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ORIGINAL ARTICLE

Clinical outcomes following intraoperative pedicle disruption in fibula free flaps

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Abstract

Objectives: Iatrogenic injury of the fibula free flap pedicle is rare. Postoperative flap survival and reconstructive outcomes following intraoperative pedicle severance are unknown. This study assesses free flap outcomes following accidental severance of the peroneal vessels.

Methods: Multi-institutional retrospective chart review from 2000 to 2020.

Results: Of 2975 harvested fibula free flaps, 26 had a history of pedicle severance during surgical reconstruction. Reasons for intraoperative pedicle severance included transection during muscular dissection 10/26 (39%), accidental severance with the bone saw 12/26 (46%), and other 4/26 (15.6%). The surgeon responsible for pedicle severance included residents 5/26 (19%), fellows 10/26 (39%), attendings 10/26 (39%), and unknown 1/26 (3.9%). The pedicle artery and vein were severed 10/26 (39%), artery 8/26 (31%), and vein 8/26 (31%). Truncated pedicle vessels were used 3/26 (11.7%), intraoperative anastomoses

were performed 23/26 (89%). Postoperative revision in the OR within 7 days of surgery was required 6/26 (23%); 4 flaps were salvaged and 2 flaps failed, both arterial thrombosis. Flap failure was attributed to vascular thrombosis. Long-term flap survival and successful reconstructions were reported 24/26 (92%).

Conclusion: Accidental severance of fibula free flap pedicle vessels can be corrected with intraoperative repair, without affecting long-term flap survival or reconstructive outcomes. Protecting the flap vessels while using the bone saw and during intramuscular dissection prevents accidental severance.

KEYWORDS

compromise, fibula, free flap, pedicle, vascular injury

1 | INTRODUCTION

The accidental severance of a fibula free flap pedicle is a rare iatrogenic injury that can complicate the harvest of a complex osteocutaneous flap. The pedicle of a fibula flap is long with a variable anatomic location and is often on the deep posterior aspect of the bone. Additionally, the vessels of the lower extremity are often dilated, further predisposing the vessels to puncture injury during harvest.[1]

Management of a fibula flap pedicle following iatrogenic severance is not clear. Immediately following severance, the attention of the surgical team is focused on managing an acute hemorrhage while preserving flap components. Assessing the viability of the flap and pursuing methods to repair the severed pedicle is at the surgeon's discretion, as no clinical evidence is available to guide surgeons.

Our study aims to provide microvascular surgeons with clinical incidence, management, and outcomes of fibula free flaps complicated by iatrogenic injury.

2 | METHODS

This study is a multi-institutional retrospective chart review from 2000 to 2020. Independent variables collected included type of iatrogenic injury leading to pedicle severance, surgeon who severed the pedicle, and the vessels of the vascular pedicle which were severed. Dependent variables collected included management of the severed pedicle, incidence of postoperative thrombosis, and long-term flap viability.

Internal Review Board approval was obtained and provided by MODCR00018404. Data was contributed by Oregon Health & Science University, Northwestern University, Louisiana State University Health Sciences Center, Washington University in Saint Louis, Head & Neck Cancer Center of Texas, University of Michigan, Loyola Medicine, University of Pennsylvania, ENT Center of Utah, University of Colorado, Cleveland Clinic Health System, University Hospitals Case Medical Center, and Duke University.

3 | RESULTS

A total of 2975 free fibula flaps were completed for head and neck reconstruction from the years 2000–2020. Of this population of patients undergoing free flap reconstruction, 26 cases were complicated by iatrogenic intraoperative pedicle severance, 0.9%.

Reasons for intraoperative pedicle severance included accidental severance with the bone saw 12/26 (46%), transection during muscular dissection 10/26 (38.5%), other 3/26 (12%), and aberrant anatomy 1/26 (3.9%).

The surgeon responsible for pedicle severance included attendings 10/26 (39%), fellows 10/26 (39%), residents 5/26 (19%), and unknown 1/26 (3.9%). The pedicle artery and vein were severed in 10/26 (39%), artery in 8/26 (39%), and vein in 8/26 (31%). The vascular pedicle remained unrepaired and the truncated pedicle vessels were used 3/26 (12%), while intraoperative re-anastomoses were performed 23/26 (89%).

An intraoperative heparin drip was used in 8/26 (31%). Postoperative IV heparin was given to 2/26 (7.7%) for 3–7 days, and 1/26 (3.9%) for less than 3. Aspirin was used in 21/26 (82%) of patients for greater than a week.

Postoperative revision in the OR within 7 days of surgery was required in 6/26 (23%) for venous congestion, vascular thrombosis, and other causes. A total of 4/26 (15%) flaps were salvaged and 2/26 (8%) flaps failed; flap failure was attributed to vascular thrombosis. Long-term flap survival and successful reconstructions were reported 24/26 (92%).

