

# Fasciocutaneous sural flap for soft tissue coverage in the third distal leg, ankle and foot

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## ABSTRACT

**Introduction:** High energy injuries in lower limbs are often associated with soft tissues defects, and reconstruction comes as a challenge. In the distal third of the leg and the foot, perforator artery flaps are the best option for coverage. The aim of this study is to report results in the treatment of soft tissues injuries in the distal leg, the ankle and the heel using exclusively fasciocutaneous sural perforator flaps.

**Materials and Methods:** Between March 2008 and February 2016, at our center we used 37 fasciocutaneous sural flaps in 35 patients. The inclusion criteria were all the patients with soft tissues defects in the distal third of the tibia and the heel, with bone or tendon exposure or defect in the sole pad. Patients averaged 49.6 years old and the average follow-up was of 18 months.

**Results:** We got complete coverage of the defect in soft tissues in 29 cases. We detected three flaps with partial necrosis and five with complete necrosis; four of these patients had history of vascular disease. The size of the defect was of 9.6 x 6.7 cm (15 x 9).

**Conclusions:** Although this is not an extensive series, its results coincide with those already published. We believe that this flap comes as a viable alternative for distal leg and feet injuries, with low complication and morbidity rates in the affected limb and satisfactory results.

**Key words:** Sural flap; soft tissues defects; distal tibial; ankle; foot.

**Level of evidence:** IV

## COLGAJO FASCIOCUTÁNEO SURAL PARA LA COBERTURA DEL TERCIO DISTAL DE PIERNA Y PIE

### RESUMEN

**Introducción:** Los traumatismos de alta energía en miembros inferiores se asocian, con frecuencia, a defectos de partes blandas y su reconstrucción puede presentarse como una tarea desafiante. En el extremo distal de la pierna y el pie, los colgajos de perforantes representan la mejor opción de cobertura. El motivo de este trabajo es comunicar el resultado del tratamiento de lesiones de partes blandas de pierna distal, tobillo y talón utilizando exclusivamente el colgajo de perforantes fasciocutáneo sural.

**Materiales y Métodos:** Entre marzo de 2008 y febrero de 2016, en nuestro Hospital, se realizaron 37 colgajos fasciocutáneos surales en 35 pacientes. El criterio de inclusión fue todo paciente con defecto tegumentario en el tercio distal de tibia y talón con exposición ósea, tendinosa o defecto de la almohadilla plantar. La edad promedio fue de 49.6 años y el seguimiento promedio, de 18 meses.

Conflict of interests: The authors have reported none.

**Resultados:** Se logró la cobertura completa de defecto de tejidos blandos en 29 casos. Se detectaron tres colgajos con necrosis parcial y cinco con necrosis completa; cuatro de estos pacientes tenían antecedentes de enfermedad vascular. El tamaño del defecto fue de 9,6 x 6,7 cm (15 x 9).

**Conclusiones:** Aunque esta serie no es extensa, los resultados coinciden con los publicados. Creemos que este colgajo es una alternativa viable para lesiones distales de pierna y pie, con una baja tasa de complicaciones y de morbilidad en el miembro afectado, y con resultados satisfactorios.

**Palabras clave:** Colgajo sural; defectos de partes blandas; tibia distal; tobillo; pie.

**Nivel de Evidencia:** IV

## Introduction

High energy injuries in lower limbs are often associated with soft tissues defects, and reconstruction comes as a challenge. In the particular case of ample defects in the distal third of the leg, the ankle and the heel, surgeons have historically resorted almost always to microvascular free flaps.

Nowadays, leg perforator flaps have come to the fore, because they avoid morbidity in the main vessels, imply using procedures in the same limb with no morbidity in the donor site, and technically they can be lifted by orthopedists without training in microsurgery.<sup>1-4</sup>

The aim of this study is to report the results of the treatment of soft tissues injuries in the distal leg, the ankle and the heel using a fasciocutaneous sural perforator flap.

## Materials and Methods

Between March 2008 and February 2016, at our centre we used 37 sural fasciocutaneous flaps in 35 patients. The inclusion criteria were all the patients with soft tissues defect in the distal third of the tibia and the heel, with bone or tendon exposure or defect in the sole pad.

Twenty-nine patients had suffered an injury of traumatic origin and, six, one of non-traumatic origin (bilateral in two of them). The cases of traumatic origin were:

- Fifteen patients with history of distal leg fracture (12 cases of open fracture) (Figure 1).
- Seven patients suffered ankle fracture (open in five cases). The remaining two patients showed soft tissues defects due to pressure ulcers (one case) and the seventh patient developed wound necrosis in the fibular approach with exposure of osteosynthesis.
- Six patients had history of calcaneus open fracture.
- One patient had history of toes and metatarsal crushing that required midtarsal amputation with consecutive necrosis of the sole flap, which was the defect of coverage to be treated.

The cases of soft tissues injury of non-traumatic origin which required coverage were:

- Three with ankle ulcers of vascular origin
- One with spinal injury who developed pressure ulcers in both heels (bilateral flaps).
- One with history of tarsal arthrodesis who developed coverage defect due to necrosis of the lateral approach.



▲ **Figure 1.** Soft tissues defect.

- One with sequel of structured talipes equines deformity due to multiple trauma who, upon receiving bilateral correction at the acute stage, developed a coverage defect that required bilateral sural flap to close the defect.

Out of the 35 patients, 11 were treated initially at our center; the rest was assisted somewhere else and referred to our center with the soft tissues defect plus chronic osteomyelitis in 23 cases.

