



## Distally based sural flap in children's ankle trauma

### *Lambeau sural a pedicule distal dans les traumatismes de la cheville de l'enfant*

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#### RESUME

**Introduction :** Le lambeau sural à base distale est un lambeau fascio-cutané à pédicule distale. Ce lambeau cutané-aponévrotique permet la couverture des pertes de substance cutanée au niveau de la cheville.

**Objectif :** Démontrer la fiabilité du lambeau sural dans la couverture de la perte de substance de la face postérieure de la cheville chez la population pédiatrique.

**Méthodes :** Etude rétrospective monocentrique transversale portant sur 14 enfants ayant une perte de substance cutanée étendue au niveau de la face postérieure de la cheville, mettant à nu le tendon calcanéen et l'articulation sous-astragalienne. Tous les enfants ont eu la même technique opératoire.

**Résultats :** Le tendon calcanéen était à nu dans 9 cas. Ils s'y sont associés 3 cas d'ouverture de l'articulation sous-astragalienne et 2 cas de section partielle du tendon calcanéen. Le délai moyen de la réalisation du lambeau sural était de 3 jours. La nécrose superficielle du lambeau a été notée dans 4 cas. La cicatrisation complète est obtenue en moyenne à 5 semaines. Au recul moyen de 29,6 mois, 13 chevilles avaient une mobilité normale et une cheville était raide.

**Discussion :** L'indication principale du lambeau sural à base distale est la perte traumatique de tissu cutané. Le lambeau sural à pédicule distal est la technique de choix pour la couverture des pertes de substance de la face postérieure de la cheville en pratique pédiatrique.

#### ABSTRACT

**Background:** The distally based sural flap is a fascio-cutaneous flap with a distal pedicle. This skin-aponeurotic flap covers loss of skin substance of the ankle.

**Aim:** To demonstrate the reliability of the distally based sural flap in covering the loss of substance of the posterior aspect of the ankle in the pediatric population.

**Methods:** Single-center, cross-sectional retrospective study of 14 children with extended loss of skin substance at the posterior side of the ankle, exposing the calcaneal tendon and the subtalar joint. All the children had the same surgical technique.

**Results:** The calcaneal tendon was exposed in 9 cases. It has been associated in 3 cases to opening of the subtalar joint and in 2 cases to partial section of the calcaneal tendon. The average timeframe for performing the sural flap was 3 days. Superficial necrosis of the flap was noted in 4 cases. Complete healing is obtained on average at 5 weeks. At a mean follow-up of 29.6 months, 13 ankles had normal mobility and one ankle was stiff.

**Discussion:** The main indication for the distally based sural flap is traumatic loss of skin. The distal pedicle sural flap is the mainstream technique for covering posterior ankle tissue loss in the pediatric population.

## I- Introduction

The traumatic loss of cutaneous substance at the posterior side of the ankle is an uncommon lesion in the pediatric population. The management of this injury poses a real problem. Knowledge of cutaneous vascularization, emanating from neurovascular axes, has led to the discovery of skin flaps including the distally based sural flap.

## II- Aim

To demonstrate the reliability of the distally based sural flap in covering the loss of substance of the posterior aspect of the ankle in the pediatric population.

## III- Methods

We conducted a cross-sectional, single-center retrospective study of 14 children treated with a distally based sural flap to cover extended loss of skin at the posterior side of the ankle. The inclusion criteria were the traumatic origin of the injury and patients aged less than 18 years. Exclusion criteria were incomplete records and the tumor or infectious origin. The clinical data were gathered from the medical files and the photographs taken perioperatively. The criterion of judgment for the realization of the distally based sural flap is the exposure of noble elements around the ankle. The evaluation of the results was clinical, based on complications and ankle range of motion. The selected population consisted of 9 boys and 5 girls with an average age of 7.8 years (6-11 years). Six children had an external fixator Hoffman 2 anti-equine beforehand. The surgical technique was the same for all children. The surgery was performed under general anesthesia in the prone position with a pneumatic tourniquet on the thigh. Tracing the site of the skin incision was beforehand. The flap was slightly larger than the recipient site. The short saphenous vein is ligated proximally. The vein and sural nerve were severed proximally. The dissection of the pedicle stops 3 centimeters above the tibial malleolus. After trimming of the recipient site, coverage was done under skin drainage. Early postoperative complications (partial necrosis or total, venous congestion, infection) and late (scar unsightly dystrophic, discomfort when putting on footwear, chronic ulceration, sensitive disorders at the flap and site donor, neuropathic pain) were sought. We evaluated the functional impact after distally based sural flap by the modified Kitaoka score <sup>[1]</sup>. The follow-up of the patients was 16 to 50 months with a mean follow-up of 29.6 months.

