

Case Report

Single Stage Reconstruction of Posterior Soft Tissue Ankle Defects with a Free Anterolateral Thigh Flap and Rolled Tensor Fascia Lata for Functional Tendo-Achilles Reconstruction - A Case Report and Review of the Literature

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Soft tissue defects in the posterior ankle region with underlying Achilles tendon loss pose a reconstructive challenge to both Orthopaedic and Plastic surgeons. Such injuries can result in a severely debilitating sequelae for the patient, therefore reconstruction of the area must provide reliable function and durability with minimal complications and aesthetically pleasing results to enable normal foot wear.

We describe the case of a twenty-seven year old male, who presented following a traumatic open rupture of the Achilles tendon and failed reverse sural artery flap. We performed a single stage composite soft tissue reconstruction with a free anterolateral thigh (ALT) flap and rolled vascularised Tensor Fascia Lata (TFL) for functional Achilles tendon reconstruction. The patient had no post-operative complications and was able to fully weight bear and dorsiflex his foot beyond ninety degrees at seven month follow-up. Whilst many options are available to reconstruct this area, we review the literature to illustrate the advantages of using this technique to achieve all of the above factors, and advocate for all foot and ankle surgeons to be aware of its use in their reconstructive repertoire.

Keywords: Functional tendo-achilles reconstruction; Free ALT flap; TFL flap; Ankle defects; Microsurgery

Abbreviations

ALT: Anterolateral Thigh; TFL: Tensor Fascia Lata; SSG: Split Skin Graft; MRI: Magnetic Resonance Imaging

Introduction

The tendo-achilles region is cited as a notoriously challenging area to achieve optimal functional, soft tissue reconstruction and aesthetic outcomes to both the Orthopaedic and Plastic Surgeon. The Achilles tendon has been described as the strongest tendon in the body and must be able to withstand weight and durability of dynamic workload [1]. The tendon permits both dorsiflexion and plantar flexion of the ankle, without which an individual may have debilitating consequences [2]. Furthermore, any composite soft tissue and tendon defect must be reconstructed with an option robust enough to protect against chronic mechanical irritation from footwear and risk of re-rupture. The reconstructive challenge is exacerbated by the limited vascularity and soft tissue availability in the region.

We present the case of a successful combined soft tissue and functional tendon reconstruction in the tendo-achilles region using a one-stage approach. We review the current literature relating to these defects and describe the advantages of using our proposed method of

the free Anterolateral Thigh (ALT) flap and rolled Tensor Fascia Lata (TFL) flap for the Achilles tendon.

Case Presentation

A twenty-seven year old male, ex-smoker with no comorbidities, caught his left heel under a motorbike wheel whilst on holiday in the Philippines. This resulted in a minimally displaced distal calcaneal fracture, Achilles tendon injury with overlying soft tissue loss. The patient underwent multiple debridements in the Philippines; the calcaneal fracture was managed conservatively with subsequent repair of the Achilles tendon and pedicled reverse sural artery flap for soft tissue coverage, eight days after the injury. The flap donor site was closed with a Split Skin Graft (SSG). Nineteen days post-operatively he developed partial flap necrosis, for which he underwent further debridement and two weeks of antibiotic therapy.

The patient presented for a routine wound check at the Leicester Royal Infirmary Plastics Dressings Clinic almost seven weeks after his initial injury with a left foot drop, 100% SSG take and most of the flap had necrosed with exposed Achilles tendon (Figures 1&2). An Magnetic Resonance Imaging (MRI) confirmed re-rupture of the Achilles tendon with a 4.5cm gap. Two months after his injury, he underwent a partial debridement of the reverse sural artery flap with



Figure 1: Partially necrosed reverse sural artery flap with exposed Achilles tendon.



Figure 2: Partially necrosed reverse sural artery flap with exposed Achilles tendon.



Figure 3: Free ALT flap to reconstruct left heel with exposed tendo-achilles.



Figure 4: Free ALT flap to reconstruct left heel with exposed tendo-achilles.



Figure 5: Free ALT donor site (right thigh), closed directly and healed 7 months post-operatively.



Figure 6: 7-months following functional reconstruction of the tendo-Achilles and overlying soft tissue.

immediate single stage functional Achilles tendon reconstruction. The gap in Achilles tendon was measured at 6cm intra-operatively. A 9x32 cm free musculocutaneous ALT flap was harvested on three perforators, from the contralateral thigh and included the TFL (Figures 3&4). The TFL was sutured to both proximal and distal remnants of the tendo-achilles using 2-0 Ethibond, and the lateral circumflex femoral vessels were anastomosed end-to-end to the posterior tibial vessels. There was one arterial and two venous anastomoses. The flap donor site was closed directly (Figure 5).

There were no intra-operative complications and the patient had a straightforward post-operative course, being discharged sixteen days later. The delay in discharge was primarily due to physiotherapy

and rehabilitation. Routine flap monitoring was undertaken as per our departmental policy and leg dangling commenced five days post-operatively, for ten minutes at a time. Seven months following his functional reconstruction, the patient was able to dorsiflex his foot beyond ninety degrees and walk unassisted (Figures 6-8). The flap was found to be bulky but had otherwise healed well with no necrosis, as had the donor site. He was due to undergo thinning of the flap by liposuction but failed to attend subsequent follow-up appointments.

