Foot Ischemia After a Free Fibula Flap Harvest: Immediate Salvage With an Interpositional Sapheneous Vein Graft

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Abstract: The most dreaded major donor-site complication of free fibula flap is a foot ischemia, which is fortunately rare. Various authors have discussed the efficacy of the use of preoperative imaging methods including color Doppler, magnetic resonance angiography, and conventional angiography. A 25-year-old man presented with a 10-cm mandibular defect after a facial gunshot injury. Lower extremity color Doppler revealed triphasic peroneal, tibialis anterior, and posterior artery flows. A fibula osteocutaneous flap was harvested, and the mandible was reconstructed. However, the suture sites at the donor site began to demonstrate signs of necrosis, abscess formation, and widespread cellulitis beginning from postoperative day 9. Angiogram of the lower extremity on the 13th day demonstrated no flow in the right posterior tibial artery distal to the popliteal artery, whereas the anterior tibial artery had weak flow with collateral filling distally. An emergency bypass with a saphenous vein graft between the popliteal artery and the distal posterior tibial artery was performed. Repeated debridements, local wound care, and vacuum-assisted closure were applied. A skin graft was placed eventually. The extremity healed without severe functional disability. In conclusion, although the arterial anatomy is completely normal in preoperative evaluation, vascular complications may still ocur at the donor fibula free flap site. In addition, emergency cardiovascular bypass surgery, as we experienced, may be necessary for limb perfusion.

Key Words: Foot ischemia, free fibula flap, salvage

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Free fibula flap is one of the most commonly used vascularized bone flaps for the reconstruction of bone defects in the maxillofacial area.[1] Easy adaptation to maxillofacial bony structures, availability of a long bone segment reaching up to 25 cm, feasibility of a simultaneous 2-team approach, and suitability of the bone for making multiple osteotomies are among the numerous advantages.[2]

Although the free fibula flap is regarded as the golden standard for mandibular reconstruction, possible donor-site complications should be kept in mind.[3] Loss of skin graft applied to the donor site, cellulitis, wound healing problems, and abscesses are among the short-term complications; whereas weakness in the foot, ankle instability, great toe contracture, or sensory disorders may be seen in the long term.[3,4] The most dreaded major donor-site complication is ischemia of the foot, which is fortunately rare.[5] This condition may result from sacrifice of the peroneal artery in the presence of an underlying traumatic, atherosclerotic, or congenital vascular disorders.[6] Numerous authors have suggested and discussed the efficacy of the use of imaging methods including color Doppler (CD) echocardiography, MR angiography (MRA), and conventional angiography before flap harvest.[6–11]

We herein present a patient who developed a catastrophic lower extremity ischemia after fibula flap harvest despite a normal preoperative CD study. The report will also describe the vascular reconstruction performed by cardiovascular surgeons to perfuse the foot and to facilitate wound healing. In addition, methods to prevent such vascular problems previously described in the literature are summarized.

PATIENT

A 25-year-old man presented with a 10-cm defect in the anterior mandible caused by a self-inflicted gun shot injury that occurred 2 months ago before admission. His medical history did not reveal any conditions that would constitute a contraindication to microsurgical repair, nor any history of previous trauma to the lower extremity. The dorsalis pedis and posterior tibial artery pulses were palpable in both feet, yet CD imaging of both lower extremities was requested to assess the circulation in the lower extremities. The CD showed triphasic peroneal, tibialis posterior, and tibialis anterior flows in both lower extremities, and the patient was prepared for free fibula osteocutaneous flap reconstruction. The dissection was performed under pneumatic tourniquet. Before division of the flap pedicle, the peroneal artery was clamped, the tourniquet was released, and circulation of the foot was verified. At the end of flap harvest, a compressive bandage and a light cast splint were applied at the donor site. Low-molecular-weight heparin at prophylaxis doses was initiated after the operation and continued until the patient was mobilized. The patient was ambulated with a below-knee splint on the postoperative third day. On postoperative day 5, the patient developed difficulty in breathing, nausea and vomiting, and tachycardia. Studies revealed pulmonary embolism, and oral anticoagulant treatment was initiated. In the meanwhile, the flap developed loss of arterial circulation. An exploration was performed immediately, where both arterial and venous thrombi were seen. Despite revision of the anastomoses, the flap was lost due to ischemia. Studies performed for finding the origin of the pulmonary embolism showed a deep venous thrombosis in the left femoral region, contralateral to the flap donor site. Although there were no problems at the donor site during the first days after surgery, the suture sites began to demonstrate signs of necrosis, abscess formation, and widespread cellulitis. Cultures revealed pseudomonas aeruginosa, and parenteral piperacillin-tazobactam treatment was initiated. Wound dehiscence, necrosis, and infection at the donor site progressed despite

