MANAGEMENT OF TENDOACHILLES INJURY: A REVIEW OF 30 CASES
Biswajit Mishra¹, Rajendra Prasad Das², Annada Prasad Pattnaik³

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ABSTRACT: BACKGROUND: Tendoachillis injuries in western patients are mainly due to sports injury. Where as in our country it is mainly due to injury in lavatory pan, road traffic accidents and direct cut injury. Pattern of injury varies and so also the method of reconstruction. We here represent a prospective study of various type of tendoachillis injury, different methods of reconstruction, associated complications and functional outcome. MATERIAL AND METHOD: A prospective study was done in M.K.C.G hospital Berhampur, Orissa from July 2013 to January 2015. A Total of 30 patients of tendoachillis injuries were included in our study. Patients were classified in to different groups depending upon nature of tendoachillis injury i.e. with or without skin loss, with or without segmental loss of tendoachillis, number of skin laceration (Single or multiple) and with or without avulsion fracture of calcaneum. Most of the patients without skin loss were treated in emergency department and all the patients with skin loss and with segmental loss of tendon were admitted to the hospital. Patients with simple laceration of tendoachillis were by repaired by prolene 1-0 and stainless steel wire. Patients with segmental loss of tendoachillis were repaired with proximal segment of tendon which was reversed upside down 180 degrees (Bosworth Technique). Skin loss were managed with peroneal perforator based distal fasciocutaneous flap, islanded reverse sural flap and cross leg flap as indicated in particular patients. All the patients were managed as per the same post-operative protocol. Patients were followed up from a minimum of 6 month to 2 year. Early and late complications were observed. RESULT: In patients without skin loss most common complications were prolene granuloma and sinus mainly related to material used for repair i.e. prolene. In patients with skin loss complications were related to flaps used for reconstruction like partial flap loss, total flap loss, flap dehiscence, infection, seroma, marginal skin necrosis. All the patients regained normal range of plantar flexion and dorsi flexion. CONCLUSION: TA tendon injury with segmental loss of tendon associated skin loss can effectively be managed by proper selection of reconstructive methods to give good functional results.

INTRODUCTION: Tendoachillis due to its definite pattern of blood supply and situation in the distal third of the leg poses technical challenge to the surgeon for successful repair. Complicated injury to TA in road traffic accidents increases the challenge of reconstruction. Injury to tendoachillis in presence of trauma particularly in road traffic accidents increases the chance of infection and contamination. In western countries tendoachillis is mainly injured due to sports injury and steroid use. In India the most common mechanism of injury is trauma and assault. We have encountered various pattern of injury to TA tendon in southern part of Orissa.
In this study we are presenting our experience with various type of tendoachillis injury, various modes of reconstruction, complication and functional outcome.

MATERIAL AND METHODS: A prospective study was carried in the department of plastic surgery in M.K.C.G medical college between from July 2013 to January 2015. A total 30 patients were treated in our group. Male 19(63.33%) female 11(36.67%). Age of the patients ranged from 9-45 year of age. In our patients the mode of injury was due to fall in the lavatory pan 19(63.33%), road traffic accident 8(26.66%), laceration due to assault 3(10%). For the management purpose patients were divided in to different groups (TABLE 1).

<table>
<thead>
<tr>
<th>TYPE of injury</th>
<th>No. of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1. Tranverse /oblique cut of tendoachillis with single level skin laceration.-</td>
<td>14(46.66%)</td>
</tr>
<tr>
<td>Group 2. Oblique cut of tendoachillis with double level skin laceration</td>
<td>3(10%)</td>
</tr>
<tr>
<td>Group 3. Segmental loss of tendoachillis with skin loss</td>
<td>7(23.33%)</td>
</tr>
<tr>
<td>Group 4. Detachment of tendoachillis at its insertion to calcaneum with avulsion of a piece of calcaneum</td>
<td>3(10%)</td>
</tr>
<tr>
<td>Group 5. Intact tendoachillis with skin loss</td>
<td>3(10%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Flaps used for soft tissue coverage</th>
<th>Total no. of cases 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local transposition flap</td>
<td>2(16.66%)</td>
</tr>
<tr>
<td>Reverse sural artery group</td>
<td>4(33.33 %)</td>
</tr>
<tr>
<td>Distally based peroneal perforator flap</td>
<td>4(33.33%)</td>
</tr>
<tr>
<td>Cross leg flap</td>
<td>2(16.66%)</td>
</tr>
</tbody>
</table>

**Table 1: Flaps used for soft tissue coverage**

**Group 1:** Transverse / oblique cut of tendoachillis with single level skin laceration. Tendoachillis was cut transversely (Fig. 1) and obliquely (Fig. 2). The overlying skin was cut longitudinally (Fig. 3) and transversely. (Fig. 4)
All the patients were treated in emergency and discharged on the same day.