4 | DISCUSSION

The fibula free flap is a complex and technically intricate flap to harvest.[1] Additionally, the harvest of a fibula flap is often completed by surgeons of differing levels of training, further predisposing the flap harvest to technical errors. The unplanned injury to a free flap vascular pedicle is underreported, leaving microvascular surgeons with little data to assess management options when an injury to the pedicle occurs. As can be seen from the low incidence (<1%) of this multi institutional study, most surgeons will not encounter this issue in their career. Only through a multi institutional study of a large group of surgeons were we able to collect enough cases to adequately describe the management and outcomes. While the iatrogenic severance of a fibula free flap vascular pedicle may seem like a devastating injury, the immediate recognition and repair of the vasculature spares the flap with minimal consequence. Our data uniquely shows the accidental severance of a fibula vascular pedicle does not affect the ability to successfully transfer the flap or its overall flap survival. The failure rate of 8% in our study is comparable to the reported failure rate of 5% in free flaps without a history of pedicle injury.[2] This data suggests that following the immediate repair of a severed pedicle there is no effect on flap survival.

Free flaps have a well-defined incidence of requiring revascularization and salvage in the immediate postoperative time. The flap may be compromised by vascular insufficiency that if recognized and corrected in the operating room in a timely fashion results in high salvage rates and overall survival. The majority of the literature would say this happens around 10% of the time.[3,4]

The majority of pedicle severance was due to traumatic disruption with a bone saw at a site distal from the proximal pedicle confluence. Being a retrospective review, we were unable to determine how much of the vessel was injured and how much of the injured vessel was removed to allow anastomosis of normal vessels. In all of these cases, the vessels were immediately repaired without impairing perfusion to the osteocutaneous anatomy intended for reconstruction. All reconstructions, boney and soft tissue were completed with no need for supplemental tissue. A number of surgeons in our study used truncated vessels for microvascular anastomosis, suggesting severance of the vascular pedicle at a proximal site during intramuscular dissection may yield a short, but viable pedicle. Accidentally severance of the vascular pedicle occurred in surgeons with various levels of experience. This would suggest that vascular injury while using a bone saw can occur at any stage of training, especially during the harvest of flaps with tortuous or friable vasculature and unusually thick bone stock. The low incidence of injury suggests that surgeons of different skill sets are equally careful in the pedicle dissection.

There was no difference in the frequency of combined arterial and venous, or individual vessel injury, suggesting iatrogenic pedicle severance is an abrupt and unanticipated injury that may occur at any stage of flap harvest. Immediate repair of the vessel or vessels can be done with excellent postoperative outcomes.

Following intra operative or postoperative vascular issues in free tissue transfer the role of systemic heparinization is unknown. There is no well-defined data or literature that has determined if the benefits of systemic anticoagulation outweigh the potential morbidities. The data in our study demonstrated that postoperative anticoagulation was used in a minority of cases by various surgeons. It did not appear to have a detrimental or beneficial effect. Only 31% patients received heparin during the initial procedure following pedicle severance. Of these 8% received heparin for <7 days in the postoperative setting. Reasons for heparin administration were not defined in the chart. Thus in a retrospective review we cannot know why it was given in these cases. Our data is too limited to draw conclusions regarding the benefit of heparin drips following pedicle severance and long-term flap outcomes. Low dose Aspirin was administered as per institutional policy. No change in protocol was initiated due to pedicle severance.

Interestingly nearly a quarter of flaps required revision of the flap in the postoperative setting. This number is higher than what is typically reported in the literature.[3,4] All vascular compromise occurred at the proximal end of the flap. Disruptions distal to this point that required vascular anastomosis remained patent. Two patients with venous thrombosis were revised with flap survival. One arterial and one arterial/vein thrombosis were unable to be salvaged and did not survive. One of these patients was administered heparin for 5 days to no avail. The other patient was not given any anticoagulation as the flap could not be salvaged. It may be that multiple anastomosis were performed or it may be a statistical variance due to low numbers. It does appear that the ultimate survival of the flap is equal to nontraumatized pedicles.

Our study is limited by the small number of patients included in our data with a history of pedicle severance. Additionally, most injured flap pedicles were repaired immediately, or the truncated pedicle vessels were used. The data is our study serves as a clinical description of management of a rare injury and does not provide statistical guidance on pedicle repair methods or postoperative flap management.

5 | CONCLUSION

Fibula free flap viability and reconstructive success was not affected by the accidental severance of the flap vascular pedicle. Most surgeons elected to perform

intraoperative repair of the flap vascular pedicle following iatrogenic severance. Intraoperative and postoperative heparin was provided to a few patients, with no clear benefit. Long-term flap survival was reported in 92%.

CONFLICT OF INTEREST STATEMENT

No financial disclosures or conflicts of interest.

DATA AVAILABILITY STATEMENT

Through request to the corresponding author.

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