

Use of Free Vascularised Sartorius Tendo-Cutaneous or Vascularised Sartorius Tendon Flap: A Potential for Reconstructing Traumatic Hand Tendon and Achilles Tendon Defects in Children

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1. Abstract

We present the discovery of free vascularised sartorius tendo-cutaneous flap or vascularised Sartorius tendon graft to potentially reconstruct traumatic hand tendon defect or Achilles tendon in pediatric cases. It is based on the perforators from descending genicular artery, saphenous artery and its venous drainage is by the accompanying vena comitans and long saphenous vein. This flap has a potential to provide good skin coverage; a vascularised tendon graft and restore function in hand tendon and Achilles tendon injuries with less obvious scar at the donor site.

Search terms: Pediatrics, surgical flaps; tendons and blood supply, tendons and transplantation, hand injuries.

Level V evidence

2. Introduction

Hand and lower limb injuries can cause morbidity and time off school for the pediatric population. Radial artery forearm flap is commonly used to reconstruct these types of tendon injuries. Though there is good colour match, there is still an obvious resultant donor site scar that has potential to cause distress from a cosmetic point especially in the pediatric population. We present the discovery of potential use of vascularised sartorius tendocutaneous flap or vascularised sartorius tendon graft in reconstructing a traumatic hand tendon defects or Achilles tendon defects in pediatric cases. This flap is based on reliable perforators.

3. Anatomy

Sartorius muscle is the longest muscle in humans, ~50cm [1]. It is located superficially in the anterior compartment of thigh and it

arises from Anterior Superior Iliac Spine (ASIS), passing obliquely and attaching to the medial part of proximal tibia (forming the pes anserinus with two other tendons: gracilis and semitendinosus). Its belly forms the anterior wall of adductor canal. Sartorius receives segmental blood supply: proximal pedicles from superficial circumflex iliac and lateral circumflex femoral arteries, middle pedicles from the superficial femoral artery and the distal pedicles from the descending genicular and popliteal arteries [2]. Vascular pedicles enter the muscle on the medial boarder. It is a type IV muscle according to the Mathes and Nahai classification [3]. Sartorius muscle is innervated by muscular branch from femoral nerve. Venous drainage is by the superficial femoral vein. Functionally, it initiates flexion of the hip and the knee joint from full flexion. It is also a weak external hip joint rotator and abductor.

Sartorius muscle is commonly used as a transposition flap after inguinal lymph node dissection to cover exposed femoral vessels [4]. It has also been used as a free muscle only flap and a free myocutaneous perforator flap [2]. However, it has never been explored as a donor for vascularised tendon graft. This muscle is readily available and easy to dissect with its superficial location. There is minimal functional morbidity when this muscle is harvested [2] which is an added advantage.

4. Surgical Technique

The discovery of this potential vascularised sarorius tendo-cutaneous flap or vascularised sartorius tendon graft was made during the elevation of a series of Descending Genicular Artery Perforator (DGAP) flaps (to reconstruct peri-patella defects).

Preoperative marking will be similar to the markings of DGAP flap

as the skin paddle for sartorius tendo-cutaneous flap has the same perforators from the descending genicular artery and saphenous artery. The perforators were identified and marked on the skin, located along the distal third of a line drawn from ASIS to the medial end of the right knee joint line (Figure 1), using a handheld Doppler. The skin paddle boundaries are marked capturing the course of the long saphenous vein with the identified perforators being in the middle.

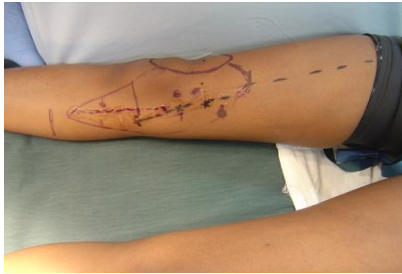


Figure 1: Preoperative marking

Position of the patient: The patient is anaesthetised in supine position with the hip joint in slight abduction and external rotation and the knee joint in a slight flexion. A tourniquet is applied to the thigh and inflated without full exsanguination to allow identification of the superficial venous system, notably the long saphenous vein and the perforators.

Wound Preparation: Radical surgical debridement/washout of all contaminated necrotic tissues down to a healthy bleeding bed should be performed. Adequate haemostasis is crucial and the size of the defect and tendon should be measured. Injured tendon stumps should be identified, prepared and mobilised.

Posterior-medial approach: This is similar to raising descending genicular artery perforator flap. A 6cm postero-medial knee incision is made. Dissection is performed until the proximal end of the long saphenous vein is identified and preserved. The dissection is continued in the subfascial plane until the anterior edge of sartorius tendon and muscle are identified. Sartorius tendon is then gently retracted posteriorly (Figure 2), demonstrating the muscular branch of saphenous artery which supplies sartorius muscle tendon.

