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# Role of tissue expansion in abdominal wall reconstruction: A systematic evidence-based review



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## KEYWORDS

Tissue expansion;  
Tissue expanders;  
Ventral hernia;  
Abdominal wall reconstruction;  
Transplantation;  
Component separation

**Summary** *Background:* Tissue expanders (TEs) can be used to assist primary closure of complicated hernias and large abdominal wall defects. However, there is no consensus regarding the optimal technique, use, or associated risk of TE in abdominal wall reconstruction. *Methods:* A systematic search of PubMed and Embase databases was conducted to identify articles reporting abdominal wall reconstruction with TE techniques. English articles published between 1980 and 2016 were included on the basis of the following inclusion criteria: two-stage TE surgical technique, >3 cases, reporting of postoperative complications, hernia recurrence, and patient-based clinical data.

*Results:* Fourteen studies containing 103 patients (85 adults and 18 children) were identified for analysis. Most patients presented with a skin-grafted ventral hernia (n = 86). The etiology of the hernia was from trauma or prior abdominal surgery. The remaining patients had TE placed before organ transplantation (n = 12) or for congenital abdominal wall defects (n = 5). The location for expander placement was subcutaneous (n = 74), between the internal and external obliques (n = 26), posterior to the rectus sheath (n = 2), and intra-peritoneal (n = 1). Post-operative infections and implant-related problems were the most commonly reported complications after Stage I. The most common complication after Stage II was recurrent hernia, which was observed in 12 patients (11.7%). Five patients with TE died. Complications and mortality were more prevalent in children, immunosuppressed patients, and those with chronic illnesses.

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**Conclusions:** Tissue expansion for abdominal wall reconstruction can be successfully used for a variety of carefully selected patients with an acceptable complication and risk profile.

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## Introduction

Complex abdominal wall defects pose a significant challenge for general, plastic, and reconstructive surgeons—both the patient population and reconstruction can be difficult to manage. The etiology of abdominal wall defects is diverse, ranging from congenital to traumatic. As a result, the approach to repair varies. Over the past two decades, techniques to address these impressive defects range from mesh support and component separation (CS) to the use of free tissue flaps.<sup>1–3</sup> Tissue expanders (TEs) have also been utilized to expand the skin and sometimes the underlying fascia to allow for primary closure. TEs can be placed a number of ways to achieve this purpose: subcutaneously, intermuscularly (between the external and internal obliques), or intra-abdominally. Subcutaneously placed expanders are more commonly used for defects with minimal fascial tension, but significant loss of skin. Less commonly, intermuscular TEs are used for large defects that involve the fascia and abdominal musculature. Intra-abdominal TEs have most often been used for congenital abdominal wall defects in pediatric populations.

Even with the option of expanders in complicated hernia repair and abdominal wall defects, there is no clear consensus about their overall use, optimal technique, complications, or risks. The technique has limited indications, and few surgeons are performing complex abdominal wall reconstruction. In addition, flap reconstruction may be of use in certain reconstructive situations, and the role of TEs is poorly defined. Many case reports describe expansion as an effective adjunct to complicated abdominal wall reconstruction; however, large case series are scarce in the literature. To the authors' knowledge, no systematic review on the use and efficacy of TEs for this purpose has been published. This paper aims to perform an evidence-based review on the use of tissue expansion in abdominal wall reconstruction, with the hope of providing guidelines using this technique to aid the reconstructive surgeon in decision-making.

## Materials and methods

### Literature search

A literature search of PubMed and Embase electronic databases was conducted using keywords such as hernia, abdominal wall reconstruction, transplantation, omphalocele, tissue expansion, and expanders to identify articles involving abdominal wall reconstruction with tissue expansion technique (for the full search strings please refer to [Supplemental Figure 1](#)). The review was performed

according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. PubMed and Embase searches were limited to English articles published between 1980 and September 2016. Titles and abstracts were examined, and articles were selected for full-text review based on the inclusion and exclusion criteria as follows: (1) The surgical technique was abdominal wall reconstruction utilizing a two-stage technique with TEs; (2) The study reported more than three cases; (3) The study reported outcomes data such as postoperative complications and hernia recurrence; and (4) The article had patient-based clinical data (not data from cadaver or animal studies). Additionally, a manual search of study references was performed to include any articles that were missed during the initial search. A flow chart of the selection process is presented in [Figure 1](#).

### Data extraction

Data obtained from papers included age, etiology, size of the abdominal wall defect, presence of stoma, surgical techniques, TE size and fill volume, postoperative care, follow-up, and outcomes.

### Quality assessment

Fourteen studies included in the final analysis were reviewed independently by three co-authors [KW, CNO, CO] for methodological quality. A quality score was calculated for each article using a checklist from the American Society of Plastic Surgeons (ASPS) guidelines for therapeutic studies.<sup>4</sup> Rating decisions were based on the consensus of the reviewing authors. The ASPS guidelines evaluate selection bias, intervention bias, and measurement bias with eight objective questions ([Table 1](#)). The maximum score that can be obtained per study is 8. The assessment of whether confounders were adequately addressed in each paper included an evaluation of the inclusion/exclusion criteria, methods, discussion of limitations and appropriateness of study conclusions based on the study results. All selected papers were also assigned a level of evidence based on the ASPS Rating Levels of Evidence and Grading Recommendations ([Table 2](#)).<sup>5</sup>

### Statistical analysis

Quantitative analyses and pooling of outcome measures were not possible because of substantial heterogeneity among studies and lack of large case series. Patient characteristics and outcomes of each study are presented in a table format for visual comparison. Frequency pie charts

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