sides after treatment

Outcome	Injured limb	Healthy limb	P value
	Mean+SD	Mean+SD	
Ankle range of motion (Planter Flexion)	36.52 z 2.76	39.8 z 0.61	P > 0.05
Ankle range of motion (Dorsi Flexion)	22.02 3.11	24.9*030	P > 0.05

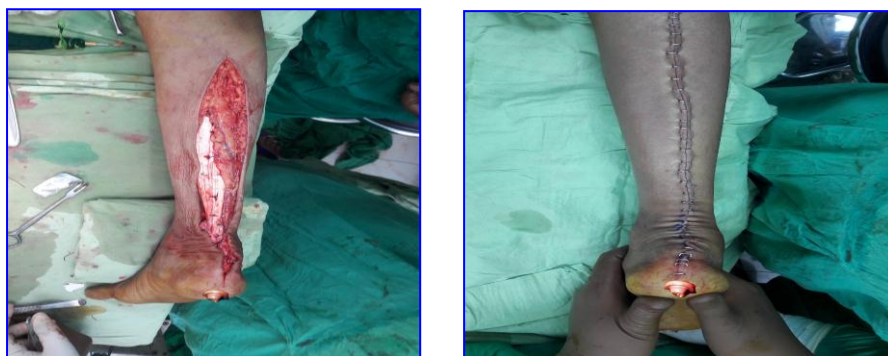
Ankle range of motion (plantar flexion and dorsiflexion) of injured and healthy sides was measured at the last follow-up. As the sample size was greater than 30, one-sample z-test was done for calculation of test

statistics, and we found that there were no significant differences between ankle range of motion (plantar flexion and dorsiflexion) of injured and healthy sides.

Table 3.10: Distribution of the patients by final outcome (n=50)

Grade	Number of patients	Percentage
Excellent	28	56.0
Good	16	32.0
Fair	4	8.0
Poor	2	4.0
Total	50	100.0
Satisfactory = Excellent + Good		
= 56% + 32%		
= 88%		
Unsatisfactory = Fair + Poor		
= 8% + 4%		
= 12%		

Per Operative Image



Post Operative Image



Conclusion

It is believed that the primary repair procedure for injured Achilles tendon injuries is safe and more economical. This repair technique with a well-controlled follow-up promotes early and good results. The primary repair technique for an injured Achilles tendon is promising and has the potential to be a valid option with a good postoperative outcome after physical therapy. Attention to the details of the technique with regular follow-up is the key to success with regard to outcome variables. But only in this way could it be said that it is the best technique with good results and few complications when compared to modern techniques.

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