

Free Flaps in Alloplastic Cranioplasty: Surgical Decision-Making and Risk Factor Analysis



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INTRODUCTION

- Microvascular reconstruction of composite cranial defects requires careful planning to achieve stable soft-tissue coverage.
- Alloplastic cranioplasty materials, including titanium mesh and polyetheretherketone (PEEK), are commonly used and differ in rigidity, porosity, and infection risk, which may influence free flap selection.
- The influence of alloplastic implant material on free flap selection and postoperative outcomes has not been well characterized

PURPOSE

To evaluate the outcomes of free flap choice in alloplastic cranioplasty and to identify factors associated with complications.

METHODS

- Retrospective institutional chart review was performed (2013-2025)
- Adult patients who underwent concurrent or delayed free flap reconstruction following alloplastic cranioplasty.
- Patient demographics, comorbidities, surgical indication, and radiation history were collected, along with operative data on implant material, free flap choice, and postoperative complications.
- Statistical comparisons were performed using the Man-Whitney U test, Kruskal-Wallis test, chi-square test of independence, or Fisher’s exact test.

RESULTS

- 21 patients underwent an immediate (95.2%) or delayed (4.8%) free flap after cranioplasty
- Median age 63.3 (range, 22.6-78.3), 52.4% male, 81.0% White, median BMI of 26.2 kg/m² (range, 19.2-33.2).
- 81.0% had a history of malignancy, 61.9% had prior radiation to the surgical site, and 28.6% underwent chemotherapy.
- Most common free flaps were anterolateral thigh (33.3%), latissimus dorsi (19.0%), and omentum (14.3%), additional perioperative characteristics in **Table 1**.
- Table 2** reports postoperative complications, length of stay, and follow-up.
- No significant difference in complications by fasciocutaneous vs. myocutaneous flaps, or by individual free flap selection. Similarly, no difference noted between complication rate and implant material or history of radiation.

TABLE 1. PERIOPERATIVE CHARACTERISTICS

	N = 21
Indication for cranioplasty	
Malignancy	16 (76.2)
Trauma	3 (14.3)
Arteriovenous malformation	1 (4.8)
Osteomyelitis	1 (4.8)
Alloplastic implant	
Titanium	16 (76.2)
Polyetheretherketone (PEEK)	4 (19.0)
Absorbable	1 (4.8)
Type of free flap	
Fasciocutaneous	11 (52.4)
Myocutaneous	3 (14.3)
Omental	3 (14.3)
Muscle-only	1 (4.8)
Osteomuscular	1 (4.8)
Osteomyocutaneous	1 (4.8)
Skin-only	1 (4.8)
Operative time (mins) ¹	487.5 (300.0 - 833.0)
Data reported as n (%) or median (minimum – maximum); ¹ Operative time calculated for patients undergoing immediate free flap reconstruction	

TABLE 2. POSTOPERATIVE OUTCOMES

	N = 21
Perioperative surgical complication	
Hematoma	2 (9.5)
Flap compromise	1 (4.76)
Flap loss	0 (0)
Unplanned reoperation	4 (19.0)
Length of stay (days) ¹	7.5 (3.0 - 65.0)
Follow up (months)	14.1 (0.6 - 113.6)
Data reported as n (%) or median (minimum – maximum)	
¹ Length of stay calculated for patients undergoing immediate free flap reconstruction	

CONCLUSIONS

- Alloplastic cranioplasty with concomitant free flap reconstruction can be performed safely with low complication rates.
- Outcomes between fasciocutaneous and myocutaneous free flaps seem to be comparable.

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