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## Management of chronic tendo achilles tear by various surgical techniques

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### Abstract

**Introduction:** The common type of sports injury is Achilles tendon rupture and the most common cause of injury is sudden plantar flexion or dorsiflexion of the ankle. About 10-25% of acute ruptures is not diagnosed initially. Patients with Tendo Achilles rupture mostly report with functional deficits. Many procedures have been described in the literature for chronic Achilles tendon rupture reconstruction. All these surgical procedures have been shown to have satisfactory clinical results, although ankle plantar flexion strength and peak torque deficits persisted.

**Material and Method:** A total of 22 cases of chronic Tendo Achilles rupture were included in the study over a period of 2 years from July 2015 to July 2017 at Dr. D. Y. Patil Medical College and Hospital, Pimpri, Pune.

**Result:** Among the three operative procedures, the functional recovery was good in Gastrocnemius-Soleus fascia turn down graft procedure as assessed by the clinical examination of the plantar flexion and Karlsson and Petersson scoring.

**Keywords:** Tendo achilles tear, chronic tear, various surgical techniques

### 1. Introduction

The Achilles tendon is the largest tendon in the body which receives fibres from the soleus and gastrocnemius muscles, the so-called triceps surae. This musculo-tendinous complex crosses the ankle, talocrural and subtalar joints [1].

A common type of sports injury is Achilles tendon rupture (ATR) which increases in incidence predominantly in middle-aged patients (75% in the range of 30-40 years) [2]. The most common cause of injury is sudden plantar flexion or dorsiflexion of the ankle, or by forced dorsiflexion of the ankle outside its normal range of motion [3]. The condition typically affects the mature male athlete who engages in a high degree of running and jumping activities. This injury is frequently found in runners, ballet dancers, basketball players. Although clinical examination is sufficient to diagnose AT rupture after injury, about 10-25% of acute ruptures remain initially undiagnosed [4]. Patients with AT rupture mostly report with functional deficits interfering with daily activities, pain is not the major complain among these patients [5]. The injury causes loss of plantar flexion strength resulting in an inability to run, stand on tip toes, and difficulty in climbing stairs [6].

Until recently the most common mode of treatment for AT rupture was non-surgical which included strapping, wrapping or braces of varying periods [7]. However, from 1920's onwards newer modalities of treatment were proposed including surgery. Studies were conducted to compare the outcome among patients treated conservatively and operatively. It was found that the group of patients treated surgically had better results compared to patients treated conservatively [8-9]. The effect of surgery is still debated. It is stated that surgery promotes a new repair process after the surgery and promotes healing with improved vascularity of the tendon [10-11]. However, the good results of the surgery could be attributed to the extended denervation. Also, other factors which could contribute are post-operative rehabilitation. The studies describing the surgical outcomes for the treatment of Achillies tendon rupture are well designed studies with long term follow-ups of patients but no randomized studies have been done to compare the different surgical methods.

Many procedures have been described in the literature for chronic AT rupture reconstruction with different local autologous material such as the gastrocnemius soleus complex with V-Y myotendinous advancement [12] or a “turn-down” of proximal AT tissue described by Bosworth [13]. Other surgical techniques used tendon transfer of peroneus brevis (PB) [14] flexor digitorum longus (FDL) or flexor hallucis longus (FHL) tendon [15]. All these surgical procedures have been shown to yield satisfactory clinical results, although ankle plantar flexion strength and peak torque deficits persisted.

There is still a lack of consensus on the best management of chronic Achilles tendon rupture. Treatment for the same is broadly classified into non-operative (cast immobilization or functional bracing) and operative (open or per cutaneous). This study has been planned to compare the post-operative clinical improvement among the various surgical modalities for Achilles tendon rupture.

## 2. Material and Methods

Our study included 22 cases of chronic Tendo-Achilles rupture treated with either of Krackov Technique or V-Y Tendinous Flap or Gastrocnemius Soleus Fascia Turn down Graft methods. The period of study was for 2 years from July 2015 to July 2017.

