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CASE REPORT

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Use of foot fillet flap for knee disarticulation in children with tibial hemimelia

Uso do retalho filé plantar para desarticulação do joelho em criança com hemimelia tibial

Luis Felipe Castro Pinheiro[1], Rafael Barban Sposeto[1], Rodrigo Sousa Macedo[1], Vicente Mazzaro Filho[1]

1. Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

ABSTRACT

Tibial hemimelia is a rare disease characterized by the absence or hypoplasia of the tibia. Because of the difficulties of reconstruction due to joint involvement in more severe cases, knee disarticulation and above-knee amputations are a treatment option. We report the case of a patient treated with knee disarticulation amputation and pedicled foot fillet flap.

Level of Evidence V; Therapeutic Studies; Expert Opinion.

Keywords: Ectromelia; Surgical Flaps; Disarticulation.

RESUMO

A hemimelia tibial é uma doença rara, caracterizada por ausência ou ainda hipoplasia da tíbia. Devido às dificuldades de reconstrução pelo acometimento articular nos casos mais graves, desarticulações de joelhos e amputações transfemorais são uma opção de tratamento. Relatamos o caso de uma paciente tratada com uma desarticulação do joelho, associado a uma cobertura com retalho tipo filé plantar.

Nível de Evidência V; Estudos Terapêuticos; Opinião do Especialista.

Descritores: Ectromelia; Retalhos cirúrgicos; Desarticulação.

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INTRODUCTION

Tibia hemimelia is a rare congenital anomaly with an incidence of approximately 1/1,000,000 live births. Early amputation is generally recommended because it typically requires only one surgical procedure and allows children to undergo simple prosthetic rehabilitation[1].

Lower limb amputation in children may be an excellent treatment alternative for complex deformities because it prevents the patient from being subjected to multiple surgeries, often with frustrating results[2].

The goal of amputation in a child with congenital limb deficiency is to provide better physical functioning and to

Work performed at the Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

Correspondence: Luis Felipe Castro Pinheiro. Rua 11 Quadra 20, Casa 42. Cohatrac IV. CEP: 65054-430, São Luís, MA, Brazil
E-mail: luisfelipe_c_p@hotmail.com

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facilitate prosthesis fitting so that the child can achieve major motor development milestones in a less traumatic manner[3].

The physical repercussions of lower limb amputation in children may be partially minimized by the motor plasticity inherent to this time of life, which will be greater the earlier the procedure is performed[4].

When available, a foot fillet flap based on the posterior tibial neurovascular pedicle is a good option because it has innervated plantar skin that provides better sensation and prosthesis compliance, allowing better long-term stability and pressure-free areas[5].

Thick skin is ideal for weight bearing and can cover a relatively large area. Furthermore, the septa between the skin and the plantar fascia prevents shearing forces from being transmitted to the soft tissue when the patient is walking with the prosthesis[6].

The aim of this study is to describe a case of tibial hemimelia with indication for knee disarticulation amputation in which we covered the stump using the foot fillet flap. During the study, we did not find a description in the literature of this covering technique for knee disarticulation in tibial hemimelia.

CASE REPORT

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 10603519.3.0000.0068.

A 4-year-old female patient was followed-up by the ankle and foot group. She was delivered by cesarean section and weighed 2,580 grams and measured 43 cm in length at birth. There were no associated obstetric complications.

On orthopedic examination, there was good mobility and range of motion of the right hip joint. The right leg was shortened with varus deformity, without changes in the skin cover. The foot was anatomically described as supinated cavovarus (Figure 1A), without skin changes, with good plantar fat pad and skin quality, with tibial pulse present and without changes in tissue perfusion or sensitivity.

Radiographs of the lower limbs showed the presence of a right femur without changes in its typical shape, with a deformity classified by Jones, Barnes, and Lloyd-Roberts as Type 2[8] (Figure 1B), and a right leg with varus deformity and slight recurvatum.

Considering the young age of the patient, the early diagnosis and especially the impossibility of limb reconstruction, knee disarticulation amputation with right plantar pad transfer was indicated,.

