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Review

Tissue expansion for breast reconstruction: Methods and techniques

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HIGHLIGHTS

- Diagnosis of breast cancer at increasingly earlier stages has encouraged the development of more conservative mastectomy.
- Breast reconstruction is an integral part of the management of breast cancer providing both psychosocial and aesthetic benefits.
- Tissue expander/implant-based reconstruction constitutes almost 65% of all breast reconstructions.
- Tissue expander/implant-based reconstruction can be performed as a two-stage procedure either in immediate setting or delayed.
- Most studies on breast reconstructions are single-center observations and no evidence-based guidelines are available yet.

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ABSTRACT

Objective: In this work, the authors review recent data on the different methods and techniques of TE/implant-based reconstruction to determine the complication profiles and the advantages and disadvantages of the different techniques. This information will be valuable for surgeons performing breast reconstructions.

Materials and methods: A thorough literature review was conducted by the authors concerning the current strategy of tissue expander (TE)/implant-based breast reconstruction following breast cancer surgery.

Results: Loss of the breast can strongly affect a woman's personal and social life while breast reconstruction reduces the sense of mutilation felt by women after a mastectomy, and provides psychosocial as well as aesthetic benefits. TE/implant-based reconstruction is the most common breast reconstructive strategy, constituting almost 65% of all breast reconstructions in the US. Although numerous studies have been published on various aspects of alloplastic breast reconstructions, most studies are single-center observations. No evidence-based guidelines are available as yet. Conventional TE/implant-based reconstruction can be performed as a two-stage procedure either in the immediate or delayed setting. Moreover, the adjunctive use of acellular dermal matrix further broadened the alloplastic breast reconstruction indication and also enhanced aesthetic outcomes.

Conclusions: TE/implant-based reconstruction has proved to be a safe, cost-effective, and reliable technique that can be performed in women with various comorbidities. Short operative time, fast recovery, and absence of donor site morbidity are other advantages over autologous breast reconstruction.

Contents

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1. Introduction

Breast cancer (BC) is by far the most common cancer in women, affecting about 12.5% women in the United States [1]. Its diagnosis at increasingly earlier stages has encouraged the development of more conservative mastectomy procedures, such as nipple-sparing, skin-sparing, and skin-reducing mastectomies [2–5]. The loss of a breast can be a traumatic experience, with serious effects on the quality of life [6,7]. For women who have undergone a mastectomy, breast reconstruction provides psychosocial as well as aesthetic benefits [8–13]. Breast reconstruction has therefore come to be regarded as not just a cosmetic procedure but an integral part of the management of BC [14,15] (see Fig. 1).

Although different approaches for post-mastectomy breast reconstruction exit, tissue expander (TE)/implant-based reconstruction constitutes almost 65% of all breast reconstructions in the US because it is considered a safe, cost-effective, and reliable technique that can be performed in women with a wide variety of comorbid states [16–20]. Even though autologous breast reconstruction provides a better cosmetic outcome and more natural-appearing breast reconstruction, TE-based reconstructions have the advantages of shorter operative time, faster recovery, and no donor site morbidity [21]. Moreover, autologous breast reconstruction can still be performed in case TE-based reconstruction fails.

Conventional TE/implant-based reconstruction can be performed as a two-stage procedure either in immediate setting at the time of the mastectomy or delayed. During the first step, a complete submuscular pocket is created for the TE by elevating the inferolateral portion of the pectoralis major muscle and the anterior insertion of the anterior serratus muscle. The second step—TE-implant exchange—is performed once the desired breast expansion is achieved. A technical modification to TE-based breast reconstruction is the use of the acellular dermal matrix (ADM) of either human or bovine origin, which allows creation of the submuscular pocket by mobilization of only the pectoralis major muscle [22,23]. The use of ADM provides numerous advantages over the conventional technique, but there are also potential disadvantages, including higher cost [24]. More recently, autologous dermal grafts have been proposed as an alternative to ADM [25,26].

There are numerous works in the literature on the methods, timing, complications, and safety of TE-based reconstruction, but most are based on empirical observations from single centers and do not provide evidence-based results [27–30]. Our work attempts to help both surgeons and their patients in the decision-making stage of breast reconstruction by collating recent data on the different method and techniques of TE-based breast reconstruction in order to determine the complication profiles and improve the health care quality.

2. History of TE/implant-based breast reconstruction

The first report of tissue expansion dates back to the 1957, when Neumann demonstrated its feasibility for achieving coverage of a subauricular defect [31]. However, more than 20 years had to pass prior that interest in tissue expansion rose again following the work of Radovan in the 1978 and Austad in 1982 [32–34]. The safety and efficacy of tissue expansion has since been thoroughly proven, and it has gained wide acceptance. The design of the TE has improved over time, and with the port incorporated in the surface of the implant, there is no longer any need for creation of a distal pocket for valve location. Moreover, textured expanders reduced the issue of their migration from the area of higher skin tightness (e.g., the inferior quadrants of the skin envelope) ensuring a better definition of the inframmamary line. Like breast implants, TEs are available in different shapes, including round and contoured shapes, which allow for greater lower pole expansion, thus increasing the upper pole slope.

The history of breast implants is even older than that of TEs and starts in the 19th century when a lipoma of the back was grafted into the breast in an attempt to provide breast augmentation [35]. Since then, different materials have been investigated, but it was only in the early 1960s that silicone implants, as currently designed, started being widely adopted [36]. The early generations of silicon implants experimented with varying thicknesses of the outer silicon layer and with silicon gel of different densities in the attempt to reduce the occurrence of capsule contracture, fluid migration, and ruptures [36]. Modern silicon implants are made of a three-dimensional matrix of cross-linked silicone molecules that do not leak out even in case of rupture of the outer layer [36]. Moreover, the introduction of textured implants has reduced capsular contracture rates and the possibility of implant malposition [36].

The latest generation of silicon implants display a vast range of shapes and volumes, varying implant width, height, and projection on the chest wall. Some manufactures provide silicon implants characterized by a more cohesive silicon gel on the top to ensure