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Salvage of planned ALT flap with rectus femoris free flap for pediatric lower extremity reconstruction: A demonstrative case report

Adnan G. Gelidan

The Division of Plastic Surgery, King Saud University, P.O. Box 7805, Riyadh, 11462, Saudi Arabia

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ABSTRACT

INTRODUCTION: Free tissue transfer in children represents a good option for reconstruction in skilled hands despite the technical difficulties, and represent a significant challenge in microsurgery. With Anteriorlateral thigh flap is a popular option even in pediatric age group.
PRESENTATION OF CASE: We report here a case of 9 year old girl that sustained a lower extremity trauma with exposed ankle joint secondary to Motor Vehicle Crash, That was planned for (ALT) Anterior Lateral Thigh flap reconstruction, and was not completed and salvaged by rectus femoris flap as an alternative option on table to complete the reconstruction.
DISCUSSION: Such case was successfully reconstructed by rectus femoris muscle free flap when ALT (Anterior lateral thigh) flap could not be completed as planned although it's the workhorse flap in majority of cases, due to absence of perforator utilizing the same vascular anatomical blood supply with no significant donor site morbidity.
CONCLUSION: Based on this case report the rectus femoris flap was successfully performed, and we believe it's an effective and reliable backup option to reconstruct complex lower extremity wound even in pediatric age group.

1. Introduction

Motor vehicle crash, and falls account for 42% of the traumatic incident in pediatrics [1], Causing variety of muscloskeletal injuries with extensive soft tissue loss. The best available techniques for reconstruction is free tissue transfer. Currently anterior lateral thigh perforator flap becoming the workhorse for the reconstruction of such complex defect. Such flap has two types of feeding perforator septocutaneous (15%), or musculocutaneous (85%). And the availability of sizable perforator range between 0–3 perforators, with an average diameter of 1.89–2.04 mm [2,3]. Perforators has three different vascular origin; from the circumflex femoral artery descending branch of the lateral circumflex femoral artery (90%), single cutaneous perforator originate from the transverse branch of the lateral circumflex femoral(4%), and single perforator from the profanda femoris artery through the rectus femoris muscle (4%) [3]. Which can be located peri-operatevily by hand held doppler. Absence of this perforator is rare, consequently if sizable perforator could not be found during perioperative mapping or intraoperative dissection it could be challenging to salvage the reconstruction by utilizing the same dissected vessels from the lateral femoral circumflex vessel territory. Available alternative option are using rectus femoris muscle which can be used as a free flap, with a low morbidity of the donor site, and successful outcome [4–6]. Rectus femoris is commonly used as a functional muscle transfer for abdominal defect to replace rectus abdominis muscle, or upper limb reconstruction [7]. The work has been reported in lie with the SCARE criteria [8].

2. Case report

A healthy 9 year old girl sustained a compound open tibia fibula fracture with amplex skin and soft tissue trauma that caused a sizable defect 10 × 7 cm over the ankle and dorsum of the foot area, after she was involved in motor vehicle crash (Fig. 1). Physical examination revealed intact nerovascular structure. Radiological testing revealed compound fracture with intact leg vessel. Management included : Wound debridement, External fixation device to stabilize the broken bones, and applying VAC therapy. After ensuring patient was stable and wound is healthy. Decision was made to perform free tissue transfer to cover the exposed bone and reconstruct the soft tissue defect, utilizing the right thigh tissue (In the form of anterior lateral thigh fascio-cutaneous flap) based on the perforator of the descending branch of the lateral femoral circumflex artery. Risks and benefits were discussed and consent was signed. Dissection started medially after standard ALT flap marking performed (Fig. 2). Unfortunately no septocutaneous or musculocutaneous perforator could be found, but during the proposed flap dissection, and elevation from medial to lateral toward the vas-

E-mail address: adnangelidan@gmail.com

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Fig. 1. Side view at the time of presentation to the author. Note Defect involving the ankle and dorsum of the foot area.

Fig. 2. Front view on table marking for the left ALT flap donor site harvest with the perforator site located.

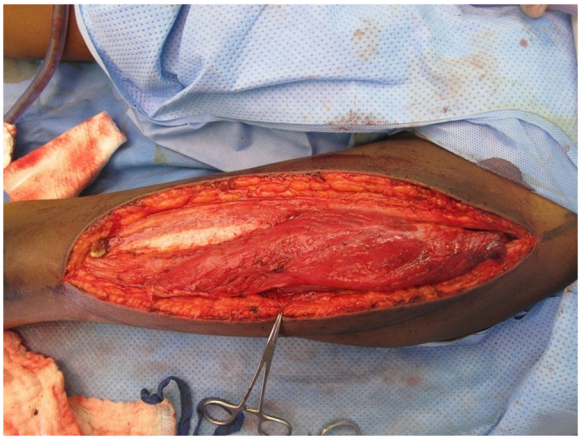

Fig. 3. Front view Rectus femoris muscle dissected proximally and distally in-situ.

cular pedicle to rectus femoris muscle was identified as part of the descending branch of the lateral femoral circumflex artery system. To avoid further compromise and morbidity to the thigh and another incision in the other thigh or other donor site, decision was made to complete the rectus femoris dissection from its origin to its insertion at the quadriceps tendon, and use it as free tissue transfer to cover the ankle and foot defect, preserving the motor branch to the remaining quadriceps tendons and muscle (Fig. 3).