### 2.1 Inclusion Criteria

- 2.1.1 All patients above 18 years
- 2.1.2 Chronic complete rupture of tendo Achilles confirmed by ultrasound
- 2.1.3 Closed Tendo Achilles rupture

### 2.2 Exclusion Criteria

- 2.2.1 Compound shaft of tibia and ankle fractures
- 2.2.2 Vascular injury.

### 2.3 Methodology

A total 22 cases were enrolled in the study. On admission, after fulfilling the inclusion criteria, an informed consent of the patients was sought to be included in the study. A detailed history of the patients was collected using a pre structured questionnaire along with clinical examination, X-ray, Ultrasound and MRI. For evaluating ankle function The Karlsson and Peterson Scoring System was used.

## 2.3 Surgical Procedure

### 2.3.1 Krackow Technique

In the operating room, the patient is given regional anesthesia in prone position. A posteromedial incision approximately 10 cm long is given which is 1 cm medial to the tendon, ending proximal to where the shoe counter strikes the heel. The skin, subcutaneous tissues and tendon sheath are sharply dissected. The ruptured ends of the are approximated. The repair is checked for stability. Close the skin and a posterior splint with the foot in plantar flexion is given for at least 4 weeks.

### 2.3.2 V-Y Tendinous Flap

In the prone position an incision is made from the lateral aspect of the Achilles tendon insertion to the mid part of the calf. The sural nerve is identified and retracted. The scar tissue is resected from the tendon ends. An inverted V incision is made through the aponeurosis. The incision is made at least 1.5 times longer than the defect in the tendon to allow approximation in a Y configuration. The flap is pulled distally and the ends of the ruptured tendon are approximated.

The incision is closed and a long above knee slab with knee in 30 flexion and foot in 20 degrees' plantar flexion is applied.

### 2.3.3 Gastrocnemius Soleus Fascia Turn Down Graft

In the operating room under regional anaesthesia, the patient is given prone position and a posterior longitudinal midline incision extending from the calcaneus to the proximal one third of the calf. The reuptured tendon is exposed to excise the scar tissue from between the ends. From the gastrocnemius soleus muscle a strip of tendon 1.5 cm wide and length according to the tendon defect is dissected leaving it attached just proximal to the site of the rupture. Turn and approximate the strip distally and pass it transversely through the proximal tendon. The wound is closed and a long leg cast for the knee in flexion and foot in plantar flexion is applied. [Figure 1, 2, 3, 4.]



Fig 1: Pre-operative gap



Fig 2: V-Y Plasty



**Fig 3:** Turn down graft



**Fig 4:** Tendo Achilles reconstruction

**2.4 Post Operatively Evaluation**

IV antibiotics were given for the first 5 days and were then shifted to oral antibiotics. Anti-inflammatory, analgesics and other supportive drugs were given. Post op dressing of the surgical wound was done on the 2<sup>nd</sup> and 8<sup>th</sup> day. Sutures were removed on the 14<sup>th</sup> post-operative day. Ankle was kept in plantar flexion using an above knee cast for six weeks. Static quadriceps and hamstrings strengthening exercises was started from the 2<sup>nd</sup> post-operative day. Plaster was removed after 6 weeks and partial-weight-bearing crutch ambulation was allowed. Ankle range of movement both active and passive was started. At 12 weeks postoperatively, patients were allowed to walk full weight bearing without support. Patients were allowed to do strenuous sports such as running and jumping at 1 year postoperatively.

**2.5 Follow up**

Patients were followed up in Out Patient Department (OPD) every 2 weeks for a period of 1 Month post-operatively, then

at 3 months, 6 month, 12 month, 1 years and 2 years.

**2.6 The Karlsson and Peterson Scoring System <sup>[16]</sup>**

Karlsson and Peterson published the scoring system based on eight functional observations (pain, swelling, subjective instability, stiffness, stair climbing, running, work activities, and use of external support). Each item was allowed a certain number of points, amounting to a total maximum of 100 points. The scoring scale is compared to a functional scale, a visual analogue scale and tested against anterior talar translation (ATT) and talar tilt (TT) on standardized stress radiographs. The scoring scale correlates statistically with the subjective and objective parameters of ankle joint stability and function

**2.7 Statistical Analysis**

The socio demographic details of the patient have been described in proportions and appropriate graphs. The functional outcome in terms of Karlsson and Petersons scoring, Plantar flexion and Dorsal flexion measured pre-operatively and postoperatively at 3 months, 6 months, 9 months and 12 months have been analysed using repeated measure ANOVA for each of the surgical technique.

