

Application of Groin Flap

Rashmi V Kumar¹, Swetha M² and Ravi Kumar Chittoria^{3*}

¹MBBS, MS General Surgery (JIPMER), Senior Resident, Department of Plastic Surgery, Jawaharlal Institute of Post graduate Medical Education and Research (JIPMER), Pondicherry, India

²MBBS, Junior Resident, Department of Surgery, JIPMER, Pondicherry, India

³MS, MCh, DNB, MNAMS, MBA, DSc, PhD (Plastic Surgery), FNAMS, FRSM (UK), FRRHH (UK), FRCS (Edinburgh), Professor & Registrar (Academic), Head of IT Wing and Telemedicine, Department of Plastic Surgery & Telemedicine, JIPMER, Pondicherry, India

ABSTRACT

Introduction: The groin flap, first described by McGregor and Jackson in 1972, is recognized as the first successful free cutaneous flap. This flap is characterized by its long, narrow pedicle based on the superficial circumflex iliac artery (SCIA) and vein, offering a reliable option for various reconstructive procedures.

Methods: A comprehensive review of anatomical and clinical literature regarding the groin flap was conducted. Key anatomical features, including the vascular supply, venous drainage, innervation, and potential donor site complications, were analyzed. Surgical techniques for harvesting the flap were also discussed.

Results: The groin flap receives arterial supply primarily from the SCIA, and venous drainage by its venae comitantes. The flap's sensory innervation is provided by the lateral cutaneous nerve of T12, with the potential for motor nerve inclusion if the sartorius muscle is harvested. The groin flap presents a versatile option for reconstructive surgery, particularly for upper extremity defects and lower abdominal repairs.

Conclusions: The groin flap is a valuable surgical option in reconstructive surgery, offering consistent vascular supply and versatility in design.

*Corresponding author

Ravi Kumar Chittoria, Professor & Registrar (Academic), Head of IT Wing and Telemedicine, Department of Plastic Surgery & Telemedicine, JIPMER, Pondicherry, India.

Received: October 17, 2024; **Accepted:** October 24, 2024; **Published:** October 31, 2024

Keywords: Groin Flap, Superficial Circumflex Iliac Artery Perforator Flap, Fasciocutaneous Flap, Upper Limb Reconstruction, Abdominal Reconstruction, Perineal Reconstruction

Key Messages

The groin flap is a reliable and versatile reconstructive option that utilizes the superficial circumflex iliac artery and vein for its vascular supply, providing excellent coverage for upper extremity and lower abdominal defects.

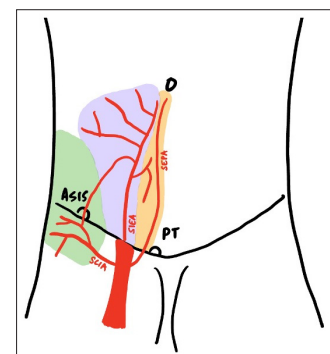
Introduction

The groin flap was initially described by McGregor and Jackson in 1972. This flap holds significance as it was the first successful free cutaneous flap performed by Dr. Antia. In McGregor's pivotal publication, he described the "cartwheel of vessels where the femoral vessels emerge from under the inguinal ligament" may be regarded as a self-contained vascular territory from which the "groin flap" could be raised. This flap, characterized by a long, narrow single pedicle lies lying roughly along the line of the groin and depends on the superficial circumflex iliac artery and vein for its blood supply [1].

Anatomy

The groin flap is classified as a Type A fasciocutaneous axial flap.

Within the femoral triangle, the femoral artery branches into three superficial vessels: the superficial external pudendal artery, the superficial epigastric artery, and the superficial circumflex iliac artery (Figure 1).

