Saphenous Neurocutaneous Flap and Cement Spacer Replacement in the Management of Arthroplasty of an Infected Knee with a Soft Tissue Coverage Defect. Case Report

Tamara Dainotto, Gonzalo Viollaz, Hernán del Sel, Fernando Lopreite
Hip and Knee Team, Orthopedics and Traumatology Service, Hospital Británico de Buenos Aires, Autonomous City of Buenos Aires, Argentina

ABSTRACT

Soft tissue defects in the setting of periprosthetic joint infection represent serious problems for orthopedic surgeons following total joint replacement. This report aims to show our experience using the proximal-based saphenous neurocutaneous flap for the reconstruction of a wound defect in the treatment of a periprosthetic knee infection.

A new cement spacer was placed and a neurocutaneous saphenous flap was performed in the same stage. **Conclusions:** Soft tissue defects around the knee can be effectively solved with the neurocutaneous saphenous flap, which provides adequate coverage to this joint within the context of infected arthroplasty.

Keywords: Neurocutaneous saphenous flap; soft tissue defects; tissue necrosis; knee arthroplasty.
Level of Evidence: IV

Colgajo neurocutáneo safeno y recambio de espaciador de cemento en el manejo de una artroplastia de rodilla infectada con defecto de cobertura cutánea. Reporte de un caso

RESUMEN

Los defectos de cobertura asociados a una infección de la prótesis son un desafío al cual nos enfrentamos los cirujanos ortopédicos en el posoperatorio de un reemplazo articular. El objetivo de este artículo es comunicar un caso de defecto de cobertura tratado con un colgajo neurocutáneo safeno por una artroplastia de rodilla infectada. Se recambió el espaciador y se cubrió el defecto tegumentario con colgajo neurocutáneo safeno en un mismo tiempo. **Conclusiones:** El colgajo neurocutáneo safeno proporciona una adecuada cobertura en la cara anterior de la rodilla y permite tratar defectos tegumentarios asociados a una infección de la prótesis.

Palabras clave: Colgajo neurocutáneo safeno anterógrado; defecto de cobertura; necrosis cutánea; artroplastia de rodilla.
Nivel de Evidencia: IV

INTRODUCTION

Infection of the prosthesis associated with an integumentary defect is a complication feared by orthopedic surgeons after joint replacement. The anterior aspect of the knee is a difficult anatomical site due to the few integuments that surround it, as well as the depth of the main vessels. [1,2]

Received on August 23rd, 2020. Accepted after evaluation on April 2nd, 2021 • Dra. TAMARA DAINOTTO • dainottotamara@gmail.com https://orcid.org/0000-0002-6645-9928
How to cite this article: Dainotto T, Viollaz G, del Sel H, Lopreite F. Saphenous Neurocutaneous Flap and Cement Spacer Replacement in the Management of Arthroplasty of an Infected Knee with a Soft Tissue Coverage Defect. Case Report. *Rev Asoc Argent Ortop Traumatol* 2021; 86 (4): 529-536. https://doi.org/10.15417/issn.1852-7434.2021.86.4.1194

The aim of this article is to present the clinical-radiological outcomes of a patient with necrosis on the anterior aspect of the knee, treated with a saphenous neurocutaneous flap in the context of multiple interventions performed after a joint replacement.

CLINICAL CASE

A 54-year-old ex-smoker male with high blood pressure and morbid obesity. He had undergone a total knee replacement for genu varus osteoarthritis in December 2016 at another center. He had an acute infection of the prosthesis with a fistula in the distal third of the surgical scar (Figure 1A), for which he required, in June 2017, surgical debridement and conversion to a spacer without rescue of germ cells (Figures 1B and C). Upon physical examination three weeks after surgery, a 2 x 3 cm area of necrosis was observed in the area of the initial fistula (Figure 1D).

Figure 1. A. Fistula in the distal third of the surgical wound in the left knee. **B and C.** Anteroposterior and lateral radiographs of the cement spacer. **D.** Necrotic area in the area of the fistula on the anterior aspect of the knee over the insertion of the patellar tendon in the anterior tuberosity of the tibia.

The patient was referred to our Service. In order to cure the infection, understanding the importance of vascularized coverage, the spacer was replaced (Figure 2) and the coverage defect was treated with the saphenous neurocutaneous flap described by Masquelet, at the same surgical stage..

Surgical technique

First stage: The knee was entered into through an external parapatellar approach, respecting the initial scar, with debridement of the necrotic tissue and the devitalized integument in the anteromedial portion and the distal third of the knee. The spacer was replaced, and six deep tissue membrane and bone samples were taken and sent for microbiological analysis. A preformed cement spacer with gentamicin was placed, with the addition of cement with 3 g of vancomycin to complement the defects and local antibiotic coverage.