The surgery was performed with the patient under general anesthesia and in dorsal decubitus, using a pneumatic tourniquet on the operated limb.

Surgery begins with a medial incision (Figure 2A) originating in the hindfoot, identifying and dissecting the neurovascular pedicle with the posterior tibial artery and vein and tibial nerve. This pathway is extended to the medial femoral epicondyle, protecting the neurovascular pedicle in its entirety.

The neurovascular pedicle is then dissected distally, protecting its branches, which nourish and innervate the plantar musculature and skin in the posterior, medial and plantar region of the foot (Figure 2B). Next, we extend the incision distally to the transition from the dorsal to the plantar skin, circling the entire plantar epidermis and musculature.

With the pedicle protected, the deep plane between the musculature and bone is dissected in a proximal to distal direction, completely releasing the skin, the plantar fat pad and the muscle from the bone (Figure 2C). At this surgical step, the foot fillet flap and its entire pedicle are free, to be used in the proximal coverage of the knee.

At the knee joint, a fish-mouth incision is made to join the two femoral epicondyles with the symmetrical anterior and posterior flaps. The previously dissected posterior tibial artery and tibial nerve are preserved. The fibular and anterior tibial arteries are connected, and the common peroneal nerve is sectioned with a slight pull so that a neuroma is formed proximal to the weight-bearing area.

Figure 1. A) Preoperative clinical condition; B) Lower limb X-ray.
Source: Authors' personal archive.

Normally, the patella and the patellar tendon are preserved for suturing to the posterior cruciate ligament; however, in these patients, these structures are not present due to malformations related to the patellar tendon. Thus, the hypoplastic tibia and the fibula are resected, maintaining only the foot fillet flap with its neurovascular pedicle. At this point, the tourniquet is loosened, hemostasis is complemented, and flap perfusion is evaluated.

The foot fillet flap with its skin, fat pad and musculature is carefully positioned in the distal femoral region to avoid creating any points of stenosis in the vascular bundle. The flap is attached using transosseous sutures in the femoral condyles and sutures in the subcutaneous plane to create a good coaptation between the flap and the skin of the thigh (Figure 2D and 2E).

A suction drain is placed before the end of the closure. After the skin is sutured, a slightly compressive dressing is applied. At 12 hours after surgery, the drain is removed due to low output.

During outpatient follow-up, the patient progressed well, with proper healing of the surgical wound and no signs of wound infection or dehiscence.

Physical therapy was started during the patient's hospital stay and included passive exercises such as flexion, extension, adduction and abduction of the hip and stretching of the hip flexors and abductors. Edema control and active lower limb strengthening were started during the third postoperative week, following the healing of the skin cover. After maturation of the stump, exercises to train for terminal weight-bearing on the flap were initiated and progressed (Figure 3A and 3B).

