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Case Report

Anterior tibial artery perforator flap for defects around the knee: a case report

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Abstract: Soft tissue reconstruction around the knee joint is usually complex for reconstructive surgeons. Defects in this area are largely caused by trauma, chronic infection, tumor, and surgical infection. In this article, we report a case of using anterior tibial artery perforator flap for reconstructing soft tissue defect around the knee joint. The patient was a 45-year-old male with an open patella fracture. He was treated successfully in our department and satisfied with the function and aesthetic of the knee joint. Hence, we believe the anterior tibial artery perforator flap is a reliable option for reconstruction of soft tissue defect around the knee.

Keywords: Anterior tibial artery perforator flap, soft tissue defect, knee joint, reconstructive

Introduction

Reconstructing soft-tissue defects around the knee remains a formidable task for reconstructive surgeons. Currently, trauma, tumor exsection, poorly healing wounds, chronic infection or exposed prosthesis may be the most common etiologies while the objectives of the surgery are to provide a settled soft-tissue cover, restore a favorable function to the joint, and achieve an aesthetically pleasing result [1, 2]. Various choices are available, such as free flaps, muscle flaps and fasciocutaneous flaps. However, the anterior tibial artery perforator flap has been rarely reported in the literature for repairing knee defect. In this article, a 45-year-old male who suffered from an open patella fracture and soft tissue defect, was successfully treated with the anterior tibial artery perforator flap.

Case report

As per the medical records, he suffered from an open patella fracture and accepted an open reduction and internal fixation, however, the defect didn't heal after removing the sutures and the remaining defect was approximately 5*2 cm (**Figure 1A**). In order to resolve this trouble, the patient was transferred to our department to perform a plastic operation in the form of the anterior tibial artery perforator flap.

Preoperatively, the perforator was located using a hand-held Doppler and the pivot of the perforator was marked at a distance from the tibia. According to the size of the defect and the pivot of the perforator, the outline of the flap was drawn (**Figure 1B**). Under an epidural anaesthesia, he was placed in a supine position with the injured legs slightly abducted. A tourniquet was applied without prior exsanguination of the limb. Flap dissection was initiated along the anterior side of the flap down to the deep fascia, and then was performed in the same fashion on the posterior side. The flap was next raised until the perforator vessel was identified (**Figure 2A**). Subsequently, the tourniquet was released so as to assess the perfusion and venous drainage of the raised flap. If flap color and capillary refill satisfied, it indicated adequate perfusion and drainage over time. Then The raised flap was able to rotate around the perforator and adapt to the defect. The process of flap dissection was performed cautiously in order to avoid damaging deep peroneal nerve. Ultimately, the flap was secured in place loosely with 3-0 absorbable sutures and two

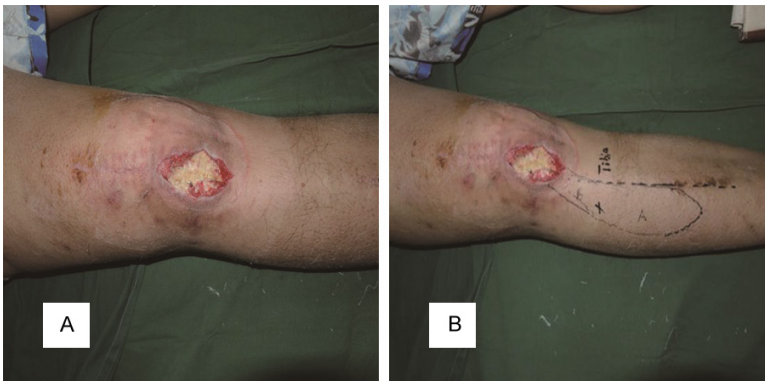

Figure 1. A: Preoperative picture: a defect with exposed kirschner wire in the knee joint. B: Preoperative picture: the outline of the anterior tibial artery perforator flap was mapped and the site of the perforator vessel was marked.

