

**Morphology of gracilis muscle and the topographic anatomy of its neurovascular pedicles**

Chettiar Ganesh Kumar, Rajanigandha Vadgaonkar, M.D. Prameela, Vandana Blossom, B.V. Murlimanju, Mamatha Tonse, Mangala M. Pai

Department of Anatomy, Kasturba Medical College, Mangalore, Manipal Academy of Higher Education, Manipal, Karnataka, India

**Introduction**

Gracilis is often utilized as a graft in the procedures of reconstruction and functioning muscle transfer.1 It is excellent for the closure of recto-vaginal and rectourethral fistulas. The distal pedicle is used during the total knee arthroplasty as a soft tissue graft.2,3 It also has wider application in the management of wounds of the groin, contractures, scars, reanimation of the face,4,5 reconstruction of the mammary gland,6 and anterior cruciate ligament reconstruction.7 Additional harvesting of the gracilis has proven to offer better post-operative functional activity like in hamstring injury.8 The main vascular pedicle of gracilis is from the medial and lateral circumflex femoral arteries, which branch from the deep femoral artery, which enters the gracilis at the junction of its upper and middle third. Distal part of the gracilis is supplied by the femoral artery9.

**Knowledge gap identified:**

After the literature search, we did not find many studies about the dimensions of gracilis muscle and topography of the neurovascular pedicle in Indian population.

**Review of literature**

In the total knee arthroplasty, one of the complications is the poor wound healing and cutaneous necrosis, which requires thin pliable tough flaps. These soft tissue defects are a challenge to fill and pedicled medial head of gastrocnemius flap can cover it. However, in cases where gastrocnemius flap is not sufficient, the surgeon can opt for distally placed gracilis muscle flap.10,11 Though the proximal pedicle of gracilis is extensively utilized in the plastic and reconstructive surgeries, distally placed pedicled gracilis flap is another alternative. The distal pedicle is simple, requires less surgical time.12,13 In some situations, reverse gracilis muscle flap could be done.14 The accurate calibre of pedicles and best vasculature of gracilis, makes it a best candidate for the distally based pedicle flap.3 Gracilis receives pedicles ranging between one and five and 75% of the limbs have two vascular pedicles.15 It was reported that the first vascular pedicle is placed at a distance of 105 ± 20 mm from the pubic tubercle.15 In another study,16 it was reported that the proximal and distal pedicle of gracilis were located 60 mm and 266 mm away from the pubic tubercle. We observed the distal pedicle at 214.6±86.8 mm and 145.3±124.4 mm away over the right and left sides. In another study, the most proximal pedicle entered gracilis at a distance of 160-180 mm. In another study, the length of gracilis was 432±20.8 mm in males and 371±7.6 mm in females. In their study, the distance of pedicle was 94±7.2 mm in males and 79±2.6 mm in females.17

**Aims and Objectives**

The goal of this anatomical study is to offer the morphometry of the gracilis and topography of its pedicles.

**Methodology**

**Study setting:** Department of Anatomy, Kasturba Medical College, Mangalore

**Study participants:** Human embalmed cadavers

**Inclusion criteria:** Adult human embalmed cadavers

**Exclusion criteria:** The specimens with congenital malformations will be excluded.

**Study duration:** 3 months

**Sample size:** 44

**Sampling method:** The sample size is similar to the earlier studies performed.

**Data collection methodology:** A digital Vernier caliper (Mitutoyo, Japan) will be used to perform the measurements.Length of the gracilis will be measured from its origin to the musculotendinous junction. The width will be measured at three different points, origin, midpoint and musculotendinous junction separately. The counting of pedicles of gracilis will be done and their distance from the pubic tubercle will be measured. The topographical location of the entry of pedicle will be measured by using the measuring tape.

**Data analysis:** The data will be presented as mean ± standard deviation and the side-based comparison of the right and left sides will be performed by using the paired ‘t’ test. The recent version of SPSS (version 27) software will be utilized for the statistical analysis. The gender-based comparison and age wise segregation will not be performed in the present study.

**Implications**

Topographic data of the vascular pedicles have implications in the field of plastic and reconstructive surgeries. In this concept, this study will offer detailed topographic anatomy of pedicles in the gracilis muscle. This study will provide morphometric data of the gracilis and topographical anatomy of the vascular pedicles. These data will assist the operating surgeons during the procedures of plastic and reconstructive surgery.