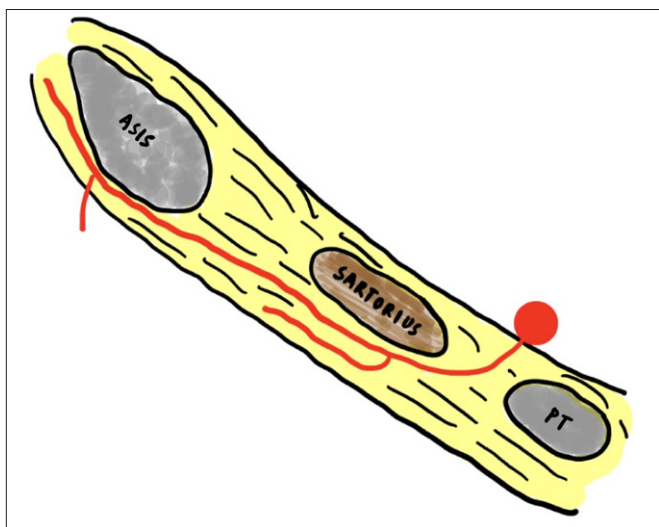


These vessels lie between the two layers of the superficial fascia: a superficial fatty layer and a deep membranous layer, both of which are continuous with the corresponding layers of the anterior abdominal wall [2]. The arterial supply to the groin flap is provided by the superficial circumflex iliac artery (SCIA). The SCIA originates from the anterolateral of the femoral artery, approximately 3cm below the inguinal ligament, and extends

laterally about two fingerbreadths below and parallel to the inguinal ligament (Figure 2).



The SCIA gives rise to a superficial branch, which is located proximally over the deep fascia of the sartorius muscle and distally within the fatty tissue. The deep branch of the SCIA travels in a superolateral direction beneath the deep fascia of the sartorius muscle. After penetrating the deep fascia at the lateral edge of the sartorius, the deep branch enters the suprafascial layer, where it gives off multiple perforators to the anterolateral region of the groin (Figure 3) [3].



The groin is drained by two primary systems: superficial and deep. The superficial system includes the superficial circumflex iliac vein (SCIV) and the superficial inferior epigastric vein (SIEV), while the deep system is composed of the venae comitantes accompanying the various arteries.

The pedicle of the flap typically measures around 2 cm in length with a diameter of approximately 1-2 mm.

The flap receives sensory innervation from the lateral cutaneous nerve of T12. If the sartorius muscle is incorporated into the flap, the motor nerve to the muscle can also be included. The components of this flap can consist of the fascia lata or the fascia from the abdominal wall, adipose tissue, and may also include the sartorius muscle, iliac bone, or the lateral femoral cutaneous nerve [4].

Flap Design

Skin Island Dimensions

- Length: 15 cm (range 10–20 cm)
- Width: 10 cm (range 5–15 cm), with a maximum width of 10 cm for primary closure
- Maximal Extent: The posterior margin can extend up to 10 cm lateral to the anterior superior iliac spine (ASIS)
- Superior Border: At the level of the umbilicus
- Inferior Border: 10 cm below the inguinal ligament

Muscle Dimensions

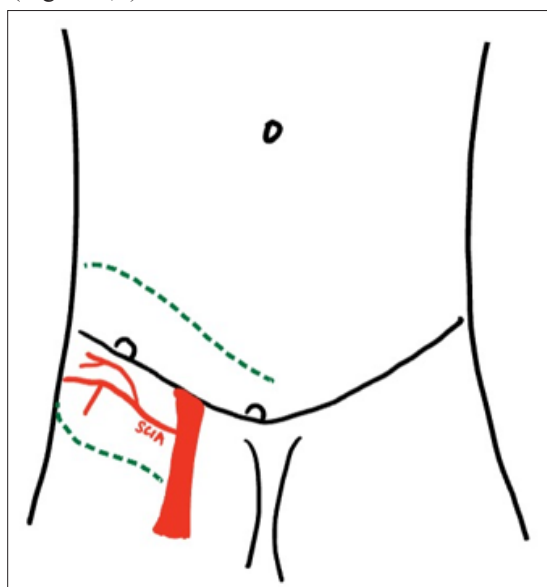
- A small segment of sartorius muscle can be harvested proximally along with this flap if needed.