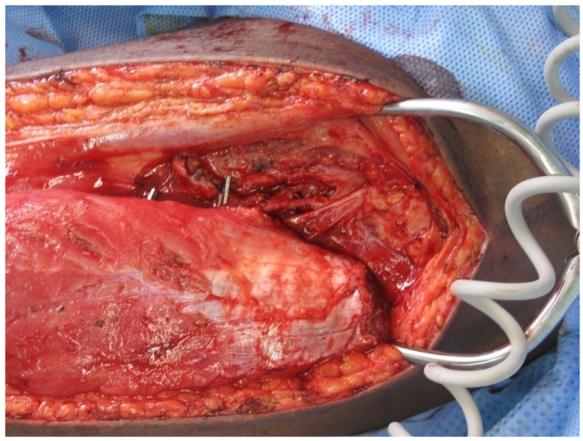

Fig. 4. Front view The Vascular pedicle to rectus femoris connecting to the descending branch to the lateral femoral circumflex artery.

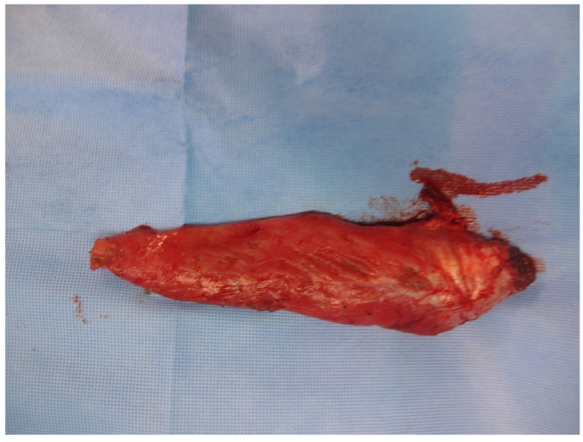

Fig. 5. Front view the rectus femoris muscle flap completely dissected and divided with the vascular pedicle showing at the proximal portion of the muscle flap.

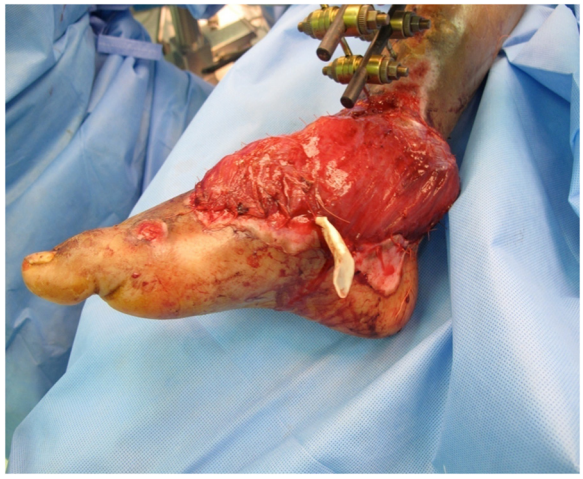

Fig. 6. Side view flap after inset over the soft tissue defect with penros drain inserted.

Muscle flap was completely dissected, and allowed to perfuse on it's pedicle, then divided (Figs. 4 and 5). The pedicle length was 5 cm with a 0.9–1 mm in diameter. Microvascular anastomosis was done in an end to end fashion between the posterior tibial vessels and the descending branch of the lateral circumflex femoral vessels, using simple interrupted 9/0 nylon suture, flap inset was completed, and then was covered with split thickness skin graft (Figs. 6 and 7).

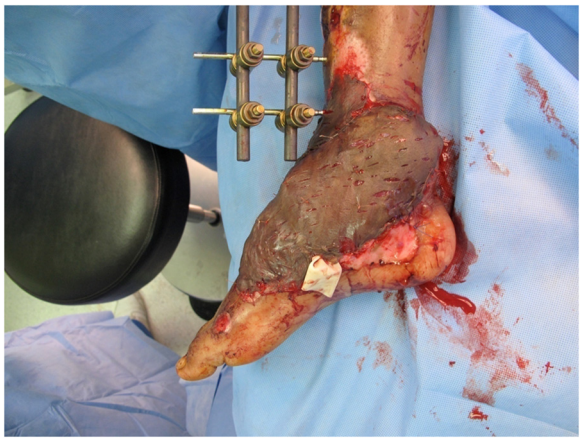

Fig. 7. Side view flap covered with STSG and sutured in place.

