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Double vascular pedicle iliac crest flap

Javier Rodríguez Fernández,[a,] Mario Mateos Micas,[a] Ramón Galán,[a] Pedro Cobos,[b] Margarita Jové,[b] Laura Aguilera,[c] Olga Vázquez,[a] Jens Mommsen,[a] Gabriel Forteza,[a] and Verónica Piera[b]*

[a]*Servicio de Cirugía Maxilofacial, Hospital Universitario Joan XXIII, Tarragona, Spain*
[b]*Unidad de Anatomía Humana, Facultad de Medicina y Ciencias de la Salud, Universidad Rovira i Vigili, Reus, Tarragona, Spain*
[c]*Unidad de Rehabilitación y Medicina Física, HUGTP, Badalona, Barcelona, Spain*

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A B S T R A C T

Introduction: The iliac crest flap is commonly used in reconstructions of the head and neck. The vascularisation of this region depends on the deep circumflex iliac artery and vein (ACIP/VCIP). The present study describes for the first time, the simultaneous use of the deep and superficial circumflex iliac systems to obtain an iliac crest flap for head and neck reconstructions.
Material and method: Ten inguinal regions were dissected in 5 cadavers in the Human Anatomy and Embryology Unit of the Faculty of Medicine of the Rovira i Virgili University (Reus, Spain). In the period 2005-2007, 3 patients required mandibular reconstruction with a microvascularised iliac crest osteocutaneous flap at the Maxillofacial Surgery Unit of the Joan XXIII University Hospital (Tarragona, Spain).
Results: The 3 cases showed a favourable outcome. This "supercharging" variation guarantees the perfusion to the skin flap, provides a better3-dimensional arrangement of the soft tissue and lowers the morbidity at the donor site, as much less internal oblique muscle cuff is harvested
Conclusions: This technique may be of great interest in the reconstruction of complex maxillofacial defects instead of having to carry out a vascular dissection and its extra anastomosis.

Colgajo de cresta ilíaca de doble pedículo vascular

Palabras clave:
Colgajo de cresta ilíaca
Microvascularizado
Reconstrucción de cabeza y cuello
Cirugía

R E S U M E N

Introducción: El colgajo de cresta ilíaca (CCI) es uno de los utilizados con mayor frecuencia en la reconstrucción facial. Su vascularización depende de los vasos circunflejos ilíacos profundos (ACIP, VCIP). Este trabajo describe, por primera vez, la posibilidad de doble irrigación de la isla cutánea del CCI incluyendo el sistema circunflejo ilíaco superficial para la reconstrucción de cabeza y cuello.
Material y método: Se diseccionaron 10 regiones inguinales de 5 cadáveres en el Departamento de Anatomía de la Facultad de Medicina Rovira i Virgili de Reus (Tarragona). En el

*Author for correspondence.
E-mail address: javier.doctork@gmail.com (J. Rodríguez Fernández).

periodo 2005-2007, 3 pacientes fueron intervenidos en el Servicio de Cirugía Maxilofacial del Hospital Joan XXIII de Tarragona, requiriendo un colgajo osteomiocutáneo microvascularizado de cresta ilíaca.

Resultados: Los 3 casos clínicos mostraron una evolución satisfactoria. Esta técnica proporciona una mayor vascularización del colgajo y una mayor disponibilidad tridimensional e implica menor morbilidad de la zona donante, ya que se necesita tallar menos cantidad de oblicuo pues la irrigación de los vasos perforantes no depende de la ACIP.

Conclusiones: Esta variación técnica del colgajo de cresta ilíaca puede sernos de gran utilidad en la reconstrucción de defectos complejos maxilofaciales a cambio de realizar una disección vascular y su anastomosis extra.

Introduction

The iliac crest flap is one of the most commonly used in head and neck reconstructions. The technique for obtaining it is constantly evolving in order to improve its results in both the aesthetic and functional aspects. The vascularisation of this region is dependant on the deep circumflex iliac artery and vein (DCIA/DCIV). The blood supply to the skin islet that covers this generally depends on perforating branches of the ascending vein of the circumflex iliac artery.

To ensure the presence of these perforating veins in the flap, a 2-4 cm portion of the abdominal internal oblique muscle that covers the flap, is traditionally included in the shaping work, as well as some overlying subcutaneous tissue. The large amount of tissue obtained in the flap is one of the greatest drawbacks against using it, as its great volume makes it difficult to have a correct adaptation.

This study describes for the first time the simultaneous use of the deep and superficial circumflex iliac systems to obtain an iliac crest flap for head and neck reconstructions in adults.[1]

According to the Hallock et al[2,3] microsurgical flap classification, the type we are describing would be classed as supercharged flaps, as 2 independent vascular systems are included in the same flap.