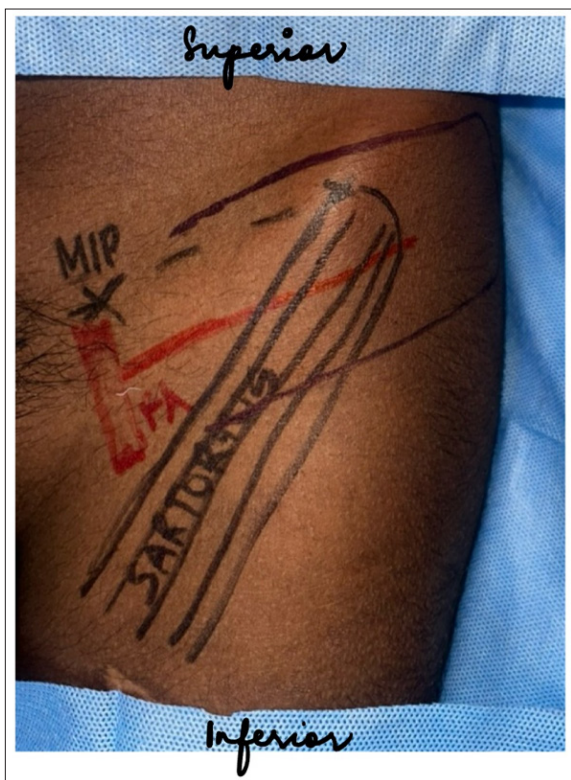
Bone Dimensions

- Length: 4 cm (range 3–8 cm)
- Width: 2 cm (range 1–3 cm)
- The iliac bone can be harvested using the superficial circumflex iliac artery (SCIA) as a vascular supply; however, it is more effectively harvested based on the deep circumflex iliac vessels.

Flap Markings

The anterior superior iliac spine (ASIS) and the pubic tubercle are marked, and an imaginary line is drawn to connect these two landmarks. The superficial femoral artery is palpated at the mid-inguinal point, which is the midpoint between the ASIS and the pubic tubercle, within the femoral triangle. The femoral vein is located medial to the femoral artery. A point 2.5 cm below the inguinal ligament along the femoral vessels is marked, indicating where the superficial circumflex iliac artery (SCIA) emerges. A line is drawn approximately two fingerbreadths (around 3 cm) below and parallel to the inguinal ligament, marking the path of the vascular pedicle. The flap is centred along this line. At approximately 6 cm from the lateral point, the SCIA divides into superficial and deep branches in relation to the sartorius muscle. The width of the flap can extend up to 10cm, allowing for primary closure (Figure 4,5).



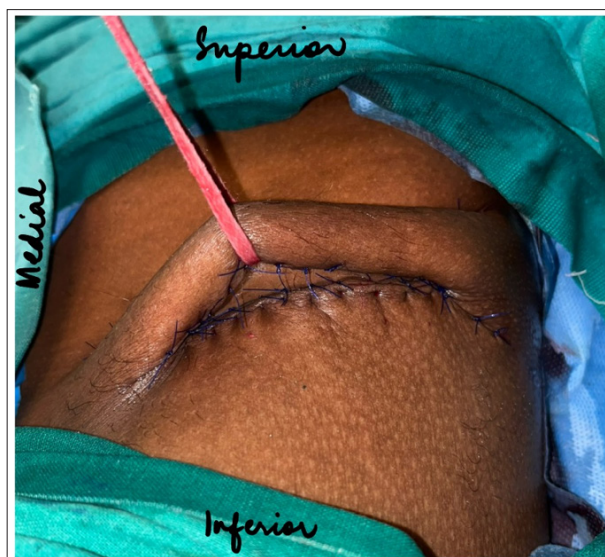
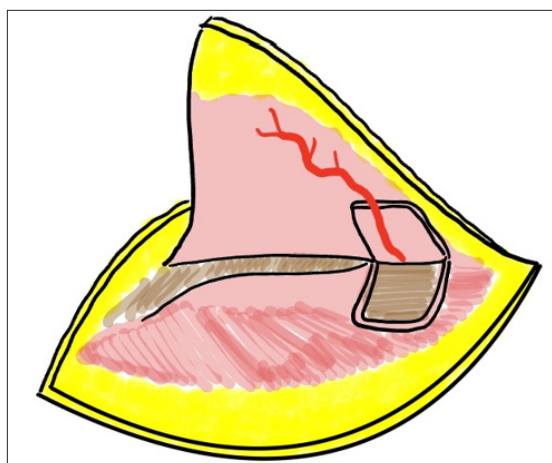