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FIGURE 1. The necrosis of the lateral compartment muscles and the superficial tarsal bones on the eighth postoperative day (top). The completely healed donor site on the 45th postoperative day after revascularization (bottom).

antibiotic treatment and local wound care. The suture line dehisced completely. The necrosis advanced to almost all of the lateral compartment muscles and the superficial tarsal bones (Fig. 1). Serial debridements and local wound care were performed. Angiogram of the lower extremity taken on postoperative day 13 showed that there was no flow in the right posterior tibial artery distal to the popliteal artery, and anterior tibial artery had only weak flow with collateral filling distally (Fig. 2). Cardiovascular surgeons attended the operation, and an emergency bypass using a saphenous vein graft between the popliteal artery above the knee and the distal posterior tibial artery was performed. Although the extremity circulation was reestablished, ischemic findings recurred in the foot 3 days after the bypass, and angiography showed a thrombus in the interposed saphenous vein graft. An embolectomy was performed, and flow was restored (Fig. 3). Repeated debridements, local wound care, and vacuum-assisted closure were applied to the lateral aspect of the leg, which was subsequently repaired by a skin graft on the 25th postoperative day. The extremity healed without severe functional disability (Fig. 1). Meanwhile, hematologic workup did not reveal any abnormalities that would create a tendency toward thrombosis.

DISCUSSION

The fibula flap is one of the most preferred flaps in mandibular reconstruction.[1] Despite this widespread use, there are no wide series in the literature that have investigated the donor site morbidities, and most of the complications have been presented as case reports.[1,4,5] Ling and Peng[12] performed a literature review of all fibula flap donor-site complications reported until 2011. Complications developed more commonly during the early postoperative period and were composed of wound dehiscence, cellulitis, graft loss, and compartment syndrome. Late complications created functional disabilities such as chronic pain, sensory deficits, gait disorders, and ankle instability. Momoh et al[3] reported 33% rate of complications in a series of 157 patients. Only 3% of these patients required surgical management. Similarly, most of the complications in other series are minor complications such as great toe contractures that do not require any intervention.[4,12] Postoperative foot ischemia and necrosis is undoubtedly the greatest and most severe complication. It is relatively uncommon, and there is no clear information on its incidence.[2,4] Widespread necrosis may be caused by an acute compartment syndrome of the donor site in the presence of overtight closure and inadequate drainage.[1] Another reason for necrosis is pseudocompartment syndrome due to the edema caused by tight closure, which subsquently impairs the circulation. Necrotizing infections have also been suggested as a possible cause.[4] In the patient presented, in contrast to an acute compartment syndrome, it did not have a rapid onset. In addition, signs such as widespread edema and pain, observed in the late phase of pseudocompartment syndrome, were absent in our patient. Besides, the deep venous thrombosis (DVT), which may be related to the pseudocompartment syndrome, interestingly affected the extremity that was contralateral to the donor leg.[5] Although the cause of tissue necrosis in our patient was initially considered to be due to a necrotizing infection, angiography showed that the condition had a vascular origin.