Obtaining double vascular pedicle flaps means an additional complication to the technique, and demands good anatomical knowledge of the region from which the flap is to be taken. Only a good surgical approach to the zone can ensure the integrity of the pedicle to be dissected. The inguinal region presents another difficulty: the abundance of panniculus adiposus, which makes it difficult to approach the superficial vascular system, particularly the veins, with a great risk of damaging this. Therefore, it is suggested to perform a series of dissections that enables us to establish a correct surgical approach to the superficial circumflex iliac system.

Material and Method

Patients

During the 2005-2006 period, 3 patients attended the Department of Maxillofacial Surgery at the Hospital Universitario Joan XXIII. Two were suffering from carcinoma, and 1 had a firearm injury. All 3 cases required a mandibular reconstruction with micro-vascularised iliac crest osteocutaneous flap.

Dissection

As a prior step to the first of these interventions, the inguinal regions of 5 cadavers were dissected in the dissection room at the Human Anatomy and Embryology Unit at the Faculty of Medicine of the Rovira i Virgili University. This consisted of dissecting 5 left and 5 right inguinal regions.

Flap Harvesting Technique

The incision in the skin is made at the superior limit of Scarpa's triangle, 2 cm towards the inguinal ligament. After lifting the skin flap, we find, among the density of the subcutaneous cell tissue, the superficial circumflex iliac vein (SCIV) and the superficial epigastric vein (SEV), both tributaries of the saphena magna vein before it forms its arch into the femoral vein (the average length of the SCIV is 8 cm and its average diameter is 1.3 mm).

At a rather deeper level, we find the first 2 collaterals of the femoral artery, the superficial circumflex iliac artery (SCIA) and the superficial epigastric artery (SEA), after having gone through the cribiform fascia. The SCIA follows a route parallel to the lower edge of the inguinal ligament (IL), towards the anterior superior iliac spine (ASIS), which has an average length of 8 cm and a diameter of between 1 and 2 mm. The SEA ascends to the mid portion of the abdominal wall to

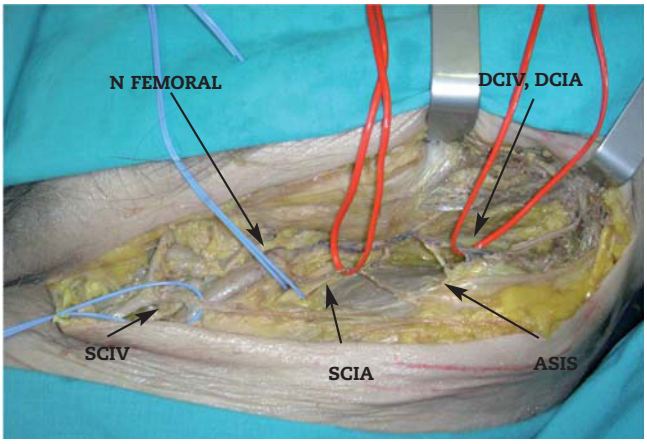

Figure 1 – Left femoral/inguinocrural region in which the superficial (SCIV and SCIA) and deep (DCIV and DCIA) circumflex iliac vessels are visible. ASIS indicates anterior superior iliac spine.

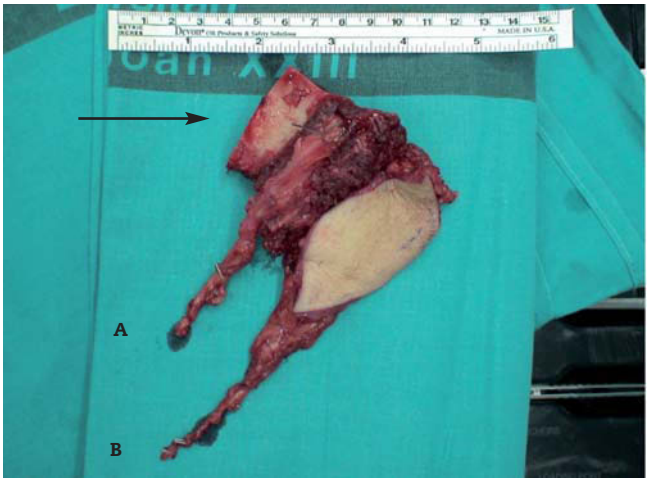

Figure 2 – Double pedicle iliac crest flap. Internal oblique muscle. Deep pedicle (A): deep circumflex iliac vessels. Superficial pedicle (B): superficial circumflex iliac vessels. Arrow: iliac crest fragment.

situate itself on the anterior rectus muscle, perforating this and anastomosing with the internal mammary artery.