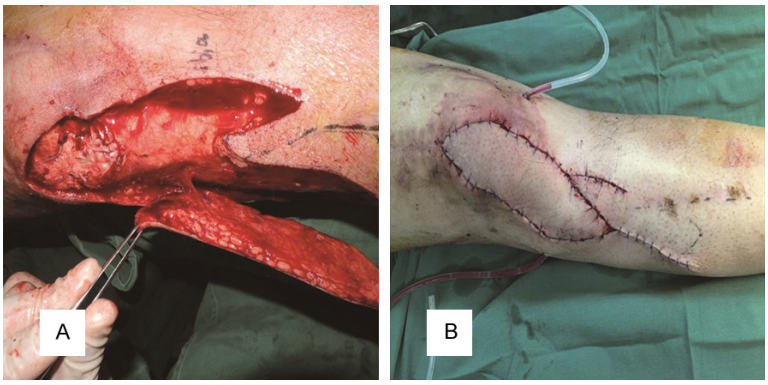

Figure 2. A: Intraoperative picture: harvesting the anterior tibial artery perforator flap. B: Early postoperative view: the anterior tibial artery perforator flap was inset into the defect with absorbable sutures and two drains were placed underneath. The donor site was closed primarily.

Figure 3. A: Appearance 7 days after operation: no complication encountered. B: Follow-up at 3 months: stable coverage with satisfied aesthetic result and good function of knee joint.

drains were placed underneath, meanwhile, the donor site was closed primarily (**Figure 2B**). The drains were removed two days after operation. Ruddy flap and capillary refill suggested the vessel had adequate perfusion and complications such as wounds infection or marginal necrosis didn't occure (**Figure 3A**). The function and aesthetic of the knee joint (5°-110° active activity, 0°-130° passive activity, 3 months postoperatively) was satisfactory and the knee presented pliable and stable coverage after three months of surgery (**Figure 3B**).

Discussion

Methods of operating on a patient with soft tissue defect around the knee are multifold, such as free flaps [3], muscle flaps [4-7] and local fasciocutaneous flaps [8-10], but it still continues to be a challenge for reconstructive surgeons because of the exposed bone, tendon, metal fixation device or prostheses. To restore contour of the knee and preserve the function of the knee joint is the main goal of soft-tissue reconstruction [11]. Thin, pliable, durable, and gliding coverage of the knee joint is a pre-condition for facilitating wound healing and any concomitant procedure.

The anterior tibial artery perforator flap is a promising option for reconstruction knee defects. By reviewing previous literatures [12-14], we find anterior tibial artery perforator flaps have been described lessly for reconstructing soft tissue defects around the knee joint (**Table 1**). We here present a case with the application of anterior tibial artery perforator flap for defects around the knee. As one of the major arteries in the lower leg [15], anterior tibial artery proximally passes

Table 1. List of the series regarding the application of the anterior tibial artery perforator flaps reported in the literature

Number of cases	Flap form	Defect location	Complication	Additional Procedure	Reference
4	Anterior Tibialis Artery Perforator flap	Patellar and proximal tibial areas	Flap necrosis (1)	None	[12]
7	Anterior Tibialis Artery Perforator plus flap	Knee joint	Marginal necrosis (1)	Not mentioned	[13]
4	Anterior Tibialis Artery flap	Knee joint; upper third of the lower leg; anterior tibial tuberosity	Not mentioned	Not mentioned	[14]

between the tibia and the tibialis anterior muscle, close to the deep peroneal nerve. According to Ariel N. Rad et al. [12], the dominate perforator located 11.4±1.7 cm distal to the lateral midpatellar margin and provided reliable option in clinical application, meanwhile, the mean pedicle length was 8.2 cm. Anterior tibial artery is one of the terminal vessels from the popliteal artery which has a constant supply of arterial blood and supplies the upper anterolateral lower leg associated with its recurrent branch. The flap can be rotated as a degree from 0 to 180 degrees to cover an adjacent soft tissue defect, depending on the proximally or distally based vessel it is also able to be applied to cover a diverse scope of defect. The distally anterior tibial artery perforator flap can repair the defect of the lower segment leg, the ankle and the dorsum pedis while the proximally anterior tibial artery perforator flap is suitable for defect on the upper third of the pretibial area and the knee region.

This flap may have the potential advantages including time efficiency, easily harvest and concise anatomical information. In addition, the recipient site has the most “like-to-like” tissues, it can provide the most appropriate tissue with the lower donor site morbidity and satisfactory aesthetic results. Because of the particularities of the knee jonit, flexion and extension, thin and pliability coverage is an adequate candidate and required to ensure excellent mobility of the knee joint. While the anterior tibial artery perforator flap also has a main disadvantage that the superficial peroneal nerve may be injured, but it may be escaped by means of concentrated attention during the dissection.

In summary, the anterior tibial artery perforator flap is a reliable and optional procedure with low morbidity, good daily functions and satisfactory aesthetic results while without sacrificing any major vessels. Hence, it is intended to be considered as a suitable alternative choice for reconstruction knee defect.

Disclosure of conflict of interest

None.

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