**References**

1. Macchi V, Vigato E, Porzionato A, *et al.:* The gracilis muscle and its use in clinical reconstruction: an anatomical, embryological, and radiological study. *Clin. Anat.* 2008;21(7):696-704.
2. Ulrich D, Roos J, Jakse G, Pallua N: Gracilis muscle interposition for the treatment of recto-urethral and rectovaginal fistulas: a retrospective analysis of 35 cases. *J. Plast. Reconstr. Aesthet. Surg.* 2009;62(3):352-356.
3. Tiengo C, Macchi V, Vigato E, *et al.:* Reversed gracilis pedicle flap for coverage of a total knee prosthesis. *J. Bone Joint Surg. Am.* 2010;92(7):1640-1646.
4. [Hussey AJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Hussey%20AJ%5BAuthor%5D&cauthor=true&cauthor_uid=17901732), [Laing AJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Laing%20AJ%5BAuthor%5D&cauthor=true&cauthor_uid=17901732), [Regan PJ](https://www.ncbi.nlm.nih.gov/pubmed/?term=Regan%20PJ%5BAuthor%5D&cauthor=true&cauthor_uid=17901732):An anatomical study of the gracilis muscle and its application in groin wounds. [*Ann. Plast. Surg.*](https://www.ncbi.nlm.nih.gov/pubmed/17901732) 2007;59(4):404-409.
5. Hassan KM, El-Moghazy AEAM, Mahmoud MA, El-Oteify M: Study of neurovascular anatomy of the split gracilis muscle for the purpose of facial reanimation. *Egypt. J. Plast. Reconstr. Surg.* 2009;33(2):261-269.
6. Peek A, Müller M, Ackermann G, Exner K, Baumeister S: The free gracilis perforator flap: anatomical study and clinical refinements of a new perforator flap. *Plast. Reconstr. Surg.* 2009;123(2):578-588.
7. Candal-Couto JJ, Deehan DJ: The accessory bands of gracilis and semitendinosus: an anatomical study. *Knee.* 2003;10(4):325-328.
8. Yosmaoglu HB, Baltaci G, Ozer H, Atay A: Effects of additional gracilis tendon harvest on muscle torque, motor coordination, and knee laxity in ACL reconstruction. *Knee Surg. Sports Traumatol. Arthrosc.* 2011;19(8):1287-1292.
9. Stranding S, Borley NR, Gray H: Gray’s anatomy: the anatomical basis of clinical practice. 41st ed. Edinburgh: Churchill Livingstone/Elsevier; 2016.
10. Mitsala G, Varey AH, O'Neill JK, Chapman TW, Khan U: The distally pedicled gracilis flap for salvage of complex knee wounds. *Injury.* 2014;45(11):1776-1781.
11. Tetreault MW, Della Valle CJ, Hellman MD, Wysocki RW: Medial gastrocnemius flap in the course of treatment for an infection at the site of a total knee arthroplasty. *JBJS. Essent. Surg. Tech.* 2017;7(2):e14.
12. Amin K, Dempsey M, Ghali S, Grobbelaar A: Saving grace: distally pedicled gracilis muscular flap in lower limb salvage. *BMJ Case Rep.* 2014;2014-205486.
13. Cavadas PC, Sanz-Giménez-Rico JR, Landín L, Martínez-Soriano F: Segmental gracilis free flap based on secondary pedicles: anatomical study and clinical series. *Plast. Reconstr. Surg.* 2004;114(3):684-691.
14. Jung JA, Kim YW, Cheon YW: Reverse gracilis muscle flap: an alternative means of skin coverage for recurrent infection after TKA. *Knee Surg Sports Traumatol Arthrosc.* 2013;21(12):2779-2783.
15. Rajeshwari MS, Kumar BNR: An anatomical study of gracilis muscle and its vascular pedicles. *Int. J. Anat. Res.* 2015;3(4):1685-1688.
16. Magden O, Tayfur V, Edizer M, Atabey A: Anatomy of gracilis muscle flap. J. Craniofac. Surg. 2010;21(6):1948-1950.
17. [[Singh H,](https://www.sciencedirect.com/science/article/abs/pii/S0003277811800274" \l "!)[Kaur R](https://www.sciencedirect.com/science/article/abs/pii/S0003277811800274" \l "!)[, Gupta N:](https://www.sciencedirect.com/science/article/abs/pii/S0003277811800274" \l "!) Morphometric study of gracilis muscle and its role in clinical reconstruction. J Anat Soc India](https://www.sciencedirect.com/science/journal/00032778). 2011;[60(2](https://www.sciencedirect.com/science/journal/00032778/60/2)):202-206.