The deep circumflex iliac artery (DCIA) is detached from the external iliac artery (EIA) at the IL, just before it becomes the femoral artery. The DCIA in the subperitoneum follows the superior edge of the IL, as far as the ASIS. The vein that accompanies the artery (deep circumflex iliac vein [DCIV]) crosses in front of the artery before reaching the iliac system. These vessels are between 8 and 10 cm long with sizes ranging between 1.5 and 2.5 mm (Figure 1). The femoral cutaneous nerve or lateral femoral cutaneous nerve runs, at this level, through the opening up of the iliac fascia and crosses the circumflex iliac vascular pedicle.

When all the aforementioned elements have been located, the final vascular pedicle is dissected at the superficial face of the iliac portion of the iliopsoas muscle. The deep pedicle is approached and resected traditionally[4-6] with a small portion of internal oblique muscle. Up to 15 cm of bone segment can be obtained.

Results

Case 1

A 58-year-old male suffering from squamous cell carcinoma in the floor of the mouth and left mandible. Resective surgery, tracheostomy and functional emptying are performed. The injured area was reconstructed with a microsurgical double pedicle iliac crest flap (Figures 2-4).

Case 2

A 45-year-old man was suffering from advanced carcinoma of mandible. Surgical treatment required radical surgery with cervical emptying. The zone was reconstructed using a microsurgical iliac crest flap with double vascular pedicle.

Case 3

A 43-year-old male. He was suffering from a firearm injury as a consequence of a suicide attempt. There is a great deal of soft tissue and bone destruction, which are primarily reconstructed by debridement, suturing, and osteosynthesis. The middle third of the mandible presents a great deal of bone loss. Overall, the patient requires a large scale facial reconstruction. The secondary reconstruction of the injuries starts with a mandibular reconstruction. To simultaneously cover both defects (skin and bone), it was decided to perform an iliac crest flap with skin paddle, including a small portion of internal oblique muscle for the intraoral closure. As a great deal of 3-dimensional mobility was required from the skin islet, the transplant was performed with a microsurgical flap with iliac crest and double vascular pedicle.

Discussion

The iliac crest flap is commonly used in mandibular reconstruction, as its structure allows a portion of internal oblique muscle and skin from the inguinal regional to be incorporated, expanding its field of application. Initially, the vessel accompanying the flap was the superficial circumflex iliac artery. In 1979, Taylor et al[7] described the flap shaping including the deep artery.

The drawbacks of this type of flap are, on the one hand, the soft parts it includes, as these can sometimes be very large and difficult to position 3-dimensionally. On the other hand, as a result of the large volume of the flap, venous return can be very difficult.[8]

Authors such as Safak et al[9] (1997) describe the possibility of harvesting the flap without an internal oblique muscular

stump, dissecting the main perforating artery to the ascending branch of the DCIA, which runs along the deep face of this muscle. However, this artery is only present in 30% of cases.

To resolve these problems, sometimes a second microsurgical soft tissue flap is harvested, such as the antebrachial, scapular, anterolateral muscle, lateral arm, or the jejunal.[10-19] These solutions involve a considerably increased risk of morbidity and surgical time, as they require 2 donor zones and independent surgical fields.

The variation in harvesting the flap we suggest allows a considerable reduction of the volume and the need for subsequent refinements. The morbidity of the donor zone is reduced and allows a better repositioning of the skin islet, as its blood supply does not depend on the perforating vessels. On the other hand, by performing a second arterial anatomises with the superficial circumflex system, and the fact that the flap includes 2 independent vascular systems, allows us to improve its blood supply from 2 independent sources. This technique also allows better venous return if both the superficial and deep systems are anastomosed. The flap obtained is not so voluminous, since it is not necessary to include the portion of the internal oblique muscle to guarantee the perforating cutaneous vessels.

On the other hand, if the skin paddle receives its blood supply from an artery other than the ascending branch of the DCIA, the muscular portion and the osseous crest can be separated, which improves the possibilities of 3-dimensional reconstruction.

In the literature consulted, no studies were found describing the use of flaps of the type we describe. Only Akoz et al[1] describe the use of the double pedicle iliac crest flap for a single case of penis reconstruction.

If we believe that the presence of a single vascular pedicle in the flap may be insufficient to make it viable, the use of a supercharged flap could be very useful. This variation allows increased blood flow to the skin islet, creating a second arterial anastomosis, that of the SCIA. At the same time, venous return can be improved by creating the anastomoses with the superficial venous system (SCIV), or both, the arterial and venous, by double anastomosis.

Conclusions

The main pedicle of the iliac crest flap is the deep circumflex iliac system. This variation enables us to guarantee additional arterial and venous blood flow originating from a source other than the skin islet. This enables us to save minor oblique muscle, thus reducing morbidity in the donor zone. It also provides us with a better 3-dimensional positioning of the soft tissues. In exchange, there is the need to carry out an additional anastomosis.

Figure 3 – Appearance of the skin islet, 1 year after the surgery. Observe the squamous metaplasia of the skin islet.

Figure 4 – Note the osteosynthesis of the iliac crest in the mandibular remnants.

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