Postoperatively the patient had smooth recovery in the intensive care unit, the flap was viable and complete take of the skin graft. Foot dangling protocol followed by mobilization with crutches scheduled and started with specialized personal in the rehabilitation department to ensure full and complete recovery of the quadriceps function.

3. Discussion

Lower extremity injuries in children following motor vehicle accident and fall represent an unfortunate common problem to the plastic reconstructive surgeon with an incidence of around 42% of all trauma related injuries [1]. Option for reconstruction range from immediate primary closure and STSG, to complex reconstructive microsurgical technique to salvage the lower extremity. The pediatric microvascular flaps are technically more challenging due to: small blood vessel diameter, which is considered much smaller than adult and as a consequence of this there is a considerable increase in anastamosis difficulty, Risk of arterial spasm, Pediatric immobilization is difficult), but at the same time it has several advantages: the anatomy is clearly defined, unscarred soft tissue, Blood vessels are normal, absence of associated diseases which will improve the final flap outcome [9].

The flap selection criteria for the lower extremity reconstruction are based on the wound surface area, type of tissue deficiency, length of the pedicle required, and donor site morbidity. In our patient the defect involved the dorsum and ankle of the right foot with exposed fractured bones which urge for free flap coverage [9].

The most commonly used flap in children are the lattismus dorsi muscle, other options are rectus abdominis muscle and radial forearm [9], recently with the increase use of perforator free flaps the anterior lateral thigh flap has become more commonly used for reconstruction even in pediatric age group several studies found that ALT to be safe and reliable appealing option for soft tissue coverage and in some centers its becoming the workhorse in even pediatric microvascular reconstruction [10,11].

With the aim to establish the best functional outcome and the lowest morbidity at the donor site. With the best possible aesthetic result specially in the pediatric population [9,12].

Therefore ALT flap was chosen in our case unfortunately no skin perforator either septocutaneous or musculocutaneous could be found introperatively in our case as this has been reported in the literature. Wong et al. 1/ 89 flaps with absent sizable perforator (1%), Lakhiani etal 1.8% of 2895 flaps hand no sizable perforator, Hsieh etal 10/923 flaps had no perforator [13–15].

Lu, etal Described an algorithmic approach for cases with absent, or inappropriate size ALT perforator when ALT is planned for lower extremity reconstruction in 30 patients. Flap was converted to ipsilateral tensor fasciae latae flap (n = 21), anteromedial (n = 5), or contralateral vastus lateralis myocutaneous flap (n = 4) [16]

Going back to anatomy the rectus femoris muscle receives it blood supply from the muscular branch of the decesnding branch of the lateral femoral circumflex artery which is the workhorse for tissue harvest in the thigh area allow for the utilization of anterior lateral thigh flaps, vastus lateralis, tensor fascia lata and rectus femoris. Which makes Rectus femoris flap a valid option for microvascular reconstruction in cases that lacks a sizable perforator or completely absent [5]

Daigeler et al. analyzed the donor site morbidity found 18–21.8 % decrease in maximum voluntary contraction of the remaining quadriceps however, baseline level of function and active range of motion of the knee and hip were reportedly unaffected [17].

Wei et al. reported no significant loss of leg function and minimal patient complaints [7] Rohrich et al. [18]. Rectus femoris muscle harvest will lead to weakness in the quadriceps tendon Freedman et al. [19]. A mild but functionally not significant deficit in terminal knee extension was mentioned by Bhagwat et al. [20] but the patients had regained excellent strength and had been able to climb stairs by adaptation of the adjacent muscle groups.

4. Conclusion

Reviewing the literature to our knowledge this the first reported use of rectus femoris free flap in pediatric age group lower extremity reconstruction. Might not be the primary option but it's a valid and useful alternative option in planned ALT flap when absent, no sizable, or iatrogenicly damaged perforator is encountered that utilizes the same vascular pedicle with out compromising other site or vessel. And should be kept in mind in all cases as a backup option and add to the cascade of techniques that can be utilized in such situation. And it has the advantage of being at the same site as the ALT flap harvest technique is simple and quick and easy, good option in cases where no skin perforator could be found, Adequate big size 6–7 × 20–25 cm, single dominant pedicle, with adequate diameter and sufficient length of the femoral artery, makes this muscle-musculocutaneous donor tissue desirable for transplantation utilizing the same pedicle as ALT flap which can be dissected as proximal as possible, Easy primary closure of the donor site.

In our patient no significant disability of the donor limb was encountered.

On the basis of our case we believe that rectus femoris muscle flap is an effective and reliable option to reconstruct complex lower extremity wound even in pediatric

Conflict of interest

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Funding

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Ethical Approval

Approval is been obtained.

Consent

Consent is been obtained.

Author contribution

Single Author no other contribution.

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Guarantor

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