**3. Results**

A total of 22 patients were enrolled in the study. Of the 22, seven were operated by V-Y Plasty, four were operated by Krackows technique and 11 were operated by Gastrocnemius-Soleus fascia turn down graft. All cases were followed up at three months, six months, nine months and one year. Clinical examination was done at each visit and ankle assessment was done using The Karlsson and Peterson Scoring System.

**3.1 Age distribution**

The proportion of patients was almost equally distributed in the age groups. The mean age of the patients enrolled in the study was 38.9±11.7 years.

**Table 1:** Age distribution

Age group	N (%)
18-30	8 (36.4)
31-45	7 (31.8)
46-55	7 (31.8)

**3.2 Sex distribution**

The males predominated the study population (68.2%) compared to 31.8% of females.

**Table 2:** Sex distribution

Sex	N (%)
Male	15 (68.2%)
Female	7 (31.8)

**3.3 Occupation**

The most common group found to be affected is Un-skilled Labours (63.6%)

**Table 3:** Occupation

Occupation	N (%)
Professional	1 (4.5)
Skilled	4 (18.3)
Un skilled	14 (63.6)
Student	2 (4.5)
Housewife	1 (9.1)



### 3.4 Mode of injury

Blunt trauma was the most common cause of the injury among the patients enrolled in the study.

**Table 4:** Mode of injury

Mode of Injury	N (%)
Blunt trauma	11 (50%)
Fall from stair	3 (13.6)
Twisting injury	4 (18.2)
Motor vehicle accidents	4 (18.2)

### 3.5 Chief complains

Majority of the patients (59.1%) came with the chief complain of pain and function deficit interfering with daily activity. The mean duration of pain reported was  $4.68 \pm 1.17$  weeks.

**Table 5:** Chief complains

Chief complains	N (%)
Pain	13 (59.1)
Swelling	3 (13.63)
Function deficit interfering with daily activity	13 (59.1)

### 3.6 Local examination

On local examination of the ankle, visible defects was present in 52% of patients. 50% of the patients had a scar, mainly those who suffered a blunt trauma or motor vehicle accident. Majority of the patients had muscle wasting. Thompsons test,

Matles test, Obrien test was positive in all the patients. The mean plantar flexion and dorsal flexion at initial presentation was  $4.1 \pm 3.9$  degree,  $7.01 \pm 2.5$  degree. The mean Karlsson and Peterson Scoring at the time of presentation was  $30 \pm 6.1$ .

**Table 6:** Local examination

Local examination	N (%)
Visible defects	12 (52.54)
Scar	11 (50)
Tenderness	13 (59.1)
Muscle wasting	18 (81.2)

### 3.7 Investigations

On ultrasound, all patients had a confirmed TA rupture. All the patients were further investigated with MRI. The mean AT retraction (in cm) observed in MRI was  $4.6 \pm 1.96$  cm.

**Table 7:** Investigations

Retraction (in cm)	N (%)
$\leq 2$	8 (36.4)
3-6	4 (18.2)
$\geq 7$	10 (45.5)

### 3.8 Operative procedure

Depending on the retraction in MRI, the operative procedure was performed.

**Table 8:** Operative procedure

Operative procedure	Retraction (cm)	N (%)
Krackow surgery	$\leq 2$	4 (18.2)
V-Y plasty	3-6	7 (31.8)
Gastrocnemius-Soleus fascia turn down graft	$\geq 7$	11 (50)

#### 3.1.8.1 Krackow surgery

A total of four patients were operated by V-Y plasty. There

was no complication.

