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British Journal of Oral and Maxillofacial Surgery 55 (2017) 270–273

BRITISH Journal of Oral and Maxillofacial Surgery

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Iliolumbar artery: a useful pedicle for the iliac crest free flap in maxillofacial reconstruction☆

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Accepted 23 December 2016
Available online 11 January 2017

Abstract

The iliac crest free flap is commonly used in maxillofacial reconstruction, and is typically supplied by the deep circumflex iliac artery (DCIA). However, the iliolumbar artery is an alternative blood supply that can potentially be used in such reconstructions. We describe the anatomy of the iliolumbar artery and review publications about its clinical use. We raised four cadaveric iliac crest free flaps using both the DCIA and the iliolumbar artery to illustrate its use in reconstructing maxillofacial defects. It provided a longer pedicle for microvascular anastomosis than the DCIA, was more versatile in orientation of the flap, and allowed the chance of anastomosing both pedicles to "super-charge" the flap's blood supply. We describe a patient in whom this flap was used successfully, which shows that the iliolumbar artery is a suitable pedicle to augment (or replace) the DCIA in an iliac crest free flap.

Keywords: Microvascular; Reconstruction; Composite Flap

Introduction

Since the development of microvascular surgery with free flaps, excellent functional and aesthetic results have been obtained after resection of maxillofacial tumours. Despite a wide range of reconstructive options being available, it is still not clear which flap is the most suitable for certain defects.[1] Two commonly used flaps for osseous maxillofacial reconstruction are the fibular free flap and the iliac crest free flap. The latter is normally pedicled off the deep circumflex artery (DCIA), but the iliolumbar artery is a possible alternative.

Since being reported by Winters et al in 1996,[2] the iliac crest free flap supplied by the iliolumbar artery rarely been described in reports of maxillofacial and reconstructive surgery. Here we explain how the iliac crest free flap can be augmented by using either the iliolumbar or the DCIA pedicle, or both, which permits a potentially longer pedicle for microvascular anastomoses, more versatility in orientation of the flap, and gives the opportunity to anastomose both pedicles to "super-charge" the flap's blood supply.

The fibular free flap is usually used when osseous or composite maxillofacial reconstruction is required. It offers relatively easy dissection of the flap, a long piece of bone, and a skin paddle with predictable perforators. However, the lack of bony height can sometimes make dental rehabilitation with implants challenging without further augmentation. The donor site of the skin paddle can be closed primarily, but often requires a skin graft to cover it. Nevertheless recent meta-analyses showed that the overall morbidity at the donor site for the femoral and iliac crest free flaps was similar.[3,4]

The iliac crest free flap is usually based on a pedicle formed by the deep circumflex iliac artery (DCIA) and vein. When compared with the fibular free flap, the iliac crest free

☆ This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
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http://dx.doi.org/10.1016/j.bjoms.2016.12.012

flap provides improved bony height and width, and if necessary, a large bulky piece of muscle in the form of the internal oblique muscle pedicled from the ascending branch of the DCIA. In 1979 it was described as a possible free flap by Taylor et al,[5] with the incorporation of a skin paddle in the same year by Sanders and Mayou,[6] followed by its use in mandibular reconstruction by Urken et al[7] The iliac crest free flap requires technically more difficult dissection than the fibular free flap (particularly in obese patients), and when a skin paddle is incorporated it is said to be immobile and more unreliable. It also has a relatively short pedicle, which can be a particular problem when used for reconstruction of the midface.[1,8]

Vascular anatomy

The iliac crest is supplied by multiple vessels including the DCIA, iliolumbar artery, fourth lumbar artery, and superior gluteal artery.[9,10]

DCIA

The mean (SD) length of the DCIA is 6.2 (0.7) cm from the anterior superior iliac spine and it has a diameter of 2.6 (0.4) mm.[11,12] It should be noted that the pedicle can be lengthened by taking a more posterior segment of the iliac crest, particularly if a segment 2-3 cm from the anterior superior iliac spine is left intact and not taken with the flap. The DCIA gives off 1-4 muscular branches to the abdominal musculature including the ascending branch, which perforates the transverse abdominis muscle to go along the underside of the internal oblique muscle, which it supplies.[13]

