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PURPOSE: Venous compromise is the most common reason for perioperative free flap complications. The dependent nature of the lower extremity likely increases this risk, especially following significant lower extremity trauma with superficial or deep venous injury and immobilization of the soleal muscle venous pump. The benefit of a second venous anastomosis, however, remains unclear in lower extremity trauma free flap reconstruction and warrants further investigation.

METHODS: Retrospective institutional registry review of 2,898 free flaps performed between 1979–2016 identified 806 lower extremity reconstructions; 361 soft tissue flaps performed for Gustilo IIIB/C coverage met inclusion criteria. Patient demographics, flap characteristics, and outcomes were examined using Chi-square, t-tests, and logistic regression.

RESULTS: Muscle flaps predominated (n=287, 79.9%) compared to fasciocutaneous (n=72, 20.1%). Single-vein outflow was more common (76%) than dual-vein (24%). Majority of recipients were in deep venous system (89%) vs. superficial (6.0%) or both (3.6%). Anastomoses were primarily end-to-end (92%); venous coupler used for 19%; 3.6% required vein grafting. Fasciocutaneous flaps were more likely to have two veins performed (p<0.001). Complications occurred in 143 flaps (39.8%) with 37 partial flap losses (10.3%), and 31 complete flap losses (8.6%). Emergent return to the operating room for vascular compromise occurred in 45 flaps (12.4%); most commonly for venous insufficiency (n=26, 57.8%), arterial (n=14, 31.0%), or undetermined (n=5, 11.1%). Compared to single vein flaps, two venous anastomoses were associated with reduced complications (p=0.007), partial flap failures (p=0.006), and any flap failure (p=0.048). Multivariable regression analysis controlling for age, sex, flap type, vein size mismatch >1mm, bone gap presence, and time since injury demonstrated two veins to be protective against complications (RR=2.58, p=0.009). Subset regression analysis by flap type demonstrated no significant association between 1 vs. 2 vein outflow and complications among fasciocutaneous flaps, however, muscle flaps with two veins demonstrated even more significant reduction in complications (RR=3.92, p=0.005). Regression analysis also found an increased total failure rate among flaps with a >1mm vein size mismatch (RR=3.02, p=0.038). No statistically significant association was found between recipient vein size (larger or smaller) relative to flap vein size and complication rates (p=0.324), takeback rates (p=0.771), or flap failure (p=0.693).

CONCLUSION: Flaps with two venous anastomoses demonstrated reduced complication rates compared to single-vein flaps. Venous size mismatch >1mm was also associated with increased complication rates. While fasciocutaneous flaps more commonly had second veins performed, the protective effect was primarily driven by improved outcomes among muscle flaps with two veins. These results suggest beneficial effects of both two-vein outflow and matched vessel diameter, particularly among muscle-based flaps, providing evidence for preferential use of two matched venous anastomoses when possible for free flap reconstruction of lower extremity trauma.

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Extracranial to Intracranial Flow through Flaps

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PURPOSE: Extracranial-intracranial bypass is indicated in ischemic disease such as moyamoya, intracranial aneurysms requiring bypass, and neurovascular disorders. Soft tissue transfer is indicated for craniofacial trauma and tumors and in cases of indirect cerebral revascularization. Fascial, skin, omental, and muscle flaps have been used for these indications. In this series, we describe early results of flow through flaps for cerebral revascularization in conjunction with soft tissue reconstruction.

METHODS: A retrospective review of a prospectively maintained database was performed. Seven patients were identified who required direct arterial bypass in conjunction with a soft tissue procedure for indirect revascularization or soft tissue reconstruction.

RESULTS: Indications for arterial bypass included intracranial aneurysm (n=1) and moyamoya disease (n=6). Indications for soft tissue reconstruction included infected cranioplasty (1) and indirect cerebral revascularization for
moyamoya disease (6). Flaps included flow through radial forearm fasciocutaneous flaps (2), a flow through radial forearm fascial flap (1) and flow through pedicled temporo-parietal fascial flaps (4). The superficial temporal vessels (6) and facial vessels (1) were used as the recipient site pedicle. Flow through reperfusion was established into the middle cerebral artery (5) and anterior communicating artery (2). There were no intraoperative complications. All flaps survived and there were no donor site complications. Postoperative imaging demonstrated graft patency in 6/7 patients. In one case of flow through TPF flap, the direct graft failed, but the indirect flap remained vascularized.