Discussion

A review of current literature highlighted the benefits a single stage free ALT flap and vascularised rolled TFL for reconstruction



Figure 7: 90-degrees dorsiflexion of the left foot 7 months post-operatively.



Figure 8: Fully weight-bearing unassisted 7-months post-operatively.

of composite defects in the tendo-achilles region. Lee et al first presented a series of three patients who had a range of soft tissue defects between 5x2.5 cm and 7x5 cm, and Achilles tendon loss of 3.5-5.5 cm. The single stage technique promoted rapid tendon healing, with patients fully weight-bearing between two to three months post-operatively with good contour, minimal donor site morbidity and the technical advantage of being able to both harvest and inset the flap with the patient supine. The only reported disadvantage within literature, which was also experienced in our case, is the bulkiness of the flap. However, this is easily remediable by liposuction after initial flap healing and provides an overall good aesthetic result enabling patients to continue wearing normal footwear [4,5]. Otherwise there were no significant complications and no further surgery was required in any case reports.

Our patient was able to dorsiflex the foot beyond ninety degrees and walk unassisted by seven months post-operatively. There have been similar reports in other cases; Lee et al. report an American Orthopaedic Foot and Ankle Society Score of 94 out of 100 at twelve month follow-up [6]. Kuo et al performed isokinetic concentric measurements on two patients; at two year follow-up dorsiflexion and plantar flexion showed a 30% and 40% deficit respectively, which resulted in mild difficulty when running but no problems when walking or climbing stairs [7]. A systematic review by Iorio et al, which had an average Achilles tendon defect of 7.8cm, concluded that there was no significant difference in the overall range of motion between vascularised and non-vascularised tendon repairs, suggesting that there is no functional superiority of one technique over the other [8].

Soft tissue defects involving the underlying Achilles tendon are commonly attributed to traumatic injury, as described in our case; post-operative wound dehiscence or chronic ulceration. A review of

the literature found successful outcomes from one-stage composite microvascular reconstruction in paediatric and elderly patients, as well as following burn injuries or life-threatening infections, such as necrotising fasciitis [6,9,10]. Rui et al described a series of twenty-five paediatric patients who underwent a one-stage free ALT with Achilles reconstruction using the iliotibial band [9]. Gaps in the Achilles tendon ranged between 3-16 cm, whilst the size of ALT flaps harvested were 5-12 cm x 8-18 cm. All flaps healed well, however two had partial necrosis which were managed conservatively with dressings, and no donor site morbidities were reported. Adreu-Sola reported no complications, and a normal gait and push-off at six months follow-up in a reconstruction performed following an acute burn injury [10]. Jandali found in their series of twenty patients that the only predictors of poor clinical outcomes, in terms of mean ankle range of motion, following a free composite anterolateral thigh flap and vascularised fascia lata, were a BMI >30kg/m² and presence of peripheral artery disease [11]. All their flaps survived and integration of the TFL into the Achilles tendon was confirmed on MRI.

The authors appreciate the difficulty of performing microsurgical reconstructions for these complex defects when resources may be limited. The vast majority of case reports describing reconstruction of the tendo-achilles region are based on the distally-based sural artery flap, or local perforator-based fasciocutaneous flaps, which often have a reliable vascular pedicle and are quick to raise, especially where microsurgery facilities are not available. Nonetheless, the incidence of complications, particularly partial or complete flap loss remains high [12-14]. This may be attributed to venous congestion upon ambulation or the relatively poor vascularity in the region to begin with. This was also illustrated in our own case, where the initial surgery was a direct Achilles tendon repair with overlying reverse sural artery flap reconstruction, consequently the flap and tendon partially necrosed and required a secondary procedure to reconstruct both. Mopuri also described the need to perform a secondary local flap reconstruction after a dehiscence of their perforator-based local flap in a series of eleven patients, but most of their patients required soft tissue reconstruction only [12]. It is important to highlight that a lot of case reports are based on small to moderate sized defects, with no underlying tendon loss. Composite defects have a much more debilitating impact on a patient's life and require an efficient and robust reconstructive option.

Other free tissue transfers have been reported for composite reconstructions, however the evidence-base for these is much smaller. The gracilis free flap was described by Sabapathy for a 20x10 cm defect; the Achilles tendon was not repaired or reconstructed but ultrasound and MRI both confirmed integration of the muscle into the tendon defect [15]. Whilst normal gait and active plantar flexion were reported, this was not until two years post-operatively, far longer than that of a single stage ALT and vascularised rolled TFL flap. Huemer et al. also reported good functional and aesthetic outcomes following a free gracilis flap reconstruction, however in their series of twenty patients, they report one complete flap loss, four haematomas, one SSG loss, two subsequent osteomyelitis, and one re-rupture of the Achilles tendon [16]. The authors welcome this novel approach to be considered for reconstruction of the tendo-achilles region, especially as the muscle atrophies it will give a somewhat aesthetically pleasing result which is not too bulky and requiring subsequent thinning

procedures. However, one should be cautious of the high risk of complications and that many of the reports in literature are based on soft tissue reconstruction only.

