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Clinical case

Contribution of local muscle flaps in the coverage of leg bone exposures at the KATI University Hospital

Apport des lambeaux musculaires locaux dans la couverture des expositions osseuses de la jambe au CHU de KATI

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Résumé

Les pertes de substance tissulaire associées ou non aux fractures de jambe constituent un problème fréquent surtout dans les pays à ressources limitées. Le but de ce travail était d'évaluer le traitement par lambeaux musculaires des pertes de substance des parties molles avec exposition tibiale dans le service d'Orthopédie-Traumatologie du CHU de Kati.

Il s'agissait d'une étude rétrospective qui a porté sur 68 pertes de substance des parties molles de la jambe traitées par lambeaux musculaires de 2012 à 2021. Le type et le nombre de lambeaux prélevés dépendaient du siège et de l'étendue de la perte de substance. Les aspects évolutifs des lambeaux ont été étudiés. Les résultats ont été classés bons, moyens ou mauvais selon une méthode basée sur des critères modifiés de d'Avila.

L'âge moyen était de 29,13 +/-13,67 ans avec des extrêmes de 8 et 69 ans. Le sex-ratio H/F était de 6,5. Le traumatisme était la principale étiologie. Il s'agissait de fractures ouvertes type IIIB de Gustillo et Anderson dans 83,8%. Lors des recouvrements, la chirurgie était sale dans 93,6% des cas. La plupart des lambeaux étaient prélevés après 6 semaines. Le lambeau le plus utilisé était le soléaire (60,3%). La cicatrisation a été obtenue sans complication dans 82,4% des cas. La nécrose totale était la complication majeure (3cas). Au stade tardif, aucune plainte fonctionnelle n'a été observée. Selon critères modifiés de d'Avila et al, les résultats globaux étaient bons dans 88,2%, moyens dans 07,4% ou mauvais dans 04,4%.

La prise en charge des expositions osseuses tibiales constitue un défi pour les chirurgiens. Le recours aux lambeaux musculaires locaux demeure une alternative de choix dans les pays à ressources limitées.

Mots-clés : Jambe, lambeaux musculaires, pertes de substances, CHU- Kati.

Abstract

Tissue loss, whether or not associated with leg fractures, is a common problem, especially in resource-limited countries. The aim of this work was to evaluate the treatment of soft tissue substance loss with tibial exposure in the Orthopedics-Traumatology department of the Kati University Hospital.

This was a retrospective study that looked at 68 substance losses from the soft tissues of the leg treated with muscle flaps from 2012 to 2021. The type and number of flaps removed depended on the location and extent of the loss of substance. The evolutionary aspects of the flaps were studied. Results were classified as good, fair, or poor according to a method based on modified d'Avila criteria.

The mean age was 29.13 +/-13.67 years with extremes of 8 and 69 years. The sex ratio M/F was 6.5. Trauma was the main etiology. These were type IIIB open fractures of Gustillo and Anderson in 83.8%. During the coverings, the surgery was dirty in 93.6% of cases. Most of the flaps were removed after 6 weeks. The most commonly used flap was the soleus (60.3%). Healing was achieved without complications in 82.4% of cases. Total necrosis was the major complication (3 cases). In the late stage, no functional complaints were observed. According to modified criteria from d'Avila et al, overall results were good in 88.2%, average in 07.4% or poor in 04.4%.

The management of tibial bone exposures is a challenge for surgeons. The use of local muscle flaps remains an alternative of choice in resource-limited countries.

Keywords: Leg, muscle flaps, substance loss, CHU-Kati.

Introduction

Tissue loss is a challenge for the orthopedic surgeon [1-7]. The leg is one of the most exposed limb segments. Direct lesions are frequent, particularly in the middle third where the tibia is made vulnerable by the skin protection on its anteromedial surface alone [1,8]. Tissue loss, whether or not associated with leg fractures, is always a problem for the surgeon and involves various difficulties in terms of viability, function and cost of treatment, especially in resource-limited countries. However, a lot of progress has been made in the last decade in the management of substance loss from the soft tissues of the leg. Several techniques have been described with their advantages and disadvantages. Many muscle and fasciocutaneous flaps have emerged and are widely used with success even by lay surgeons [7,9]. The existence of leg muscles performing the same function allowed the use of many muscle flaps without major functional disturbances. Surgery of the muscle flaps of the leg has completely changed the prognosis of significant defects [3].

The aim of this work was to evaluate the treatment of soft tissue substance loss with tibial exposure using muscle flaps.

Clinical case

- Patients:

Sixty-eight patients were included in this study. The mean age was 29.13 +/-13.67 years with extremes of 08 and 69 years. These were 59 men and 09 women (sex ratio: 6.5). Each patient had a loss of substance from the leg. Six patients received two flaps, including a medial gastrocnemius associated with a medial hemisoleus due to the extent of substance loss. All other patients each received a single flap.