CONCLUSIONS: Flow through flaps can be safely used for conditions where combined arterial bypass and soft tissue procedures are required. Early outcomes have not demonstrated any major complications. Long-term results with direct and indirect re-vascularization are pending.

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35 Years of Lower Extremity Take-Backs: Free Flap Type Influences Salvage Outcomes

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PURPOSE: Free flaps for lower extremity trauma reconstruction have a notoriously high failure rate compared with other anatomic sites. In addition, the choice between fasciocutaneous and muscle-based flaps remains controversial: muscle flaps provide pliable bulk for elimination of dead space and may promote osseous union while fasciocutaneous flaps avoid muscle sacrifice, are more easily re-elevated, and may provide a superior aesthetic result. Considering the high incidence of lower extremity flap failure, we compared salvage rates after take-backs for vascular compromise between fasciocutaneous and muscle free flaps for lower extremity trauma reconstruction.

METHODS: Retrospective institutional registry review of 2,898 free flaps performed between 1979–2016 identified 806 lower extremity reconstructions; 361 soft tissue flaps performed for Gustilo IIIB/C coverage met inclusion criteria. Patient demographics, injury mechanism/location, flap type, operative details, and peri-operative outcomes were evaluated. Complications, take-backs, and flap failure rates were compared between muscle and fasciocutaneous flaps using Chi-square and logistic regression. Bonferroni adjusted z tests were used to determine the association between sub-location of injury and flap type. Complication and take-back rates were additionally stratified by defect location and flap type to help eliminate confounding variables.

RESULTS: Overall, muscle flaps predominated (n=287, 79.9%) compared to fasciocutaneous (n=74, 20.5%). Congruent with traditional reconstructive dogma, the distal third was most common defect location (55.5%); within this sub-location, a higher percentage of fasciocutaneous flaps were used (72.5% vs. 51.3%, p=0.016). Fasciocutaneous flaps had smaller mean surface area compared to muscle (205 ± 115cm² vs. 301 ± 253cm², p<0.001). Complications occurred in 143 flaps (39.8%) with 37 partial flap losses (10.3%), and 31 total flap losses (8.6%). Overall complication rates were comparable between muscle and fasciocutaneous flaps (43.5% vs. 39.4%, p=0.538). Partial flap losses were significantly more common among muscle flaps (12.1% vs. 4.1%, p=0.009), however, similar rates of total flap failure occurred in both groups (8.7% vs. 8.1%, p=0.772). Emergent return to the operating room for vascular compromise occurred in 45 flaps (12.4%) due to venous (n=26, 57.8%), arterial (n=14, 31.0%), or undetermined (n=5, 11.1%) causes. There was a trend towards earlier take-backs among fasciocutaneous flaps compared to muscle (1.93 ± 2.5 vs. 3.97 ± 4.8 days, p=0.072). Regression analysis controlling for age, sex, time since injury, number of veins, and flap size found a significantly higher take-back rates among fasciocutaneous flaps (n=15, 20.2%) compared to muscle (n=30, 10.5%) (RR=2.63, p=0.027). Despite higher take-back rates, however, additional regression analysis controlling for the same variables plus skin paddle presence demonstrated higher rates of successful flap salvage after take-backs among fasciocutaneous flaps (66.7%) compared to muscle (16.7%), (RR=13.03, p=0.038).

CONCLUSION: Compared to muscle, fasciocutaneous flaps demonstrated lower partial flap failure rates despite more frequent take-backs for vascular compromise. These findings are likely related to a combination of lower metabolic demand in fasciocutaneous tissue compared to muscle and easier visual recognition of vascular. Interestingly, this