Conclusion

The tendo-achilles region poses a reconstructive challenge for both soft tissue and tendon defects. We believe the single stage free ALT flap with rolled vascularised TFL to reconstruct the Achilles tendon, provides the most versatile and durable option that is aesthetically pleasing, adaptable to all sized defects with minimal complications and donor site morbidity, to a condition which is already significantly debilitating. This has been echoed in the literature, which illustrates its suitability for paediatric to elderly patients, and near-normal functional outcomes relatively early following surgery. Whilst there are many options available for reconstruction in this region, there is no robust evidence to suggest superiority of one technique over another. We advocate the single stage free tissue approach when faced with complex composite defects in the posterior ankle region and resources permit, as a safe and efficient option to be considered by all Foot and Ankle and Plastic surgeons.

References

1. Fredrick MA. Traumatic disorders. In Canale ST, Beaty JH, editors. *Campbell's Operative Orthopaedics*. 11th ed. Philadelphia: Mosby Elsevier; 2008; 2753-2758.
2. Sato R, Hibino N, Yamano M, Yoshioka S, Terai T, Kita K, et al. One-stage reconstruction for re-rupture of Achilles tendon with soft tissue infection: Using an anterolateral thigh flap incorporating a vascularised muscle flap and a strip of iliotibial tract. *J Hand Microsurg*. 2018; 10: 105-108.
3. Lee JW, Yu JC, Shieh SJ, Liu C, Pai JJ. Reconstruction of the Achilles tendon and overlying soft tissue using the antero-lateral thigh flap. *Br J Plast Surg*. 2000; 53: 574-577.
4. Deiler S, Pfadnhaur A, Widmann J, Stutzle H, Kanz KG, Stock W. Tensor fascia lata perforator flap for reconstruction of composite Achilles tendon defects with skin and vascularised fascia. *Plast Reconstr Surg*. 2000; 106: 342-349.
5. Houtmeyers P, Opsomer D, Landuyt KV, Monstrey S. Reconstruction of the Achilles tendon and overlying soft tissue by free composite anterolateral thigh flap with vascularised fascia lata. *J Reconstr Microsurg*. 2012; 28: 205-209.
6. Lee YK, Lee M. Treatment of infected Achilles tendinitis and overlying soft tissue defect using an anterolateral thigh free flap in an elderly patient: A case report. *Medicine*. 2018; 97: 11995.
7. Kuo YR, Kuo MH, Chou WC, Liu YT, Lutz BS, Jeng SF. One-stage reconstruction of soft tissue and Achilles tendon defects using a composite free anterolateral thigh flap with vascularized fascia lata: clinical experience and functional assessment. *Ann Plast Surg*. 2003; 50: 149-155.
8. Iorio ML, Han KD, Evans KK, Attinger CE. Combined Achilles tendon and soft tissue defects: functional outcomes of free tissue transfers and tendon vascularisation. *Ann Plast Surg*. 2015; 74: 121-125.
9. Rui H, Yi-jun R, Li Y, Qiong H, Wen-jun C, Wu-sheng K. A free anterolateral thigh flap and iliotibial band reconstruction of soft tissue defects at children's feet and ankles. *Injury*. 2015; 46: 2019-2023.
10. Andreu-Sola V, Aguilera-Sáez J, Rivas-Nicolls D, Bosacoma Roura P, Barret JP. Functional reconstruction of acutely burnt achilles tendon with composite anterolateral thigh flap with fascia lata: a case report. *Ann Burns Fire Dis*. 2017; 30: 309-312.
11. Jandali Z, Lam MC, Merwart B, Mohring B, Geil S, Muller K, et al. Predictors of clinical outcome after reconstruction of complex soft tissue defects involving the Achilles tendon with the composite anterolateral thigh flap with vascularised fascia lata. *J Reconstr Microsurg*. 2018; 34: 632-641.
12. Mopuri N, Karri V, Patel N, Niranjana N. Reconstruction of soft tissue defects in the Achilles tendon region with perforator-based fasciocutaneous flaps. *Eur J Plast Surg*. 2013; 36: 701-706.
13. Bullocks JM, Hickey RM, Basu CB, Hollier LH, Kim JY. Single-stage reconstruction of Achilles tendon injuries and distal lower extremity soft tissue defects with reverse sural fasciocutaneous flap. *J Plast Reconstr Aesthet Surg*. 2008; 61: 566-572.
14. Akhtar S, Hameed A. Versatility of the sural fasciocutaneous flap in the coverage of the lower third leg and hind foot defects. *J Plast Reconstr Aesthet Surg*. 2006; 59: 839-845.
15. Sabapathy R, Venkataramani H, Latheef L, Bhardwaj P. Reconstruction of segmental defects of Achilles tendon: is it a must in infected complex defects? *Indian J Plast Surg*. 2013; 46: 121-123.
16. Huemer GM, Larcher L, Schoeller T, Bauer T. The free gracilis muscle flap in Achilles tendon coverage and reconstruction. *Plast Reconstr Surg*. 2012; 129: 910-919.