Journal of Plastic, Reconstructive & Aesthetic Surgery (2016) 69, e48—e54

JPRAS
An International Journal of Surgical Reconstruction
www.JPRASurg.com

Breast reconstruction by tissue expansion: What is the integrity of the chest wall?

Mario Cherubino [a,*], Stefano Scamoni [b], Francesca Maggiulli [a], Chiara Floridi [c], Monica Mangini [c], Danilo Di Giovanna [a], Carlo Fugazzola [c], Luigi Valdatta [a]

[a] *Division of Plastic Surgery, Department of Biotechnology and Science of Life, University of Insubria Varese, Italy*
[b] *Division of Plastic Surgery, Ospedale di Circolo Fondazione Macchi Varese, Italy*
[c] *Division of Radiology, Department of Morphologic and Surgery, University of Insubria Varese, Italy*

Received 15 January 2015; accepted 28 November 2015

KEYWORDS
Breast reconstruction;
Tissue expander;
Chest wall deformity;
Breast implant

Summary *Background:* Both tissue expanders and implants are commonly used during breast reconstructions. These devices are the preferred choice of many plastic surgeons around the world during breast reconstruction due to their technical ease of use, low comorbidity and safety. However, several issues such as the integrity of the chest wall during and after tissue expansion remain unclear. Here we present a longitudinal study that shows deformities of the chest wall caused by the use of tissue expanders.
Patients and methods: A prospective longitudinal study of the chest wall in 36 patients who underwent immediate two-stage expander-to-implant reconstruction from 2010 to 2013 was conducted to evaluate the possible causes of chest wall deformity. Computed tomography (CT) scans of the chest walls were taken before the second-stage reconstruction and after 1 year. Chest wall deformities (graded from I, no deformities, to V, costal fracture) were evaluated with CT scans.
Results: This study examined 36 breast reconstructions. Chest wall deformities were observed by a CT scan before the second-stage reconstruction. There were eight patients with grade I scores, 14 with grade II, 10 with grade III and four with grade IV. No cases of costal fracture (grade V) were observed. At the 1-year follow-up after the TE/implant change, 22 patients had the same degree of chest wall deformity. Ten patients showed an improvement and four a higher-grade deformity.

* Corresponding author. Viale Borri 57, Varese 21100, Italy. Tel.: +39 0332278150.
E-mail address: mario.cherubino@gmail.com (M. Cherubino).

http://dx.doi.org/10.1016/j.bjps.2015.11.020

Conclusion: Chest wall deformities commonly occur after tissue expander/implant reconstruction. However, the size of the expander, reconstruction timing and filling volume are not correlated with deformity development.

Introduction

The use of breast implants in breast reconstruction surgery began in the early 1960s with silicon gel-filled implants. Radovan subsequently introduced the concept of a breast tissue expansion in the early 1980s.[1] The popularity of the one-stage reconstruction decreased as a result of increased use of a two-stage tissue expander/implant reconstruction (TE/I). Similar to implants, tissue expanders have evolved over the years, and several different options are available currently. Current TE has textured surfaces and is anatomically shaped to allow for preferential expansion in the lower pole of the reconstructed breast in order to create a more natural breast. The expanders are typically prepared in varying heights, widths, degrees of projection and shapes so that an optimal device can be selected for each individual patient's requirements.

The expander is always placed in a pocket under the pectoral major muscle and could be covered in the inferior pole by the serratus muscle or fascia (complete muscular pocket) or by a patch of an acellular dermal matrix (ADM).[2] The literature[3–6] indicates that the use of a TE causes several complications similar to those associated with breast implant surgery in general. Several case studies report a chest wall deformity after tissue expansion.[7] We believe that a correlation between the use of the TE and a temporary or permanent alteration of the chest wall can occur. Here, we present a study based on computed tomography (CT) scans of the chest wall after using TE and provide a new scoring system for the deformity.

Patients and methods

The institutional ethical committee approved this study, and informed consent to all the patients was obtained. A prospective longitudinal study of the chest wall of patients who underwent immediate two-stage expander-to-implant reconstruction from 2010 to 2013 was conducted in order to determine the development of chest wall deformities. Routine preoperative examination of all patients was conducted by evaluating the preoperative X-ray of the chest. Patients with a history of chest wall deformity or malformation were excluded from this study.

All patients analysed underwent a two-stage reconstruction following mastectomy. Only monolateral cases were included. The first surgery was performed immediately after the mastectomy. During this operation, a total sub-muscular pocket was created under the pectoral major muscle, and the lower part of the pocket was created under the serratus muscle. All of the patients received the same type of expanders (MENTOR CPX 2 Medium Height Tissue expander, style 6200). The tissue expanders were of different sizes but had equal heights, degrees of projection and shape. The day before surgery and then 1 year after the second-stage reconstruction, one of the authors performed the imaging studies.

Imaging and score system

The imaging consisted of a 64 multidetector-row computed tomography (MDCT) chest scan (Aquilion 64, Toshiba, Japan). CT imaging is a sensitive method for detecting occult deformities. We propose a scoring system to quantitatively describe these deformities comparing the contralateral side. Each MDCT scan was acquired with a thickness of 0.5 mm, voltage of 120 kV and tube current of 250 mA. We developed the scoring system presented in Table 1 to characterise chest wall deformities. The following two outcomes were considered at the time of permanent implant: chest wall deformities (graded from I, no deformities, to V, costal fracture) (Figures 1 and 2) evaluated with a CT scan. The variations were evaluated at the follow-up (at least 1 month after maximal expansion before the second-stage reconstruction and 1 year after permanent prosthesis implant).

Pulmonary function

Pulmonary function was measured by spirometry before the first surgery and the day before the implant exchange. The pulmonary function was measured again a year after the second stage of the reconstruction. The bone densities of all patients were evaluated by bone densitometry the day before the mastectomy. A complete set of preoperative and postoperative images were also taken to document each patient. The statistical analyses were performed on 36 breast reconstructions. We considered several parameters including total lung capacity, a measure of the maximal amount of air that the lungs can hold when fully inflated. We also examined vital capacity, a measure of the maximal

Table 1 Chest deformity classification.

Stage	Chest deformity
I	No alteration
II	Flattening profile of the ribs
III	Inflection of the profile rib with pleural sinking of the limiting
IV	Infraction rib