Peroneal Tendofascial Flap: Further Experience

Ashraf Hussien M.D.
Department of surgery, Faculty of Medicine, Fayoum University

ABSTRACT

In a preliminary report, the author presented the successful use of a new fascial flap to cover exposed Achilles tendon in 4 cases. The new flap was developed by dissecting the common peroneal tendon sheath as a proximally based fascial flap and referred to it as peroneal tendofascial flap. This work was conducted to further evaluate the versatility of this new flap and review the literature regarding the previous report. In the year 2005, six male patients underwent this procedure to cover the Achilles tendon in 3 cases and the fibula and pretibial area in another 3 cases. Their age ranged from 23 – 42 years with mean 30 years. The size of the flap ranged from 5 x 12 cm to 8 x 16 cm while the largest defect size was 8 x 14 cm. All flaps survived and skin grafts have been taken well. 6 months follow up proved the durability and sound coverage of the defects treated by this procedure. This work proved the advantages previously reported to this new flap. Further, both the size of the flap and its domain of coverage were expanded with successful outcome.

Key words: tendofascial, tendon sheath, fascial flap, Achilles tendon, fibula.

INTRODUCTION

In 2003, the author presented in a preliminary report, the successful use of a new fascial flap with STSG over it to cover the exposed Achilles tendon in 4 cases. Peroneal tendofascial flap was the name given to the new flap. The flap was developed by dissecting the common peroneal tenosynovial sheath off the peroneal tendons as a vascularized proximally based fascial sheet from within the lateral compartment. In 3 cases the muscle fibers of the lower end of the peroneus brevis muscle were disinserted and elevated attached to the fascial flap leaving the tendon in place. However, in the fourth case the tendon was cut distally and elevated with its muscle belly attached to the fascial sheet to cover a higher and wider defect. The inclusion of the tendon was behind the name given to the new flap.

In 2007, Ning et al reported the use of the peroneal tendofascial flap conjoined with adipofascial flap to cover naked Achilles tendon and calcaneal bone in six cases. All their fascial flaps survived and skin graft had been taken over it. In their report, the largest area covered was 6 x 13 cm. They concluded that peroneal tendofascial flap conjoined with adipofascial flap is a handy and dependable way for repairing the small tissue defects of the lower third of leg and heal. Also in 2007, Bhattacharya et al reported the use of the common peroneal tenosynovial sheath as a distally based flap to cover exposed Achilles tendon in 5 cases. They mentioned that their flap has been reported before as a proximally based flap and referred to the peroneal tendofascial flap. They reported successful coverage in all cases, their largest defect size was 2 x 3 cm located at the distal end of the Achilles tendon.

In this work, the author will present further experience in using the peroneal tendofascial flap in coverage of soft tissue defects in the lower third of the leg in six clinical cases.

Anatomical Considerations

The lateral compartment of the leg contains two muscles. The peroneus longus is superficial and higher than the peroneus brevis as it arises from the upper two thirds of the lateral surface of the fibula. Its muscle fibers end at the beginning of the lower third of the leg with a tendon passing vertically downward behind the lateral malleolus to be inserted on the base of the first metatarsal and medial cuneiform bone. The peroneus brevis muscle arises from the lower two thirds of the lateral surface of the fibula. The muscle fibers taper to end just proximal to the malleolus. Its tendon passes deep to that of the longus behind the malleolus to be inserted on the base of the fifth metatarsal bone.
The two tendons are enclosed in a common tenosynovial sheath part of which contains synovium\(^5\).

**Vascular basis of the flap:**

Longitudinal splitting of the dissected common peroneal tendon sheath will result in fascial sheet continuous proximally with fascial sheath "epimysium" of the peroneal muscles. This fascial sheet was found to be very well vascularized being perfused through a rich plexus of vessels that was noticed clearly by the author's naked eye within the transparent substance of the flap both in the previous and present work. Also, the injection study done by Bhattacharya et al on 10 fresh postmortem limbs proved this observation as they visualized a continuous longitudinal vascular arcade along the whole length of the common peroneal tendon sheath. The plexus seems to be nourished mainly via multiple perforators emerging from the peroneal muscles along its length and to a lesser extent a single inconstant perforator from the peroneal vessels lying 4 – 6 cm from the malleolus\(^1\&3\).

**PATIENTS & METHODS**

In the year 2005, six male patients underwent this procedure. Their age ranged from 23 years to 42 years (mean: 30 yrs). The peroneal tendofascial flap with STSG over it was used to cover an exposed Achilles tendon in 3 cases. However, it was rotated anteriorly in another 3 cases to cover exposed fibula and pretibial area. The demographic data of cases is summarized in table(1).