## IV- Results

The etiology of the skin loss was entrapment of the heel of the foot in the spokes of a motorcycle wheel in 13 cases and a crushed ankle in a traffic accident in one case. The calcaneal tendon was exposed in 9 cases. Exposure of the subtalar joint or calcaneus (Figure 1) was noted in 3 cases and partial section of the calcaneal tendon in 2 cases. All the children underwent a surgical exploration of the wound, a trimming, and a stabilization of the ankle

by an external tibio-1st metatarsal fixator in 6 cases. The tendon suture was also performed urgently. The average time to perform the DBSF was 3 days (2-4 days).



**Figure 1:** Loss of skin substance in the heel with exposure of the calcaneus. Perte de substance cutanée au niveau du talon avec exposition du calcaneus.

The external fixator was removed after an average of 4 weeks (3-6 weeks). The closure of the donor site was instantaneous in 6 cases (Figure 2) and with dynamic suture in 8 cases.



**Figure 2:** Coverage with a distally based sural flap and instant closure of the donor site. Couverture avec un lambeau sural à base distale et fermeture instantanée du site donneur.

Superficial partial skin necrosis of the distally based sural flap was objectified in 4 cases due to venous congestion, which the evolution was favorable. At the mean follow-up of 29,6 months, we noted 3 unsightly dystrophic scars at the donor site (Figure 3), 1 hypertrophy of the subcutaneous fat, 1 junction syndrome (trophic disorders) at the recipient site and 1 stiff ankle but with plantigrade walking.



**Figure 3:** Dystrophic and unsightly skin scar at the donor site. Cicatrice cutanée dystrophique et inesthétique au niveau du site donneur.

The mean value of the modified Kitaoka score was 73/80. This score was considered excellent in 10 cases (71.5%) (Figure 4), good in 3 cases (21.5%), and bad in 1 case (7%). One patient had a stiff ankle with a Kitaoka score of 40/80 following an ankle crush.



**Figure 4:** Clinical result of a sural flap in the left ankle at one year follow-up. Résultat Clinique d'un lambeau sural au niveau de la cheville gauche au recul de un an.

## V- Discussion

Skin loss substance of the ankle posterior side exposing noble anatomical features in the pediatric population is not common. Few paper focused on this subject [2,3]. In our series, we have described an entity and a mechanism that is frequent in our country. Typically, in the case of a child who is a rear passenger of a motorcycle, the heel may be trapped in the spokes of the rear wheel. There are many options for coverage of these defects, including fasciocutaneous flap and internal plantar flap. The distal-based sural flap is very useful for covering heel and foot defects when the loss of substance is significant. Something the internal plantar flap cannot accomplish. It is reliable, easy to take with minimal morbidity. This flap does not sacrifice any of the major vessels of the limb and hence it is very safe flap [4]. The main indication for the distally based sural flap is traumatic skin loss [2,5]. There are other indications for this flap, including coverage of loss of substance in the distal third of the leg, ankle, midfoot and forefoot [6,7]. If there is important damage of calcaneal tendon, the distally based sural flap with gastrocnemius tendon reconstruction is a viable and practical method to salvage Achilles tendon defect and overlying soft tissue coverage, with minimal adhesion and satisfactory function [5]. The realization of an external fixator makes it possible to reduce the vascular complications at the level of the flap in relation to the compression of the pedicle or the direct compression of the flap against the bed, since it is a flap located in a support zone [2]. The clinical results are excellent to good in the different series of the literature [8]. The early complications are especially by partial or superficial necrosis of the flap without major impact on the final result [2,7]. The two-step technique [9] and double-pedicle propeller flap [10] and modified distally based sural flap [11] reduced morbidity related to the vascularization of the flap. In addition, Flap choice should be based on the size of the defect. For large diameter loss of substance, the distally based sural flap is not applicable [12]. There are two major complications that are sequelae at the recipient site, functional at the ankle in relation to joint mobility and footwear. Sequelae at the donor site were represented by skin dystrophy with an unsightly scar. The quality of skin healing at the donor site is improved by skin grafting and dynamic suturing, allowing progressive skin closure. The hypoesthesia at the level of the lateral edge of the foot related to the sacrifice of the sural nerve gradually disappears and good results have been reported by the different series [2,7]. The reconstruction outcomes in most pediatric patients were evaluated as "excellent" or "good" [2,4,13].

## VI- Conclusion

The distally based sural flap is a good alternative for soft tissue defects of the foot and ankle in children, because of its simplicity, low risk, and minimal donor site morbidity. Advances in surgical techniques have significantly reduced the morbidity associated with the removal of the flap.

## VII- References

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