**Table 9:** Krackow surgery

Variable (4)	Pre operatively	3 months	6 months	9 months	12 months	P value
Karlsson and Peterson Scoring	$27.7 \pm 8.5$	$51.5 \pm 10.5$	$62.6 \pm 5.03$	$69 \pm 4.6$	$75.6 \pm 1.15$	0.01
Plantar flexion	$3.7 \pm 4.7$	$23.7 \pm 4.8$	$36.6 \pm 2.8$	$41.6 \pm 2.8$	$43.3 \pm 2.8$	0.01
Dorsal flexion	$6.2 \pm 2.5$	$13.7 \pm 2.5$	$15 \pm 0.0$	$15 \pm 0.0$	$15 \pm 0.0$	0.016
Thompsons test	100%	0%	0%			
Obrien test	100%	0%	0%			
Matles test	100%	0%	0%			

On examination, the Thompsons, Obrien and Matles test became negative for all patients at 3 months. The dorsal flexion came to 15 degree at 6 months and the mean plantar flexion in degree achieved by 12 months was  $43.3 \pm 2.8$ . This change over one year was found to statistically significant (repeated measure ANOVA).

The change in the Karlsson and Peterson Scoring was found to

be increasing which was statistically significant by repeated measure ANOVA ( $p=0.01$ ).

#### 3.1.8.2 V-Y plasty

A total of seven patients were operated by V-Y plasty. Only one patient developed complication, superficial infection.

**Table 10:** V-Y Plasty

Variable	Pre operatively	3 months	6 months	9 months	12 months	P value
Karlsson and Peterson Scoring	$32.4 \pm 5.6$	$57.7 \pm 10.7$	$68.2 \pm 5.3$	$81.3 \pm 3.9$	$87.8 \pm 2.0$	$<0.001$
Plantar flexion	$3.5 \pm 3.7$	$24.29 \pm 4.5$	$33.6 \pm 3.8$	$39.2 \pm 2.0$	$44.1 \pm 3.7$	$<0.001$
Dorsal flexion	$7.1 \pm 2.6$	$14.3 \pm 1.9$	$15 \pm 0.0$	$15 \pm 0.0$	$15 \pm 0.0$	0.001
Thompsons test (+)	100%	0%	0%			
Obrien test (+)	100%	14.3%	0%			
Matles test (+)	100%	0%	0%			

On examination, the Thompsons and Obrien test became negative for all patients at 6 months and Matles test became negative at 3 months. The dorsal flexion came to 15 degree at 6 months and the mean plantar flexion in degree achieved by 12 months was 44.1±3.7 degree.

The change in the Karlsson and Peterson Scoring over a period of 12 months was observed pre operatively, 3 months, 6 months, 9 months and 12 months. The change in score was

found to be increasing significantly over a period of 1 year. The difference was found to be statistically significant on repeated measure ANOVA ( $p < 0.001$ ).

### 3.1.8.3 Gastrocnemius-Soleus fascia turn down graft

A total of 11 patients were operated by Gastrocnemius-Soleus fascia turn down graft. Two patients developed complication, delayed wound healing.

**Table 11:** Gastrocnemius-Soleus fascia turn down graft

Variable	Pre operatively	3 months	6 months	9 months	12 months	P value
Karlsson and Peterson Scoring	29.2±5.5	53.81±7.8	67±5.9	82.7±4.2	87.4±2.3	<0.001
Plantar flexion	4.5±4.1	25.9±4.9	36.8±2.5	43±4.2	46.0±3.2	<0.001
Dorsal flexion	7.2±2.6	14.5±1.5	15.0±0	15±0.0	15±0.0	<0.001
Thompsons test	100%	0%	0%			
Obrien test	100%	18.2%	0%			
Matles test	100%	0%	0%			

On examination, the Thompsons and Matles test became negative for all patients at 3 months and Matles test turned negative at 9 months for all patients. The dorsal flexion came to 15 degree at 6 months and the mean plantar flexion in degree achieved by 12 months was 46.0±3.2. This change over one year was found to be statistically significant (repeated measure ANOVA).

The change in the Karlsson and Peterson Scoring was found to be increasing which was statistically significant by repeated measure ANOVA ( $p < 0.001$ ).

