Evidence-Based Strategies for Managing Post-Cranioplasty Infections: A Literature Review

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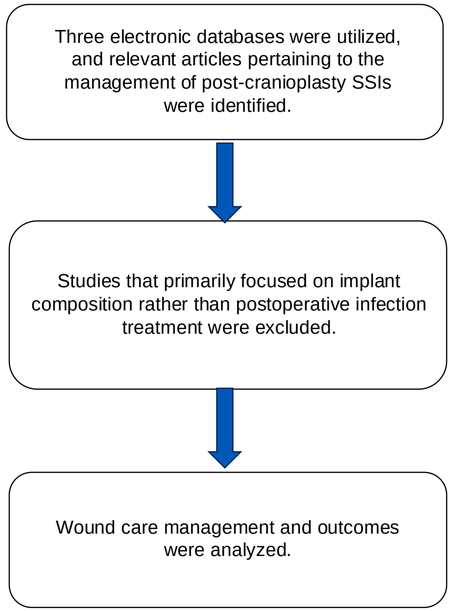
Introduction

- Cranioplasty, the surgical repair of the skull, is one of the oldest procedures in medicine. Despite advancements in surgical planning, the use of synthetic materials, and custom-printed implants, complication rates remain high, previously reported at 31.3%.
- Among these complications, surgical site infection (SSI) remains one of the most problematic, often requiring reoperation. Reoperation increases surgical risks, raises cranioplasty costs, and prolongs recovery time.
- In this literature review, we summarize recent advancements and techniques in caring for SSI after cranioplasty to determine areas of focus for future research.

Methods



Results

- A total of nine papers were included in the review. Staphylococcus species were the most mentioned infection, discussed in 88.9% of papers, followed by Cutibacterium acnes, discussed in 77.8% of the papers.
- Early-stage infections were successfully managed by empirical antibiotics, while late-stage infections almost always required explanation. It was found that debridement combined with antibiotics can resolve infection to avoid reoperation in select cases.
- While most authors pointed to removing the cranioplasty, treating the infection, and subsequent reoperation, some authors advocated for research into prophylactic measures to reduce infection.

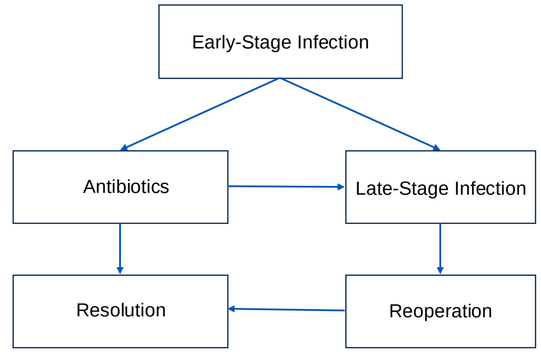


Figure 1. Common work-flow to deal with cranioplasty SSI. Despite early antibiotic treatment, reoperation is usually still required. Current research on SSI treatment should focus on effective intervention that can reduce the need for reoperation, bone flap removal, or explanation.

TABLE 1: Results from Lit Review

Author(s)	Management Approach	Outcome	Reoperation Required
Butenschoen et al.	Bone flap removal, sonication to detect contamination	Aseptic: Bone flap necrosis occurred	Yes
Bruce et al.	Surgical debridement, bone flap preservation with antibiotics	11/13 cases resolved with preserved bone flaps, 2 required removal	Yes,
Honeybul & Ho	Aseptic technique adherence, titanium cranioplasty after infection resolution	Infection rate with standardized	Yes, for infected cases
Auguste et al.	Removal of infected flap, irrigation	Most infections resolved	Yes, in most cases
Frassanito et al.	Antibiotics for early cases; removal of infected flap and delayed cranioplasty	Early cases managed conservatively; late infections required surgery	Yes, for late infections
Walter A. Hall	Removal of infected flap, delayed cranioplasty after infection resolution	Most infections resolved	Yes, typically
Hsu et al.	Radical debridement, salvage cranioplasty with antibiotic-impregnated PMMA	Most infections resolved	Yes
Haruki et al.	Reoperation, prolonged antibiotic therapy	No fatalities, but infections required long-term treatment	Yes

Discussion

- Removal of the implant was required in most cases of late-stage infection. While antibiotics and surgical debridement can treat early-stage and select infections, there is still no thorough way to avoid reoperation in SSIs following cranioplasty.
- Research should focus on prevention and early treatment of infections to reduce the number of cases requiring reoperation. Research on antibiotic-impregnated cranioplasty implants, early detection and treatment of infections, and standardized aseptic techniques is necessary to improve outcomes by reducing infections following cranioplasty.

References

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