Second stage: the patient remained in the dorsal decubitus position, with the ipsilateral hip in flexion and abduction, and knee flexion at 90 °. The saphenous neurocutaneous flap was designed according to the skin marking (Figure 3) and the previous Doppler ultrasound. The exploratory incision was made in the subdermal plane and the internal saphenous vein was recognized as a guide. Next, the pedicle was dissected 2 cm anteriorly, the incision was deepened, and the fascia was incised with translucence recognition of the saphenous nerve over it.

Figure 2. Anteroposterior and lateral radiographs of the new antibiotic-loaded cement spacer. Postoperative control.

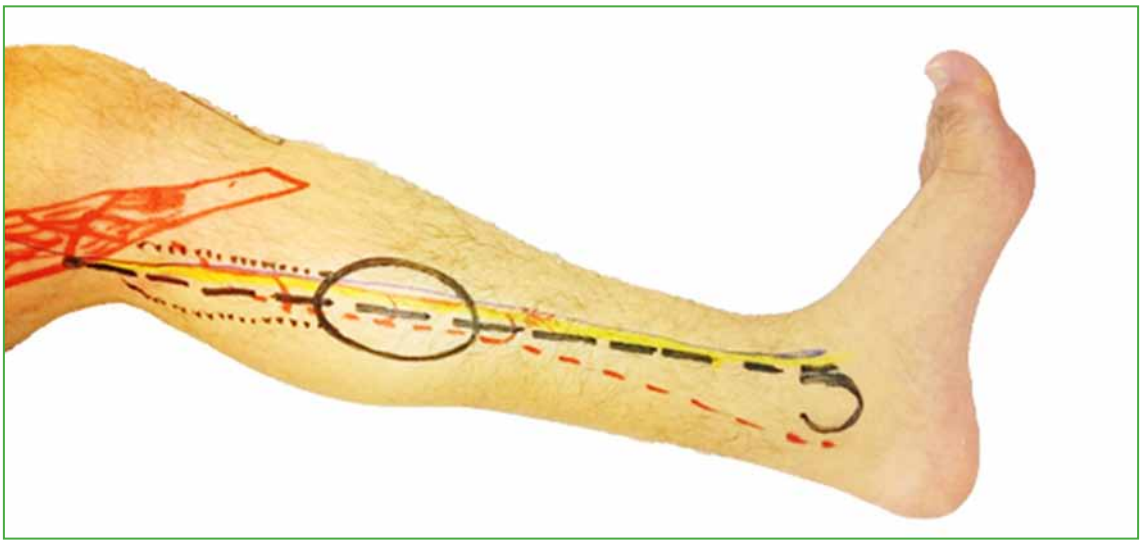

Figure 3. Preoperative skin marking for the Masquelet flap.

The saphenous vein and saphenous nerve within the pedicle ensure the survival of the flap. The pedicle and flap were completely carved from the subfascial plane, keeping a 2 cm pedicle on each side of the mentioned elements. The saphenous vein and saphenous nerve were ligated at the distal end of the flap. The flap was released and the defect was covered (Figure 4).

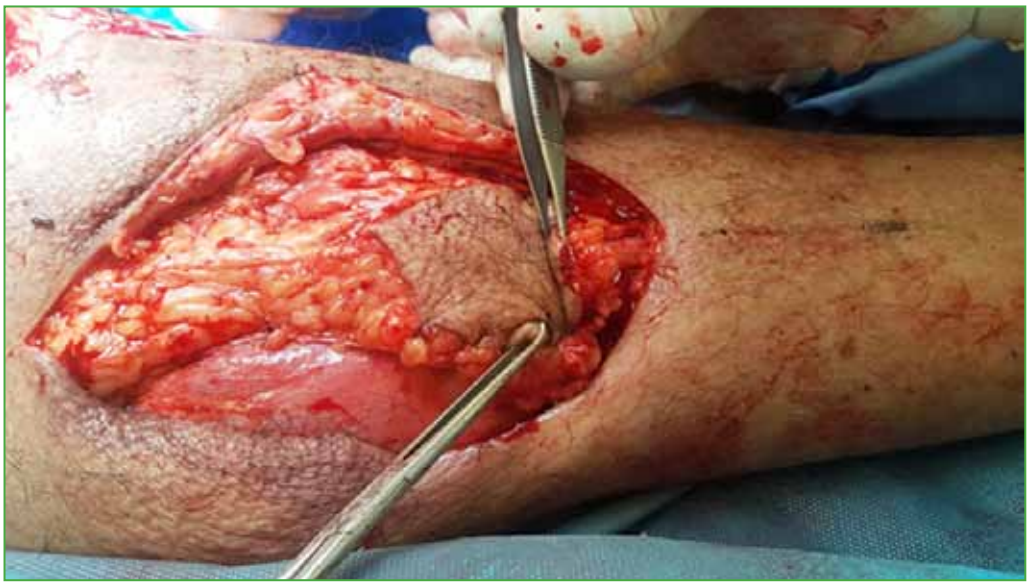

Figure 4. Carving and releasing of the saphenous neurocutaneous flap.

Figure 5. A. A 6 x 5 cm soft tissue defect on the anterior aspect of the left knee. **B and C.** Wound closure and coverage of the defect on the knee, with the placement of a drain.