Repair was carried under sciatic block with patients in prone position. These groups of patients were relatively easy to manage. Out of the 14 patients treated in this group 7 patients were treated by ss wire pull through suture (FIG no. 5) and 7 patients were treated by prolene no1 using modified Kessler technique. Skin was closed with no 3Ethilon. Corrugated rubber drain was given in all the patients. All legs were put in a POP cast or splint with 20° plantar flexion for 3 weeks. After first dressing change on 5th post-operative day, admitted patients were discharged with advice to use crutches for 6 weeks. The skin sutures were removed 15-20 days post operatively depending on the wound condition and healing and SS wires were pulled out after 1 month.
Patients were first asked to stand for increasing lengths of time but refrain from walking till 6 weeks. Between 6 and 12 weeks, patients increased activities and physiotherapy was performed but sporting activities were restricted till 6 months.

**Group 2:** Oblique cut of tendoachillis with double level skin laceration (fig 6).

The treatment depends on viability of the intervening skin segment on both medial and lateral side. When the intervening segment has good circulation tendon was retrieved by squeezing the muscle proximally and dissection for retrieval of tendon was done in a subfascial plane. The subfascial dissections particularly help to preserve the blood supply to the overlying skin. After retrieval of the tendon suturing was done in the similar method described above. Post-operative protocol was also same as in group 1 patients.

**Group 3:** Segmental loss of tendoachillis with skin loss. Some of the patients presented on the day of injury. Few patients were initially treated outside and refereed to us after several days. Those presented to us during initial period had more edema and contamination.

Since vascularity of distal portion of leg is very precarious soft tissue reconstruction in this portion of the leg is very difficult. When this is associated with tendon loss this becomes a much more technically demanding procedure. These groups of patients require reconstruction of tendon
and simultaneously durable soft tissue coverage has to be given to provide protection of the repaired tendon.

When segmental loss of Tendoachillis was present proximal aponeurotic portion of gastrocnemius was cut it was turned upside down 180 degree as suggested by Bosworth (fig. 8) so that smooth external surface lied next to subcutaneous tissue.

![Figure 8: Repair of tendon by turnover technique of Bosworth](image)

When the length of the tendon remaining in the distal portion was less than 1.5 cm the suture was anchored to calcaneum. When distal portion of the tendon attached to calcaneum was more than 1.5 cm repair of the tendon was done with modified Kessler technique. After the repair of the tendon soft tissue reconstruction was done with perforator based fasciocutaneous flap. (Fig. 9, 10) and Reverse sural artery flap. (Fig. 11).

![Figure 9: After repair of tendon fasciocutaneous flap was raised](image)

![Figure 10: Flap in setting Completed](image)
**Group 4**: Avulsion of tendoachillis near its insertion to calcaneum with avulsion of a segment of tendoachillis.

The avulsed bone fragment was fixed to calcaneum by a cancellous screw. After screw fixation there was tightness in the tendoachillis which was released by giving stab incisions at distance of 2, 5, and 8 cm above its insertion alternating the incision on the medial and lateral side according to the requirement.

**Group 5**: Intact tendoachillis with skin loss.

These patients were treated by reverse sural artery flap and cross leg flap. Patients presented to us initially without any intervention were managed with reverse sural artery flap. But some patients were referred to us in which flap coverage was tried by some other surgeon but it had failed. In those cases cross leg flap was done as a last resort.

Average operation time when flap coverage was done along with tendon reconstruction was 1 hour 45 minutes. Post op immobilization and suture removal was done in the same manner as described above. When flap coverage was done flap was monitored for congestion, flap necrosis, flap dehiscence. All the patients were followed up for minimum of 6 month ranging from 9 month-36 month. When prolene was used for repair they were evaluated for complications like prolene granuloma (fig. 12), sinus, and palpability of the suture under skin. When flap coverage was done they were evaluated for durability of the flap, sensation in the lateral aspect off the foot.
RESULT: The common complications occurred after prolene repair was prolene granuloma and sinus which were treated by exploration and removing the offending suture material.

These complications were less when tendon repair was carried out with stainless steel wires. Out of 12 flap reconstructed all the flaps survived with few minor complications. None of the reverse sural flap had necrosis. Among the distally based fasciocutaneous flaps one had partial necrosis which was managed conservatively. One flap had venous congestion which was resolved on the next day. There was severe infection only in one case which resulted in prolonged hospital stay with marginal flap necrosis. All the complication had occurred when the manner of injury was due to road traffic accident. Average healing time was 17 days and average hospital stay was 18 days.