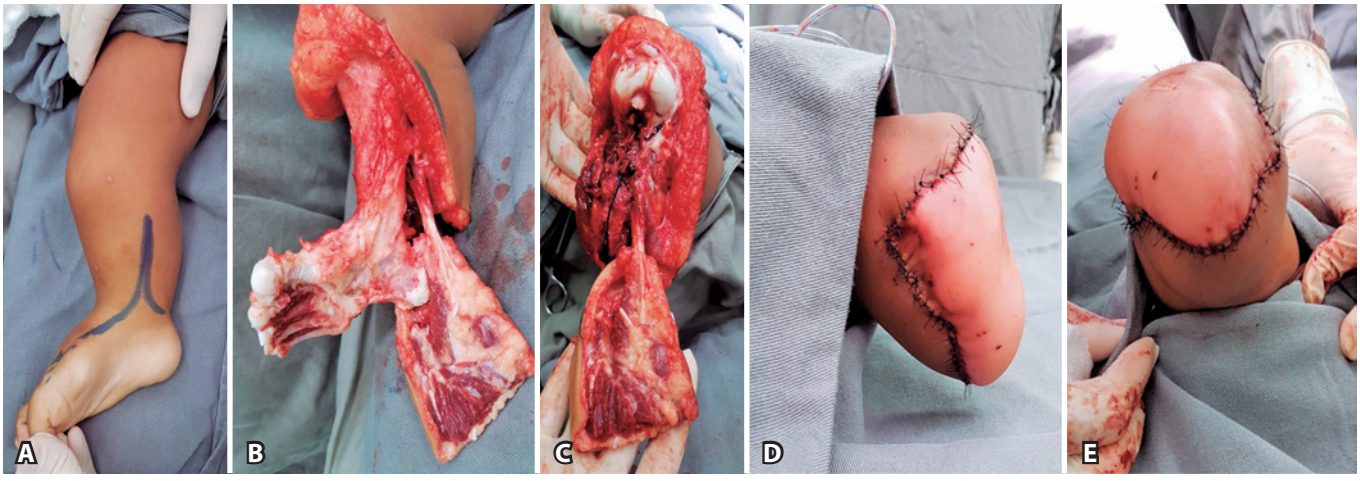

Figure 2. A) Surgical planning; B and C) Deep dissection of the right leg; D and E) Foot fillet flap placed on the distal femur.
Source: Authors' personal archive.

Figure 3. A and B) Front and side views of the stump 8 months after surgery; C) Right leg prosthesis.
Source: Authors' personal archive.

A stiff-knee prosthesis was prescribed (Figure 3C) to begin gait training, with terminal weight-bearing on the stump between the fourth and fifth month after surgery. After the fifth month, the patient was walking independently with the prosthesis.

DISCUSSION

Foot fillet flaps are a reconstructive option for transtibial amputation and can be used as free or pedicle flaps. The pedicled flap can avoid the need for microvascular anastomosis and preserve the continuity of the tibial nerve, with less complex surgeries and reduced potential for complications[7].

The objective of reconstruction of complex defects in the lower limbs is to restore the maximum possible function by providing stable wound closure, mechanical stability of the cover, plantar sensation and painless weight support[6].

Despite the possibility of treating tibial hemimelia with reconstructive procedures, a large percentage of cases are treated with amputation due to the impossibility of reconstruction. The rapid postoperative recovery and the good adaptability to prostheses should be taken into consideration for the early indication of this procedure[2].

The main objective in rehabilitating a patient with lower limb amputation is to provide appropriate social integration with effective ambulation, without complaints and with minimum effort and energy expenditure. Thus, the ideal amputation level is as distal as possible, as long as the patient maintains a function al, painless gait and good soft tissue coverage. In patients with tibial hemimelia, the most distal functional level possible is knee disarticulation[9].

Knee disarticulation, when compared to the transfemoral amputation, has a number of advantages, such as a greater lever arm; less tendency toward secondary hip deformities in flexion, abduction and external rotation; lower energy expenditure during gait; and, importantly, the possibility of terminal weight-bearing on the amputation stump[10].

Our patient underwent surgery at the age of 4 years and presented no intra- or postoperative complications. Eight months after surgery, the patient was walking and engaging in age-appropriate play activities independently and without complaints.

It is important to consider these factors in decisions regarding the early treatment of tibial hemimelia given that it is worth investing in the production of a better quality stump that can support weight for as long as possible with a minimum number of reoperations.

This report describes a case with only 8 months of progression; consequently, we do not have data to compare the difference in progression between knee disarticulation techniques. However, this description shows that knee disarticulation in children with tibial hemimelia using the pedicled foot fillet flap minimizes the need for a microsurgeon with careful dissection of the neurovascular pedicle, the critical point of the surgery, and has good medium-term progression and potential long-term benefits.

CONCLUSION

When amputation is indicated for the treatment of tibial hemimelia in children, the combination of knee disarticulation with a pedicled plantar fillet flap cover is feasible, with good progression in the medium term and potential long-term benefits. Comparative studies with longer follow-up times and a larger sample are necessary to show the impact of this procedure on function and quality of life.

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