**Surgical Technique:**

1. Debridment of the defect site including excision of devitalized tissue together with all fibrous tissue.
2. Exposure was attempted by extending the lateral edge of the defect few centimeters up and down (Fig.1b&2b). The length of the needed flap determined the length of the incision on either sides.
3. The peroneal compartment was entered after incising the deep fascia 1 cm posterior to the fibula and reflecting it to both sides. Great care was practiced not to injure the underlying fascia.
4. Flap dissection started by collar incision in the common peroneal tenosynovial sheath at the tip of the lateral malleolus. Only in one case the incision started one cm distal to this point to cover the distal end of Achilles tendon "case No. 3".
5. The common sheath was splitted vertically from distal to proximal together with dissecting it off the peroneal tendons till the lower most muscle fibers were reached. Then dissection was continued by cutting the tendon of peroneus brevis and separating the muscle from the fibula to be attached to the splitted sheath.
6. The longitudinal cut started over the tendon of peroneus brevis then continued over the edge of its muscle. This made the lower part of the peroneus brevis muscle fibers lying attached at the free edge of the fascial flap (Fig. 1c).
7. Now, the flap was elevated as a vascularized sheet of fascia proximally based and attached to the lower fibers of the peroneus brevis muscle with its tendon (Fig. 1b). The length of the muscle fibers included was determined by the size and level of the flap.
8. The tendon was excised from the elevated flap leading to expansion of the muscle fibers (Fig. 1c).
9. The flap was then transposed either anteriorly (Fig. 2b) or posteriorly (Fig. 1c) to lie over the defect.
10. The deep fascia of the peroneal compartment was sutured by interrupted simple polypropylene stitches over the intact tendon of peroneus longus "covered by the visceral layer of tendon sheath and synovium (Fig. 1b)."
11. A sheet of meshed STSG was harvested from thigh and fixed over the flap and covered by vaseline gauze and cotton soaked dressing then light compression was applied for 7 days. The ankle joint was immobilized by a slab for 21 days.
12. The first dressing was done on the 7th day then daily dressing till complete healing was achieved.
13. Follow up for at least six months was conducted for durability of skin graft and movement of ankle joint especially foot eversion.
RESULTS
All flaps survived and skin grafts took completely within 21 days (Fig. 1d &2c). Sound durable coverage of the six defects was achieved. The author did not notice any skin graft breakdown during the follow up period. Also, the movement of the ankle joint was completely normal without experiencing pain or tendon tethering.

Table 1 Summary of cases and results

<table>
<thead>
<tr>
<th>No</th>
<th>Age (yrs)</th>
<th>Aetiology</th>
<th>Site* of defect</th>
<th>Size of defect</th>
<th>Size of flap</th>
<th>Arc of rotation</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23</td>
<td>shotgun</td>
<td>3</td>
<td>8 x 14</td>
<td>8 x 16</td>
<td>posterior</td>
<td>success</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>trauma</td>
<td>2</td>
<td>7 x 15</td>
<td>7 x 15</td>
<td>posterior</td>
<td>success</td>
</tr>
<tr>
<td>3</td>
<td>37</td>
<td>trauma</td>
<td>2</td>
<td>7 x 14</td>
<td>7 x 14</td>
<td>posterior</td>
<td>success</td>
</tr>
<tr>
<td>4</td>
<td>42</td>
<td>Chronic eczema  + trauma</td>
<td>3</td>
<td>5 x 12</td>
<td>5 x 12</td>
<td>anterior</td>
<td>success</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>trauma</td>
<td>4</td>
<td>6 x 9</td>
<td>6 x 12</td>
<td>anterior</td>
<td>success</td>
</tr>
<tr>
<td>6</td>
<td>28</td>
<td>trauma</td>
<td>2</td>
<td>4 x 10</td>
<td>7 x 13</td>
<td>anterior</td>
<td>success</td>
</tr>
</tbody>
</table>

* Distance between lower border of defect and level of the tip of lateral malleolus.
DISCUSSION

The lower leg poses a great challenge to the reconstructive surgeons. The author described a new fascial flap to cover the exposed Achilles tendon in the lower leg and referred to it as peroneal tendofascial flap. The flap was developed by dissecting the common peroneal tendon sheath as a vascularized fascial flap proximally based. Further experience with this flap use in reconstruction of the lower third of the leg proved its high versatility as all flaps survived. In this work, the peroneal tendofascial flap was used successfully to cover larger defects overlying the distal part of Achilles tendon. The largest size covered in the previous work for a defect lying 3 cm above the heel was 6 x 9 cm while in this work it was 8 x 13 cm lying at the same level. Leaving the lower part of the peroneus brevis muscle belly attached to the edge of the fascial sheet after excision of its tendon resulted in expansion of the breadth of the flap. Also, in this work the flap was rotated anteriorly for the first time to cover the fibula and pretibial area in 3 cases with successful outcome.

