A Systematic Review of Tissue Expander Use in Staged Calvarial Reconstruction
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Background

Calvarial reconstruction is a common procedure following decompensatory craniectomy. Tissue expansion (TE) is standard practice in several reconstructive applications. However, the role of TE in staged calvarial reconstruction is uncommon.

Here, we systematically reviewed the literature describing the use of TE in staged cranioplasties and post-operative outcomes.

Methods

A systematic literature search was completed according to the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) guidelines. 1

Systematic Search

- PubMed, Embase, Cochrane Library, Web of Science, and Scopus were queried without any publication date limit in July 2019
- Combination of search terms: “cranioplasty,” “calvarium reconstruction,” “scalp reconstruction,” “tissue expander,” and “scalp expander”

Screening

- Inclusion and Exclusion Criteria can be found in Table 1
- To eliminate bias, two authors independently screened all articles for inclusion or exclusion and in the case of conflict, a third author screened as a tiebreaker

Data Extracted

- Study specifications; patient demographics; pre-operative characteristics; bone defect characteristics; tissue expander characteristics; surgery details; implant specifications; and post-operative outcomes
- Pooled analysis was done and graphed with a 95% confidence interval using GraphPad Prism
- Studies that did not report specific patient or procedural characteristics were removed from descriptive analysis for that data element

Analysis

• Studies that did not report specific patient or procedural characteristics were removed from descriptive analysis for that data element

Table 1. Inclusion and Exclusion Criteria

<table>
<thead>
<tr>
<th>Inclusion Criteria</th>
<th>Exclusion Criteria</th>
</tr>
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<tbody>
<tr>
<td>Articles published in English</td>
<td>Articles not published in English</td>
</tr>
<tr>
<td>Cranioplasty / Calvarial reconstruction AND use of Tissue Expander</td>
<td>No full text availability</td>
</tr>
<tr>
<td>Systematic reviews, literature reviews, Case reports / series, Retrospective &amp; Prospective studies</td>
<td>Studies where patients underwent soft tissue or scalp reconstruction not involving the calvarium</td>
</tr>
<tr>
<td></td>
<td>Animal or non-human studies</td>
</tr>
<tr>
<td></td>
<td>Letters, comments, and editorials</td>
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</tbody>
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Table 2. Pooled Complication Rates

<table>
<thead>
<tr>
<th>Complication</th>
<th>Rate (%)</th>
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<tbody>
<tr>
<td>Seroma</td>
<td>1.18</td>
</tr>
<tr>
<td>Wound Breakdown</td>
<td>2.35</td>
</tr>
<tr>
<td>Infection</td>
<td>3.53</td>
</tr>
<tr>
<td>Implant Exposure</td>
<td>3.53</td>
</tr>
<tr>
<td>Hematoma</td>
<td>7.06</td>
</tr>
<tr>
<td>CSF Leak</td>
<td>7.06</td>
</tr>
</tbody>
</table>

Figure 1. PRISMA Flow Chart of our systematic review.

Figure 2. Complication Rates for Patients Receiving Tissue Expanded Staged Cranioplasty. Graphs represent average rate and bars represent the 95% confidence interval.

Results

Records identified through database searching (n = 775)

Records after duplicates removed (n = 773)

Records screened (n = 773)

Records excluded (n = 734)

Full-text articles assessed for eligibility (n = 39)

Full-text articles excluded (n = 13)

- 5 did not use Tissue Expander
- 3 Not in English
- 2 Insufficient data to extract
- 2 did not perform staged bony cranioplasty
- 1 Duplicate patient data

Studies included in qualitative synthesis (n = 26)

Discussion

Of 755 identified publications, 26 articles met inclusion criteria. 85 patients underwent a staged cranioplasty with TE.

Defect size and type of implant used did not significantly predict complication rates.

Infection and local complication rates (3.53% and 9.41%) are relatively low, compared to recent large study of alloplastic cranioplasties. 2

This is the first comprehensive review to describe current practices and outcomes in staged cranioplasty with TE and will serve as a valuable tool in guiding future reconstructive efforts.

Overall, TE is a safe and effective means for soft tissue coverage in a staged cranioplasty.