After it has passed the anterior superior iliac spine, the DCIA travels between iliacus and transversalis fascia close to the iliac crest (up to 2 cm below its superior edge) where it provides branches to nourish the inner bony cortex. Where it ends is controversial, as some authors have described a terminal musculocutaneous perforator approximately 6 cm posterior and 1.5 cm lateral to the anterior superior iliac spine.[13] However, Chen et al[14] and Taylor et al[5] showed that it anastomoses with the iliolumbar artery before terminating separately (Fig. 1).

lliolumbar artery

The iliolumbar artery and its branches have been successfully used as both pedicled and microvascular free flaps for orthopaedic and spinal surgery.[10,13,15] Both cadaveric and clinical studies have shown that it supplies a distribution area of the iliac crest of about 7.0 (2.2) cm, with the artery having a reliable anatomical course without appreciable ethnic differences.[9,14,16] It usually originates from the internal iliac artery (96%), and less often from the common iliac artery or the posterior trunk of the internal iliac artery.[9,14,16] Thereafter it passes between the obturator nerve, lumbosacral plexus,

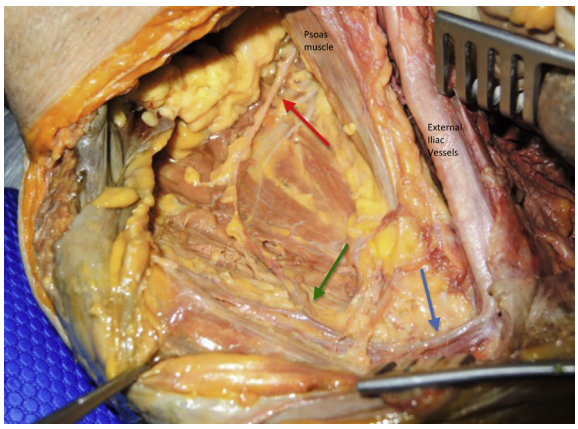

Fig. 1. Anastomosis (green arrow) of deep circumflex iliac pedicle (blue arrow) to the iliolumbar pedicle (red arrow). The iliolumbar vessels emerge lateral to the psoas muscle.

and external iliac vessels before running under the psoas major muscle and emerging from its lateral edge (Fig. 1).[9,10] In most cases the artery runs between the iliac fascia and iliacus muscle to supply both the iliac crest bone (iliac branch) and the iliacus (muscular branch),[1,10] thereafter anastomosing with both the DCIA and the fourth lumbar artery.[14,16] It is likely that the internal oblique muscle also has a vascular supply from the iliolumbar artery, which allows it to perfuse adequately if the iliolumbar artery, or the DCIA, or both are used for microvascular anastomosis.[2] It should be noted that anatomical variation has been described where the dominant nutrient pedicle to the middle aspect of the iliac crest was the fourth lumbar artery.[14] However, this has not been documented elsewhere.

At the lateral edge of the psoas muscle (clinically the most proximal site of possible ligation of the iliolumbar artery during harvest of an iliac crest flap) the iliolumbar artery is a 7.0 (3.9) cm long with a diameter of 2.0 (0.4) mm,[1,14] which is predictably narrower than at its origin with the iliac artery where it is 3.7 (0.7) mm. The iliolumbar artery travels with a single vena comitans, however there are venae comitantes in 32.6% of cases, which join together at the lateral edge of the psoas muscle. They drain into a variable venous system including the internal, external, common iliac, and ascending lumbar veins.[14]

Clinical applications

Winters et al showed that the iliolumbar artery can be used successfully as a pedicle for reconstruction with an iliac crest flap in spinal surgery.[10,13,15] However, only a few papers have described its use in maxillofacial free flap reconstruction. Winters et al described a case where it was used to supplement ("super-charging") the DCIA in the harvest of a large (14 cm) DCIA composite osseomyocutaneous flap.[1] Chen et al[14] used it in two free flaps, and Liu et al[17] used both the DCIA and the iliolumbar artery for a large mandibular recon-