Hypoesthesia along the lateral aspect of the foot was present in all the patients treated with RSA which improved over a period of 6 months. None of the flap required any debulking procedure. There was no problem in wearing the shoes. Two years follow up showed no ulcerative complications in reconstructed flaps. Donor site healing was satisfactory except in two cases which had hypertrophy at the margins. There was no neuroma in our series. All the patient showed normal range of dorsiflexion and plantar flexion of foot.
DISCUSSION: Blood supply to the TA tendon is provided by longitudinal arteries that run along the length of the muscle complex. The area of the tendon with the poorest blood supply is approximately 2 to 6 cm above the insertion of calcaneum. The Achilles tendon does not have a true synovial sheath but instead has a paratenon. There is a connective tissue sheath that surrounds the entire tendon and is able to stretch 2 to 3 cm with movement which allows maximal gliding action.\(^{(1)}\) Exposed Achilles tendon further presents a complex problem specially if associated with tendon and soft tissue loss.\(^{(2)}\) Principles of management of complex wound is radical debridement, single stage tendon reconstruction and flap coverage. When there is no defect in the tendon repair can be done by different options like percutaneous suture method, modified Kessler method, Bunnel, and Krakow’s techniques. When there is segmental defect of tendon various options are Lindholm technique,\(^{(3)}\) Bosworth technique\(^{(4)}\) and V-Y repair.\(^{(5)}\) In all our repair we have used modified Kessler method and for segmental defect we have used Bosworth technique. Various pedicle flaps has been described by many authors for complex tendochilines injuries like reverse sural artery flap,\(^{(6),(7)}\) adipofascial turnover flap,\(^{(8)}\) and fascial flap.\(^{(9)}\) With the advent of micro vascular reconstruction single stage reconstruction has been done with the use of latissimus dorsi muscle flap,\(^{(10),(11)}\) scapular parascapular flap,\(^{(12)}\) anterolateral thigh flap,\(^{(13),(14)}\) groin flap.\(^{(15)}\) Micro vascular reconstructions require surgical expertise, expensive instrumentation and a backup team for monitoring the flap and exploration at the earliest if needed is crucial for successful outcome. In contrast pedicle flaps require less technical expertise, less costly if properly done.

Other option for coverage of tendochilines area include lateral calcaneal artery flap and cross leg flap. Local calcaneal flap can cover defect only up to 3cm. In majority of our cases defect were of larger size negating its use. Cross leg flap is a fasciocutaneous flap raised from the opposite leg. But it should not be a first option. Cross leg flap involves immobilization for a period of 14 days which is cumbersome to the patient. This procedure cannot be used in elderly patients. Cross leg flap must be reserved as a life boat procedure for failed ipsilateral flap. Most
of the literature suggests use of reverse sural artery flap. We have used this flap in 33.33% cases. In 33.33% cases we have used peroneal artery based fasciocutaneous flap. Another option for reconstruction around lower third of leg is to use Perforator based flap are raised on the perforators of main axial vessels of the leg. i. e. posterior tibial artery and peroneal artery. When raised as an islanded flap it has many advantages. It avoids raising a large flap for the coverage of a small defect in the distal third of leg. It is a single stage procedure. However it is a technically demanding procedure. It requires precise anatomical knowledge of location of perforators, meticulous dissection around the perforator, detachment of all the fascial strands to island the flap. When done appropriately it is a very safe procedure.

In our series majority of the reconstructions were by reverse sural artery neurocutaneous flap. This flap is based on the distribution of the sural nerve. It is accompanied by more or less extended well defined sural artery which continues up to the retromalleolar region as a true vascular network and the retrograde perfusion is maintained by the anastomosis of the cutaneous perforating branches of the peroneal artery and the median superficial sural artery. This communication is the pivot point of the flap which is approximately 3 fingers breadth (5cm) above tip of lateral malleolus.

It is a single stage procedure and has minimal donor site morbidity. This flap can be harvested by both plastic surgeons and orthopedic surgeons.

Another option is peroneal perforator based distal fasciocutaneous flap. The flap harvest is relatively simple and done with ease. The disadvantage is that it is a two stage procedure and requires the harvest of a very large flap for the coverage of a small defect. In our series we first began raising this flap and as we gained experience now we have shifted to doing reverse sural island flap.

None of reverse sural artery flap had flap necrosis. The result is comparable to the rate of flap necrosis as described by Jepegnanam et al.,(2) Ioannis A. Ignatiadis, et al.(7) Both these these authors had 100% success rate. Samira et al.(16) had complete flap survival in 80% cases. Several techniques have been employed for complete flap survival. The flap is always raised with a subcutaneous pedicle of 2.5 to 3cm. Though many authors have suggested inclusion of a portion of gastocnemius muscle to increase the survival of the flap we have never included the muscle. In one case we had delayed the flap prior to harvest of the flap. Many studies have suggested that venous congestion, and not lack of arterial supply, is the most significant reason for flap necrosis.(17) The fundamental problem is the presence of venous valves that can prevent the retrograde flow of blood out of the flap in spite of the venous collateral vessels. The methods reported to improve venous outflow are exteriorizing the Pedicle,(18) intermittent drainage of short saphenous Vein,(19) leaches, and the supercharging of the flap by anastomosing the proximal end of the lesser saphenous vein to a vein in the recipient defect.(20)

We exteriorized the pedicle if found the bridging skin tight or if congestion of the flap was noted after tunneling of the pedicle. Notable improvement in the congestion of flaps was seen in these cases.

Perforator based adipofascial flap is another option however we have no experience in this flap. All our patients had a normal gait. They were able to stand on tip toes, had active plantar flexion and had full range of ankle movement.
CONCLUSION: systematic approach to the tendoachillis injury can give rise to successful outcome. Even in the era of micro vascular surgery reverse sural artery flap and distally based fasciocutaneous flaps are reliable flaps for complex tendoachillis injury. Simultaneous reconstruction of the tendon and flap coverage is the treatment of choice for acute open tendoachillis injury.

REFERENCES:

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