Technique

The procedure can be performed under general, spinal, or local anaesthesia. The patient is positioned supine with a wedge placed under the ipsilateral pelvis to elevate the posterior superior iliac spine (PSIS). Flap markings are made as previously described. An incision is made along the superior, inferior, and lateral margins and the flap is raised superficial to the fascia from the ASIS distally to the medial border of the sartorius muscle proximally [5]. The fascia of sartorius is then identified, incised and entered. Dissection is carried out deep to the fascial layer and superficial to the sartorius muscle. The superficial circumflex iliac artery (SCIA) pierces the fascia at the medial side of the sartorius muscle, making the sartorius a crucial landmark for identifying the pedicle during dissection. This careful approach helps to avoid injury to the pedicle (Figure 6,7).

The arc of rotation for the flap is positioned over the femoral vessels beneath the inguinal ligament. The flap is inset after removing excess subcutaneous tissue lateral to the sartorius muscle. The inset begins at the centre of the distal margin to the edge of the defect proceeding symmetrically on either side toward the pedicle end, with or without tubing. It is important to maintain equal tension on both sides and to avoid overlapping the edges.

For upper extremity defects, the flap should be positioned anterior to the fingers, aligned in the direction of the thumb. If tubing is necessary, it should be done before the inset, as this is more convenient. If tubing is not utilized, any unused segment of the pedicle may be grafted. The flap is typically divided 2–3 weeks later and contoured to fit the defect appropriately. The donor site can be closed primarily or covered with a split-thickness skin graft (Figure 8).



Variations

Free Groin Flap

Dissection can be carried out from lateral to medial or vice versa. Starting from the medial side has the advantage of allowing identification of the vessels at their points of origin and entry into the superficial femoral artery and vein. Once the vessels are located, the flap markings may be adjusted to better centralize the pedicle. If the pedicle is found to be too small or absent, the surgeon can opt to utilize the superficial inferior epigastric artery (SIEA) or switch to the opposite side. Care must be taken to ligate all branches supplying the sartorius muscle during the procedure [6].

Superficial Circumflex Iliac Artery Perforator (SCIP) Flap

The dominant perforator from both the superficial and deep branches of the superficial circumflex iliac artery (SCIA) system is typically found at a point 3 cm medial to the anterior superior iliac spine (ASIS) along the course of the SCIA. The flap is outlined to include this point and the area over the ASIS. A cutaneous vein located within the adipose layer is included as part of the venous drainage system for the flap, as the accompanying vein of the SCIA is sometimes too small for successful anastomosis. The flap can be elevated based on a single perforator [7,8].

Combined SCIP–Anterolateral Thigh (ALT) Flap (Siamese flap)

This flap comprises two adjacent flaps that share a single vascular source: the superficial circumflex iliac artery (SCIA) and the perforators from the lateral circumflex femoral system. It is particularly useful for reconstructing large cervical defects [9].

Combined SCIP Or Groin Flap with Vascularized Iliac Bone Graft

This combined osteocutaneous flap offers excellent blood circulation [10].

Other variations of pedicled flaps include the peninsular groin flap, islanded groin flap, fenestrated peninsular groin flap, super thin groin flap, and delayed extended groin flap. In addition, there are various types of free flaps, such as the free iliac skin flap, free sartorius cutaneous flap, sensate flap, free adipofascial flap, and vascularized lymph node transfer (VLNT).

Postoperative Management

Patients are allowed to ambulate 1-2 days after surgery and can typically stand straight around 3-4 days postoperatively.

Indications

Pedicled flaps are used for the reconstruction of various areas, including the lower abdomen, proximal thigh, penile, perineal, urethral, vaginal, and other genital regions. They are most commonly utilized for defects in the upper extremities. The groin flap can effectively reconstruct soft tissue defects on the entire palm, dorsum of the hand, and lower arm, accommodating maximum defect sizes of 10 x 25 cm. Free flaps are used for procedures such as head and neck facial augmentation, trunk or breast reconstruction, and the repair of skin defects in both the upper and lower extremities [11-13].