Two drains were placed, the wounds were closed, and an elastic bandage without compression was placed (Figure 5). The vitality of the flap was monitored every 12 h, during the first 72 hours. The patient stood up with an immobilizer and weight-bearing at 24 h (Figure 6).

In the microbiological culture, extended-spectrum β-lactamase-producing *Klebsiella pneumoniae* was isolated. The Infectious Diseases Service indicated ertapenem for two months.

With clinical-humoral parameters of remission of the infection[3] and after having achieved adequate coverage and healing, the conversion to a knee prosthesis was carried out in January 2018 (Figure 7).

Figure 6. A. Control of the wound two weeks after surgery. **B.** Control of surgical scars 45 days after surgery, once the stitches had been removed.

Figure 7. Anteroposterior and lateral control radiographs in the immediate postoperative period.

Currently, the patient has no infection according to clinical and laboratory parameters and he walks unaided and without limitation. Radiographic signs of loosening of the prosthesis are not observed (Figure 8) and flexion-extension is 0-120 ° (Figure 9).

Figure 8. Anteroposterior and lateral radiographs two years after conversion from cement spacer to revision knee replacement. No signs of loosening or osteolysis are observed.

Figure 9. Current images of the knee in extension. Two-and-a-half year follow-up after the last spacer-to-prosthesis conversion surgery. Correct healing of the flap and adequate range of motion.

DISCUSSION

Complications in the surgical wound of a primary joint replacement or a revision surgery of a knee prosthesis can account for up to 20% of all complications. There is a risk of skin necrosis with soft tissue involvement, which implies a high risk of prosthesis infection, soft tissue coverage defects, and even limb amputation.[1] Occasionally, the use of flaps is required to achieve adequate treatment of these defects and thus plan a new surgery.[2,3]

The fine skin and tissues that surround the knee allow flexion-extension movements. The ideal coverage should have the same characteristics as the lost tissue, with similar elasticity, thickness, color, texture, and tension.[4,5]

To plan the treatment of a soft tissue defect, it is important to assess certain factors, such as size, location, associated contamination, and the state of the surrounding tissues, as well as the clinical state of the patient and his/her comorbidities.[3,4]

There are various options for treating coverage defects with bone or implant exposure in the anterior aspect of the knee, including local, regional, or remote flaps. The first two offer the possibility of covering the defect with similar tissues, and the technique is less complex. The main disadvantage is not having large flaps due to the scarce anatomical donor area, added to the scar tissue that may exist.

A historically known regional flap option for the proximal tibia is the medial belly of the gastrocnemius muscle, which provides richly vascularized tissue with low complexity carving.[6,7] The main disadvantage is the difficulty to cover pre-patellar defects, even when disinserting the gastrocnemius muscle from its proximal insertion. It is also possible to carve pedicle flaps from the peroneal artery, perforating the medial sural artery or the axis of the lateral circumflex femoral artery.

Free flaps from healthy tissue donors allow large defects to be covered and specialized coverage to be performed. Its use requires specific microsurgical training.

In 1992, Masquelet detailed, in 64 patients, the vascular axes that accompany three nerves of the leg, including the saphenous nerve. He described the antegrade saphenous neurocutaneous flap for the coverage of soft tissue defects in the knee and the proximal third of the leg, applying it in six clinical cases.[5] The saphenous nerve emerges from the depth of the sartorius muscle accompanied by the saphenous artery, which forms an anastomotic network around the saphenous nerve, branching out to the skin of the medial region of the leg from the knee to 3-5 cm proximal to the medial malleolus, where the last anastomosis of this vascular axis with the posterior tibial artery is located.[5,6] Few scientific studies describe the use of this flap. Dai et al. published a series of 17 patients with coverage defects of up to 9 x 18 cm who were treated with 11 x 20 cm flaps, the maximum size reported to date, with an average follow-up of 16 months. The authors reported survival of the flap in 16 cases and partial necrosis in one patient.[8]

Despite the limited literature on the matter, the usefulness of this antegrade axis flap has been demonstrated for the coverage of small and medium defects in the anterior aspect of the knee, the anterior tuberosity of the tibia and the proximal third of the leg, and it is contraindicated if there is severe venous insufficiency or scarring in the pedicle area.

CONCLUSIONS

The Masquelet saphenous neurocutaneous flap is an interesting alternative to treat coverage defects in the context of knee joint replacement. Although the size it allows to cover is a limiting factor, it generates little morbidity by not compromising muscle structures, and the gastrocnemius can be chosen as a second option, if necessary. In our case, it allowed us to cover an anteromedial sector of the knee that was necrotic, facilitating the treatment of the knee prosthesis infection.

Conflict of interests: The authors declare they do not have any conflict of interests.

G. Viollaz ORCID ID: https://orcid.org/0000-0002-4573-883X
H. del Sel ORCID ID: https://orcid.org/0000-0002-3655-1408
F. Lopreite ORCID ID: https://orcid.org/0000-0002-2065-8649

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