Multiple local flaps have been reported to be valid in coverage of soft tissue defects located at the lower lateral leg. These include muscle flap, fasciocutaneous flaps and adipofascial flaps. The peroneus brevis muscle flap proved to be useful in covering small defects of the lower lateral leg either proximally based or distally based. Its limitation is the narrow breadth which does not exceed 4 cm. The reversed sural island flap, being a fasciocutaneous flap, became a versatile important option for covering small and medium sized defects. On the other hand, it adds unwanted bulk to the ankle region and results in poor aesthetic appearance regarding the donor site. Also, its pedicle may be injured by the aetiological factors behind the soft defects in the lower lateral leg. This is because its pedicle is superficial and lying intimately behind the lateral malleolus. The reverse adipofascial flaps based on distal perforators of the main leg vessels constitute a valuable option to achieve reconstruction of small and medium sized defects with the advantage of preserving leg skin. However, its pedicle is also subjected to injury as the previous flap. Further, it is not pliable enough in handling and is not an ideal bed for graft take hence, many authors prefer delayed grafting after granulation tissue formation.

The peroneal tendofascial flap has the advantages of being thin, pliable, highly vascularized with constant blood supply, easily disected, can cover small medium sized defects, has a wide arc of rotation and potentially can offer vascularized tendon graft transfer. In addition, its tissues lie in a deeper anatomical plane to that of both the fasciocutaneous and fascial flaps. As a result, it may be a valuable option when others fail. This could be noticed in case No. 1 as the patient sustained shotgun injury which deprived the Achilles tendon from its soft tissue cover. Unfortunately, failed attempt was
done by an orthopaedic surgeon destroyed the pedicles of the available reverse adipofascial and fasciocutaneous flaps. He did two longitudinal release incisions (Fig. 1e) and undermined the bipedicle skin flaps to meet over the defect, but it sloughed leaving larger defect. Peroneus brevis muscle was found to be small to cover that medium sized defect and the other local option could not be relied upon as its pedicles were in the site of trauma and failed surgical procedure. However, the peroneal tendofascial flap with the procedure reported here in enabled the author to achieve sound coverage of this medium sized distally located defect obviating the need for free tissue transfer.

In the previous report, the author did not notice any significant perforator cut during dissection of the common sheath. However, in this work a small perforator was seen to enter the sheath in two cases at a point 4 cm and 5 cm respectively proximal to the tip of lateral malleolus. A constant sizeable perforator emerging from the peroneal vessels was found to end in the posteromedial aspect of peroneus brevis muscle as it was cut during separating the muscle fibers from bone. This was located at a point lying proximal to the lateral malleolus 10 cm in two cases and 12 cm in 4 cases. These findings match those reported by McHenry (13) in his anatomical dissection performed on 10 fresh cadaveric limbs to study the vascular pedicles of peroneus brevis muscle. The average distance of the distal pedicle from the tip of lateral malleolus was found to be ranging from 3.5–12 cm with mean 6.7 cm.

The tendon of peroneus brevis muscle was left in place in the previous work in 3 cases. However, it was cut and elevated attached to its muscle with the flap in the fourth case. In this work, the tendon was cut and elevated with flap then excised. Actually, inclusion of the tendon in the flap is not essential except if it is required in the reconstructive procedure as a vascularized tendon graft. Also, the dissected common sheath and lower fibers of peroneus brevis can be transposed as a flap leaving the tendon in place attached to the proximal part of the muscle, hence preserving its function. On the other hand, cutting the tendon facilitates dissection and enable the surgeon to determine the site of the muscle fibers in relation to the splitted tendon sheath. However, it will be feasible to accomplish this without cutting the tendon when we get more experience with the technique.

Conclusion
In 2003, the author described the use of the common peroneal tendon sheath as a proximally based fascial flap and referred to it as a proximally based fascial flap. The flap with STSG over it was used successfully to cover exposed Achilles tendon in 4 cases. In this work, the author presents his experience in doing additional six cases. The author modified the technique of dissection to increase the breadth of the flap. Also, coverage of the fibula and preitibial area was attempted for the first time via anterior transposition. All flaps survived completely and offered the patient durable sound coverage.

This work proved the advantages previous reported to the peroneal tendofascial flap.

REFERENCES

7. Erens S, Ghofrani A, Reifenrath M: The distally pedicled peroneus brevis muscle