On average, referral was six months after the accident (ranging from 2 months to 2 years) with more than one previous surgical procedure. Patients averaged 49.6 years (ranging from 8 to ninety) and the average follow-up was of 18 months (ranging from 1 to 60).

Pre-operative evaluation was made determining the presence of perforator arteries by Doppler. In those cases with history of vascular disease, we evaluated the presence of the fibular artery under digital angiography.

### ***Surgical technique***

The surgical technique is widely described in the literature; however, it is worth mentioning that we used a reverse-pedicle fasciocutaneous sural flap, and as rotation pivot we took the last perforator arteries at the level of the fibular malleolus detected by Doppler.

In the area of the rotation pivot, we were careful enough so as to prevent the pedicle from bending and thus avoid vascular injury.

Among the technical details that we considered during the procedure was the position of the patient, not only for the crafting of the flap itself, which is facilitated in prone position, but also for the need of performing simultaneous procedures on bone structures that are favored by the patient's supine position.

For this reason, a high percentage of procedures were carried out with the patient in lateral position.

In two patients with respective histories of diabetes and vascular disease we set out the possibility to perform a two-stage procedure.<sup>5</sup>

The flap was designed in cutaneous island, greater than the defect to cover, and was lifted with its cutaneous axis in the direction of the vascular pedicle to decrease tension and facilitate ulterior anchorage upon rotating it.

In most cases, we opened the cutaneous bridge between the flap axis and the defect to

cover; only six patients received tunnels (Figure 2), and based on personal experience the surgeon ruled out the damage of the pivotal area.

We did not have to resort to skin graft to close the donor site (except in one patient), delaying closure 48-72 hours.

After the surgery patients were made to maintain their limb elevated and avoid pressure over the flap for 7 to 10 days.

Patients were evaluated two and four weeks after the surgery, and then on a monthly basis until definite healing (Figure 3).



▲ **Figure 2.** Defect coverage with sural flap immediately after the surgery.



▲ **Figure 3.** Late post-operative patient's status.

## Results

The average size of the cutaneous island was 9.6 x 6.7 cm (15 x 9). As regards the rotation arch of the pedicle of the flap to reach the defect area, patients were divided into two groups depending on rotation being near 90° or 180° (14 patients in the first group and 23 in the second group).

In 29 of the 37 flaps, including two-stage flaps, there were no complications and local adaptation was good with no necrosis.

In three cases, flaps showed partial distal necrosis which was treated by just advancing the flap by more distant flap crafting (avoiding the injury of the last perforator artery) or partial skin grafting with no further procedure.

There were five cases of complete necrosis in spite of an appropriate surgical technique. It is worth highlighting that these patients with complete necrosis of the flap had history of serious peripheral vascular disease (4 cases) and sarcoidosis (one case). Moreover, three of them were long-term smokers and all of them were >50 years old. These characteristics are prognosis factors that can be associated with higher failure rates in this type of flaps; however, they do not represent a contraindication for this type of surgeries. If a given patient accumulates bad prognosis factors, failure probabilities are clearly higher, but they do not represent surgical contraindications either.

## Discussion

Over the past years there has been an increase in the use of fasciocutaneous sural flaps to cover soft tissues defects in the distal third of the leg and the foot. Success with these flaps is associated with the type of patient and the type of injury; success rates are high in young and healthy patients whose defect is of traumatic origin.

Usually complications occur in the elderly with comorbidities.

Parret et al.<sup>6</sup> report 50% of complications in 57 patients: 16% in healthy patients and 34% in unhealthy patients with comorbidities such as diabetes, peripheral vascular disease and smoking. Similarly, Baumeister<sup>7</sup> report that 36% of 70 flaps showed partial or total necrosis in patients with comorbidities. This rate is high as compared to other authors' such as Yilmaz et al.<sup>2</sup> (12%), Hasegawa et al.<sup>1</sup> (5%), Rajacic et al.<sup>3</sup> (14%) Touam et al.<sup>8</sup> (5%) and Fraccalvieri et al.<sup>9</sup> (17%). Only Almeida et al.<sup>10</sup> report similar rates of necrosis—26.3%. The latter authors report lower complication rates because they operated on healthy patients with history of traumatic injury. In our country, Iglesias et al.<sup>11</sup> also highlight the virtues of this flap with results similar to those in the global literature.

In our piece of research there were five patients who suffered major complications with complete necrosis of the flap, which are associated with history of peripheral

vascular disease, smoking and old age, and coincides with most authors. There were minor complications such as partial necrosis in three patients which might be attributed to flaps with excessively long pedicles.

Other issues to consider for the sake of good results in flapping are the patient's elevation of the limb immediately after the surgery to avoid or decrease venous congestion, as well as excessive pressure upon the flap.

The fasciocutaneous sural flap comes as an alternative to free flaps in the treatment of the distal injuries of the leg; the rotation pivot should be kept about 5 or 6 cm above the lateral malleolus with a wide and short pedicle to decrease the risk of vascular complications.

Peripheral vascular disease does not contraindicate these flaps, but surgeons should be careful, as stated by

Noack et al.;<sup>12</sup> for example choosing a more proximal rotator pivot and perhaps using a two-stage technique so as to avoid or decrease vascular crisis with low blood flow to the flap. Such technique consists of lifting exclusively the cutaneous island and waiting 7 to 10 days to stimulate blood flow through the perforator arteries that supply the flap, at what time the flap is moved.<sup>5</sup>

## Conclusion

Although our series is not extended, results coincide with those in literature. We believe that this flap comes as a viable alternative for distal leg and feet injuries with low complication and morbidity rates in the affected limb, and satisfactory results.

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