- Methods:

This was a retrospective single-center descriptive study of a series of 68 pedicled muscle flaps performed for the reconstruction of the soft tissues of the leg at the Kati University Hospital. It took place over a period of 10 years from 2012 to 2021. This study concerned patients who had a loss of substance of the soft tissues with tibial exposure treated with a muscle flap whose follow-up was at least one year. Tibial exposure was primary (traumatic) or secondary (necrosis, infection). Open fractures were classified according to Gustillo and Anderson [10]. Preoperative sepsis of lesions was classified according to Altemeier [11]. According to Byrd HS [12], the time taken to complete the flaps was divided into three phases: acute (0 to 6 days), subacute (1 to 6 weeks) and late (more than 6 weeks). Regional anaesthesia was used in all patients. The installation was supine with a cushion under the contralateral buttock and a pneumatic tourniquet at the ipsilateral thigh. Prior debridement of septic lesions as many times as possible resulted in clean lesions ready for recovery. The incision was made two centimetres behind the postero-medial edge of the tibia and extended towards the popliteal fossa (if medial gastrocnemius was specified) or retromalleolar (if soleus was removed). The flap was removed while preserving the saphenous vein and nerve. The type and number of flaps collected depended on the location and extent of the loss of substance. In the case of fractures, bone reduction and stabilization were performed after flap removal. A subcutaneous tunnel was made wide enough to allow the flap to pass through to the recipient site. After lifting the tourniquet, the flap bleeding control as well as a careful hemostasis were performed. Closing the donor site with suction drainage and a greasy dressing on the flap ended the procedure. The removal of the drain was performed 72 hours postoperatively and the thin skin graft one to two weeks later. The evolutionary aspects of the flaps were studied. The results were classified as good, fair, or poor according to a method based on modified d'Avila criteria [2]. They were good if healing was achieved without suffering from the flap. The results were average for necrosis of less than a flap third. Poor results were characterized by necrosis of more than one-third of the flap with or without infection.

Data were collected from patients' medical records and operative report records. These data were analyzed using SPSS v20-32bit2 software in the following steps: coding of variables, computer input, statistical analysis of the data, and tabling to summarize the results. An association between the variables was made as well as the Chi-squared test followed by the p-value. The significance threshold was set for p-value less than 0.05. Statistical analyses were performed with a 95% confidence interval.

Ethical considerations: This study was conducted in accordance with the protocol of good clinical practice and the principles of the Declaration of Helsinki. The investigators observed total anonymity of the information obtained during the study.

Results

The main etiologies of tissue loss from the leg were traumatic. These were type IIIB open fractures of Gustillo and Anderson in 83.8% due to road accidents (72.1%) and firearm injuries (11.7%). In 16.2% of cases (n=11), the lesions were secondary to chronic osteomyelitis (11.7%) or skin necrosis (04.5%). During the coverings, the surgery was dirty (93.6%) or contaminated (04.4%). The most removed flap was the soleus (60.3%). It was used for reconstruction of the middle third (57.4%) and the distal third (02.9%). The medial gastrocnemius was used to cover the proximal third in 30.9% of cases. The combination of medial gastrocnemius and medial hemisoleus was used in 08.8% of cases to cover the loss of substance of the proximal 2/3. Only four flaps were made in the acute phase. All other flaps were collected in the sub-acute (42 cases) or chronic (22 cases) phase. Progressively, healing was achieved without complications in 82.4% of cases. Secondary complications were noted in 12 cases (17.6%). These were infection in 04 cases, necrosis associated or not with the infection in 6 cases and 2 cases of excessive budding of the flap. Necrosis was total (03 cases) or partial, affecting less than a third of the flap (03 cases). Compared to the management of total necrosis, leg amputation was performed in one case and a hetero-hamstring sural fasciocutaneous flap in two other cases. In the late stage, no functional complaints were observed. Unsightly scars (03 cases) and persistent fistula (one case) were noted. According to modified criteria from d'Avila et al [2], the overall results were good (88.2%), average (07.4%) or poor (04.4%). No statistical relationship was observed between the type of flap collected and the occurrence of complications as well as between the type of flap and the final results (p=0.913).