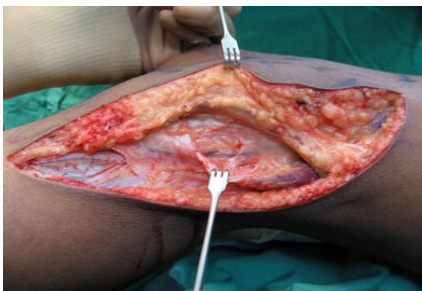


Figure 2: Sartorius tendon gently retracted posteriorly

Dissection is then performed deep to sartorius tendon and saphenous artery (contrary to descending genicular artery perforator flap which dissection is only in the subfascial plane, above saphenous

artery). The sartorius tendon is divided proximally and distally (Figure 4) making sure the artery to sartorius tendon is spared. Saphenous nerve (Figure 5) is dissected off the tendo-cutaneous flap. All perforators are preserved. Incision is extended superiorly until visualising vastus medialis. Further dissection is done until the vascular origin of descending genicular artery which is included as a vascular pedicle of the free flap. The flap is raised in the subfascial plane from distal and then deeper to the sartorius tendon and the pedicle (Figure 3 and Figure 4). Long saphenous vein (Figure 6) is divided distally and dissected proximally to get enough length for micro-anastomosis. Descending genicular artery (origin) and proximal end of long saphenous vein are divided and flap harvested. The flap is then ready for transfer. Harvesting vascularised tendon alone (with no skin paddle) is approached similarly with a poster medial approach. Dissect until you identify anterior edge of sartorius tendon, gently retract the tendon posteriorly until you identify the perforators from the saphenous artery going into the sartorius tendon. Saphenous nerve is then dissected off the saphenous artery and preserved. We then divide the distal end of the sartorius tendon after measuring the required length. The proximal end of the tendon is also divided at the musculo-tendinous junction. We also divide the distal end of the saphenous artery. Dissection progresses from distal to proximal, deeper to the pedicle and the saphenous artery until the descending genicular artery origin is identified.

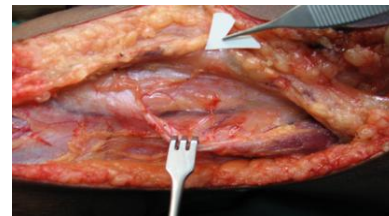


Figure 3: Sartorius tendon vascular pedicle (small white arrow)

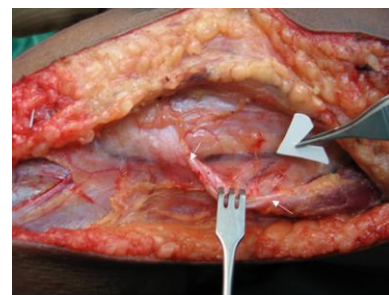


Figure 4: Sartorius tendon vascular pedicle (big white arrow) and distal and proximal parts where Sartorius tendon is divided (small white arrows)



Figure 5: Saphenous nerve (shown with a pair of forceps)



Figure 6: Long saphenous vein (shown with a pair of forceps)



Figure 7: Post DGAP flap reconstruction of knee defect (following wide local excision of malignant fibrous histiocytoma in a 13 year old female patient)

5. Discussion

Tendon reconstruction on hands and Achilles tendon defects, where there is skin loss is aimed at soft tissue coverage and restoring hand function. Our potential donor site for our vascularised tendo-cutaneous free flap technique aims to give more option in reconstructing these injuries. From our experience with the descending genicular artery perforator flap the anatomy of the sartorius tendon perforators was consistent. The flap has sizeable perforators with adequate pedicle length, making it a suitable donor site for vascularised tendon grafts.

Vascularised tendons rapidly heal with less adhesions between tendons and wound bed [5]. This does facilitate good healing and tendon glide within few weeks of repair. Early supervised active movements are essential to facilitate this. As a strong tendon, this could potentially lower the risk of tendon rupture complication. The donor site (Sartorius tendon) can be closed directly and is located in the poster medial aspect of knee, with potential for a less obvious scar. The long saphenous vein can be incorporated in the tendo-cutaneous flap to augment venous drainage.

6. Conclusion

Vascularised Sartorius tendo-cutaneous free flap is a potential flap for hand and lower leg reconstruction in children with open hand tendon and Achilles tendon defects respectively. From our experience, saphenous artery and its source vessel (descending genicular artery) are of good size and adequate pedicle length. The blood supply to sartorius tendon was consistent when raising descending genicular artery perforator flap, however further anatomical dissection and large clinical series will confirm our clinical findings that vascularised sartorius tendon is a potential donor site. The

skin paddle has blood supply from descending genicular artery and saphenous artery perforators which can provide a skin paddle with minimal donor site morbidity. The potential scar is located on the postero-medial aspect of the knee, making it less obvious.

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