Contraindications

Contraindications for the groin flap include patient refusal, non-compliance from patients who must maintain their hand in position for three weeks, polytrauma patients with concomitant life-threatening injuries, and local infections at either the recipient or donor site. Additionally, previous surgery, scarring, vascular injuries at the donor site, and irradiated areas of the donor or recipient are also considered contraindications.

Advantages

- Reduced scarring at the donor site
- Simultaneous harvesting of tissue
- Reliable and consistent pedicle
- Coverage for upper limb defects without the need for microvascular anastomosis

Disadvantages

- Requires a two-stage procedure for upper limb reconstruction
- Potential discomfort and stiffness in the elbow and hand due to the pedicle
- Maintaining the required position for 2-3 weeks can be challenging
- Risk of continuous soakage of the dressing
- The flap may be bulky in appearance

Complications

- Hematoma
- Seroma
- Infection
- Delayed healing and wound dehiscence
- Scar contracture
- Hypertrophic scarring
- Joint stiffness
- Partial flap necrosis
- Venous congestion
- Suture dehiscence

References

1. McGregor IA, Jackson IT (1972) The groin flap. *Br J Plast Surg* 25: 3-16.
2. Smith PJ, Foley B, McGregor IA, Jackson IT (1972) The anatomical basis of the groin flap. *Plast Reconstr Surg* 49: 41-47.
3. Jordan DJ, Malahias M, Hindocha S, Juma A (2014) Flap Decisions and Options in Soft Tissue Coverage of the Lower Limb. *Open Orthop J* 8: 423-432.
4. Chuang DC, Colony LH, Chen HC, Wei FC (1989) Groin flap design and versatility. *Plast Reconstr Surg* 84: 100-107.
5. Hong JP, Choi DH, Suh H, Mukarramah DA, Tashti T, et al. (2014) A new plane of elevation: the superficial fascial plane for perforator flap elevation. *J Reconstr Microsurg* 30: 491-496.
6. Harii K, Omori K, Torii S, Murakami F, Kasai Y (1975) Free groin skin flaps. *Br J Plast Surg* 28: 225-237.
7. Goh TLH, Park SW, Cho JY, Choi JW, Hong JP (2015) The search for the ideal thin skin flap: superficial circumflex iliac artery perforator flap--a review of 210 cases. *Plast Reconstr Surg* 135: 592-601.
8. R G, Km R, S O, V P, J A, et al. (2013) The superficial circumflex iliac artery perforator flap in intra-oral reconstruction. *J Plast Reconstr Aesthetic Surg JPRAS* 66: 1683-1687.
9. Koshima I (2001) A new classification of free combined or connected tissue transfers: introduction to the concept of bridge, siamese, chimeric, mosaic, and chain-circle flaps. *Acta Med Okayama* 55: 329-332.
10. Iida T, Narushima M, Yoshimatsu H, Yamamoto T, Araki J, et al. (2013) A free vascularised iliac bone flap based on superficial circumflex iliac perforators for head and neck reconstruction. *J Plast Reconstr Aesthet Surg* 66: 1596-1599.
11. Cobb ARM, Koudstaal MJ, Bulstrode NW, Lloyd TW, Dunaway DJ (2013) Free groin flap in hemifacial volume reconstruction. *Br J Oral Maxillofac Surg* 51: 301-306.

12. Goertz O, Kapalschinski N, Daigeler A, Hirsch T, Homann HH, et al. (2012) The effectiveness of pedicled groin flaps in the treatment of hand defects: results of 49 patients. *J Hand Surg Am* 37: 2088-2094.
13. Koshima I, Nanba Y, Nagai A, Nakatsuka M, Sato T, et al. (2006) Penile reconstruction with bilateral superficial circumflex iliac artery perforator (SCIP) flaps. *J Reconstr Microsurg* 22: 137-142.

Copyright: ©2024 Ravi Kumar Chittoria, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.