Table I: Flap Type and Overall Results

Type of flaps	Results			
	Good	Medium	Bad	Total
Soleus	36	03	02	41
Medial gastrocnemius	18	02	01	21
Medial Gastrocnemius + Medial Hemisoleus	06	00	00	06
Total	60	05	03	68

Chi-square = 0.977; p-value= 0.913

Discussion

In resource-constrained countries like ours, treatment options for tissue loss remain limited. The use of free flaps requires a long duration of intervention, an adapted technical platform and microsurgical expertise [6,9]. Locoregional pedicled muscle flaps are an alternative of choice in our context. The advantage of using these flaps is that they are simple, reliable, reproducible and can be performed without the assistance of a plastic surgeon [1,7,9]. Due to their posterior location and their often common function, these muscles are spared from trauma and can be removed without major functional disturbances [6]. In addition, they limit the risk of infection and allow revascularization of the necrotic bone through their rich vascularization [7,12,13]. Several muscles can be used to cover the bone exposures of the tibia with varying indications depending on the site and extent of the loss of substance. In our study, as in those of d'Avila F [2] and Barbiers O [9], the medial gastrocnemius and the soleus were the only muscles sampled. However, Ralahy MF et al [4] used lateral gastrocnemius in 02 cases on 08 muscle flaps; R Bonny-obro et al [6] used the hemi-soleus with distal pedicle, the long fibular and the long flexor toe for the coverage of the distal third.

The soleus flap was the most commonly used in this study. This is related to the predominance of losses of substance to the middle third. Classified as type II by Mathes and Nahai [1], the soleus is the reference muscle in the loss of substance in the middle third of the leg. It provides vascular safety for defects in the middle third of the leg [13-15]. Nevertheless, its variant with a distal pedicle intended to cover the distal third has minor pedicles with multiple variations that are unreliable [1,6]. The latter was subject to necrosis in the study by R. Bonny-obro et al [6]. However, it was not used in our study. As for the medial gastrocnemius, it is a great classic that can always be counted on in the loss of substance of the proximal third of the leg and knee. It is reliable almost 100% of cases and technically easy. [1,3,15,16]. It allowed the coverage of 21 losses of substance of the leg giving a good result in 18 cases. It is the most widely used flap in the series by Bertrand JT et al [5]. It is also the flap of choice in the treatment of substance loss from the prosthetic knee [18, 19].

The combination of medial gastrocnemius and medial hemisoleus was used in 6 cases (08.8%) for the recovery of extensive losses of substance from the proximal to the middle third with satisfaction in all cases. This association is widely reported in the literature, with the main advantage being the coverage of extensive substance losses [20-22].

Compared to the time taken to complete the flaps, most authors recommend early coverage [4,10,23]. This earliness of coverage must remain a constant concern. However, in countries with limited resources such as ours, the reconstruction of substance losses often comes up against significant logistical constraints. The flaps are usually made in the sub-acute or chronic phase for lesions that are more often contaminated and dirty [5,6].

Healing was achieved without complications in 82.35% of cases. Necrosis was the predominant complication encountered in 06 cases, of which 03 were total. It has been reported by several authors in varying proportions depending on the study [5,6,9]. In this series, no partial necrosis required re-covering. Total necrosis is characterized by total re-exposure of the defect, which imposes the need for an additional surgical procedure. Thus, 2 revisions by heterolegmic sural flap and an amputation were performed for the management of these total necrosis. Contrary to our study, no amputations were performed in the series by Bertrand JT et al [5]. The use of other recovery methods in the event of necrosis therefore seems essential but depends on the technical platform [4,8,9,24]. Other complications were represented by suppuration and excessive budding. The suppuration could be related to a pre-existing infection of the recipient site. She was treated with local care combined with targeted antibiotic therapy. The excessive budding of the flap was due to a delay in performing the skin graft.

No functional complaints were found in this study. G Lassere [24] reported at the end of a study of 14 cases that baropodometric analysis did not show a deficit in locomotor function after a flap taken at the expense of the triceps sural, either for walking or for greater physical exertion. Riccio also noted a complete recovery of walking ability but some deficits in kinetic parameters during the body phase [25]. The absence of other baropodometric abnormalities and the lack of impact of this surgery would be linked to a compensation of the remaining muscle leaders and/or adaptation mechanisms [24].

A statistically significant difference between muscle flaps and fasciocutaneous flaps was not reported based on indications and evolution [7, 24]. Our final results according to d'Avila's modified endpoints [2] were good in 88.2% of cases. However, a failure rate of 04.4% was found. Many authors confirm that muscle flap surgery continues to provide good results both cosmetically and functionally, with a significant risk of failure [2,6,7,9].

This study has limitations. It is monocentric and retrospective with a reduced number of students despite a period of 10 years. Risk factors for flap failures such as smoking and medical history were not identified. The area of substance losses was not measured. Bone consolidation, which is an important criterion for evaluating the results of limb reconstructions, has not been studied. The multiplicity of operators, among whom there were learners for a surgery whose performance requires competence in roofing technique or, failing that, frank and close collaboration with the plastic surgeons.

Conclusion

The reconstruction of the loss of substance from the soft tissues of the limbs is a real problem in both orthopedics and osteoarticular traumatology. Tibial exposure is very common because of its anatomical situation. The management of these lesions remains a challenge for surgeons. While several procedures are described, the use of local muscle flaps is an alternative of choice in countries with limited resources. These flaps remain reliable with a low-demand collection technique, tolerable donor site morbidity and minimal functional sequelae.

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