## 4. Discussion

The management of chronic AT rupture is a challenge for most orthopedic surgeon. Chronic AT rupture with large gaps can lead to ankle dysfunction<sup>[17]</sup> if the gap by scar tissue it will lead to ankle weakness and gait disturbance<sup>[18]</sup>. AT rupture is frequently misdiagnosed. After Achilles tendon rupture occurred, the strength of plantar flexion is reduced<sup>[19]</sup>, and the patients are not able to perform a single-limb heel rise with the injured lower extremity. In our study, the test used to diagnose AT rupture is Thompson's test, O'Brien's, test and Matles test. For treatment, the reconstruction surgeries for chronic AT rupture are complex, and many factors like the retraction length affect the choice of procedures. There is no perfect documented surgical or conservative treatment protocol reported for chronic AT rupture. Our study has been done to evaluate the various surgical methods for AT rupture. In our study, a total of 22 patients were involved and surgical procedure was done based on the retraction length between the two stumps. V-Y plasty was done among 7 patients, Gastrocnemius-Soleus fascia turn down graft was done among 11 patients and Krackow technique was used for 4 patients.

### 4.1 Krackow surgery

This surgery is a percutaneous surgical technique which was done for patients with  $\leq 2$ cm of retraction on MRI scans. All four patients had clinically and statistical improvement in the functional assessment of the ankle from pre-operative to post-operative at one year. The mean Karlsson and Petersons score improved from 27.7 pre-operatively to 75.6 post-operatively at 1 year ( $p = 0.01$ ). No patient developed any complications.

This surgery technique has widely been used in Acute Achilles tendon rupture repair. In a study done by Lukas Kołodziej *et al.* reported the patient returned to work after an average of 5.2 weeks post surgically. No re-rupture or nerve injury was reported in the patient<sup>[20]</sup>.

### 4.2 V-Y Plasty

In our study patient with a retraction of 3-6 cm treated with this surgery had a good post-operative functional recovery. Functional recovery, as assessed by Karlsson Peterson scoring, improved from a pre-operative score of 32.4 to 87.8 at 1 year. This improvement was both clinically and statistically significant ( $p < 0.001$ ). The plantar flexion improvement was also clinically and statistically significant. The dorsal flexion improvement was 15 degree by the end of 6 months whereas plantar flexion returned to near normal at 1 year. Only 1 patient reported with superficial infection after the surgery and no case of re-rupture was reported. Khaimi *et al.* reported the study to be suitable for a retraction of 3 to 5 cm AT rupture<sup>[21]</sup>. Yangjing Lin *et al.* found the surgery to be useful in a maximum gap of 9 cm in length. No serious complications were seen and the AOFS and ATR score showed significant improvement<sup>[22]</sup>. Ahmad *et al.* deemed that gaps greater than 6 cm in chronic Achilles tendon rupture could be a big challenge to surgeons<sup>[23]</sup>. The surgery could correct the functional deformity in about 75% of the patients and they could perform heel raise test.

In the present study the Thompsons test and Matle's test returned to negative at 3 months whereas O'Brien's test returned to negative at 6 months.

### 4.3 Gastrocnemius-Soleus fascia turn down graft

A total of 11 patients were surgically operated for AT rupture by Gastrocnemius-Soleus fascia turn down graft technique. This technique is useful in correcting those ruptures where the defect is large. Christensen first reported the method where he filled the defect measuring 2cm by 10 cm using a fascial turn-down flap<sup>[19]</sup> in our study a maximum of 11 cm gap was surgically treated by this technique. The functional outcome as assessed by Karlsson Peterson scoring improved from a mean pre-operative score of 29.2 to 87.4 after one year postoperatively. The Thompsons test and Matle's test were negative by 3 months whereas O'Brien's test became negative at 3 months. The Plantar flexion from a mean 4.5 degree movement pre operatively improved to 46.0 degree post-operatively at one year. This change was clinically and statistically significant ( $p < 0.001$ ) on repeated measure ANOVA. Another study by Tay *et al.* treated with two turn down flaps and FHL augmentation yielded satisfactory result after a follow up period of two years<sup>[24]</sup>. Yangjing Lin *et al.* found the surgery to be useful in a maximum gap of 10 cm in length<sup>[25]</sup>.

Operative plan was made based on the retracted ends of the Achilles tendon. Among the three operative procedures, the functional recovery was good in Gastrocnemius-Soleus fascia turn down graft procedure as assessed by the clinical examination of the plantar flexion and Karlsson and Petersson scoring.

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