Numerous studies have emphasized that ischemic complications in the donor site could result in potential problems, and adequate preoperative workup is necessary for their prevention. Foot ischemia after fibula flap harvest may be caused by vascular problems such as atherosclerosis, previous trauma, or congenital arterial malformations.[6] In most cases, vascular insufficiency of atherosclerotic or traumatic origin may be noticed by checking the pulses. In congenital conditions such as the peroneal arteria magna variation, where the major artery of the lower extremity is the peroneal artery, there is unfortunately no specific sign that suggests this conditon.[7] As a result, numerous studies have stressed the need to demonstrate the arterial condition of the donor site before the operation by using various imaging methods.[7–9] The advantages, disadvantages, and strengths of angiography, CD, and MRA were compared in previous studies.[6,8–10] Some authors stated that physical examination of the pulse solely was sufficient.[11] For example, Lutz et al[6] stated that further studies were not needed when both pulses were palpable. When at least 1 pulse was present or there was a history of previous trauma, they suggested that a CD alone would be sufficient. Kim et al[13] suggested that the peroneal artery should be clamped during the operation, and foot circulation should be assessed with a CD. On the other hand, some authors stated that

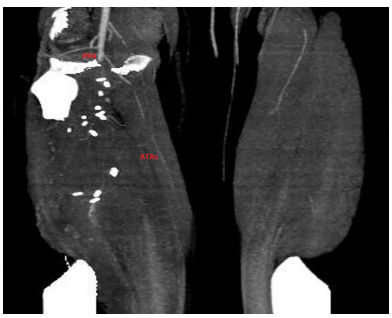

FIGURE 2. Postoperative 13th-day angiogram. No flow detected in the right posterior and anterior tibial arteries distal to the popliteal artery. Weak filling in the anterior tibial artery collaterals is noted distally. PPA, proximal popliteal artery; ATAc, anterior tibial artery collaterals.

FIGURE 3. Anigographic view after an interposed saphenous vein graft between the popliteal and posterior tibial arteries. Note the functional vein graft. PA, popliteal artery; SVG, sapheneous vein graft; PTA, posterior tibial artery.

CD is not enough, and angiography or MRA must be obtained.[7,8] Smith et al stated that CD was a very reliable study, and angiography should be requested only when there are abnormal findings on CD.[10] In contrast, Lorenz and Esclamado[14] advocated the need for routine MRA, preoperatively.

In the patient presented here, the pulses were palpable, and CD was obtained before the surgery. Normal findings on both examinations led us to believe that the flap could be elevated safely. All the 3 vessels seemed normal intraoperatively, and there were no problems in foot circulation after clamping the peroneal artery, which led us away from an arterial abnormality not detectable with CD. Therefore, wound site problems that became evident on postoperative day 9 were initially linked to infectious causes. The development of DVT in the contralateral leg and pulmonary embolism were interesting. Hematologic assessment did not reveal any tendency toward thrombosis. On the other hand, the development of DVT despite early mobilization, failure of the flap, and secondary thrombus after bypass surgery suggested an unexplained thrombotic tendency.

In summary, although the fibula flap is versatile, its potential complications should be considered. Foot ischemia is the most feared complication, without a doubt. Vascular pathologies should be considered when there are wound healing problems and necrosis at the donor site. To prevent this complication, one of the imaging methods that shows perfusion of the lower extremity should be obtained before surgery. Although evaluation with CD is sufficient in most cases, it may fail to show variations of the arterial system. In addition, it is important that, although the arterial anatomy is completely normal in preoperative evaluation, vascular complications may still occur because of unpreventable and unrecognizable conditions, such as an unexplained tendency toward a thrombosis as seen in our patient. An immediate evaluation of the patient with respect to vascular pathologies and correction of the ischemia using a bypass when necessary are crucial to prevent limb loss. Autogenous saphenous vein graft might be the valuable option in such cases, as we experienced. Close monitoring of the graft after the procedure and early intervention in case of a problem are crucial for limb salvage and preservation of graft patency.

In conclusion, the catastrophic and demonstrative case presented in this report demonstrated that physical examination and radiologic studies may rarely fail to prevent vascular complications. In addition, emergent cardiovascular bypass surgery for limb salvage, which we have not come across in the literature, might be necessary in limb salvage.

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