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Microbial growth within saline-filled tissue expanders☆

Ronald D. Ford, William P. Schmitt*, Mitchell G. Eichhorn, Shannon D. Armstrong

Division of Plastic and Reconstructive Surgery, Grand Rapids Medical Education Partners/Michigan State University, 221 Michigan St. NE, Suite 200-A, Grand Rapids, MI, USA

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Summary *Background:* Tissue expander based reconstruction is the most common restorative procedure used following mastectomy. Infection is a common complication in the postoperative period and may lead to failure of the reconstruction. Various previous studies have investigated the potential sources of infection during these procedures. The purpose of this study was to examine the fluid within the saline-filled tissue expander at time of implant exchange for the presence of microbial growth.
Methods: Twenty-five patients (39 breasts) were enrolled in the study. Fluid samples were sent for Gram stain, aerobic, anaerobic, fungal, and acid-fast bacilli (AFB) cultures. Average age was 53.1. Mean time to exchange was 7.7 months. Average follow-up was 25 months.
Results: None of the samples were positive for microbial growth at final culture (0/39).
Discussion: These results show the tissue expander fluid maintains a microbial-free environment during the expansion process, and is unlikely a significant source of contamination in cases of infection.
Level of evidence: Level II, prospective cohort, therapeutic study.

Introduction

The use of tissue expanders and implants has become the most prevalent method of breast reconstruction following mastectomy. Innovative advancements in the design of tissue expanders and implants, the introduction of acellular dermal matrix, and the addition of fat grafting have significantly improved the appearance and shape of the

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* Corresponding author. 221 Michigan St. NE, Suite 200-A, Grand Rapids, MI 49503, USA. Tel.: +1 616 254 9883; fax: +1 616 732 6255.
E-mail address: William.schmitt@grmep.com (W.P. Schmitt).

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breast using implant-based techniques.[1–3] In 2011, the ASPS reported 96,277 tissue expander-based reconstructions were performed.[4] The popularity of this procedure necessitates an understanding of the potential complications to provide informed decision-making for patients. Complications such as infection, poor wound healing, implant exposure, capsular contracture, and contour irregularities may result in poor outcomes and reconstructive failures.

Post-operative breast infection is a common cause leading to the removal of the implant and has been the subject of many investigations. Reported rates of clinical infection requiring surgical intervention are variable in the literature. Cordiero et al. (2006) reported 2.7% infection rate in 1522 reconstructions.[5] Francis et al. (2009) reported 16.5% rate of infection in 413 breasts. Risk factors for post-operative infection in tissue expanders included history of irradiation, delayed reconstruction, larger breasts (>C cup), and re-attempted implant after primary failure.[6] Radiation and lymph node dissection have been shown to increase the risk of infection by a factor 4.88 and 6.29, respectively.[7]

A number of studies have examined the potential sources of tissue expander infections. Reiger et al. reported 52% (12/23) periprosthetic cultures were positive following vortexing and high frequency sonication of the tissue expander. The most commonly isolated organisms were *Propionibacterium acnes* and coagulase-negative *Staphylococcus* species.[8] MacAdam et al. (2009) reported 43% of periprosthetic fluid specimens surrounding tissue expanders had at least one positive culture.[9]

The fluid within the tissue expander lumen has also been evaluated. Two separate studies reported positive intraluminal cultures for *Serratia marcescens* and *Pseudomonas aeruginosa*, respectively.[10,11] Other studies suggest the majority of tissue expanders maintain a sterile environment with serial expansion. In 1996, Becker et al. reported no growth in 45 randomly selected tissue expanders.[12] Brown et al. (2002) confirmed these findings after sampling fluid from 32 tissue expanders with no growth reported in all cultures.[13]

As occasional leakage or iatrogenic rupture may occur during exchange of the expander, it is important to further investigate the potential for microbial contamination. As colonization may lead to clinical infection, extrusion, capsular contracture or implant failure, it is essential to evaluate the presence of microbial growth within saline-filled tissue expanders. The purpose of this study was to obtain intraluminal cultures from saline-filled tissue expanders at time of exchange for permanent implants and assess the presence of microbial growth.

Methods and materials

Selection criteria

The study design was approved by the Institutional Review Board at Mercy Health Saint Mary's Hospital (Grand Rapids, MI, June 2010, IRB # SM10-0921-01) and adhered to all ethical standards outline in the World Medical Association Declaration of Helsinki (June 1964) and subsequent revisions. A research grant was provided by the Mercy Health Doran Research Foundation to cover only the expense of the microbial analysis. All authors had no financial interests or disclosures for this study. No animals were included in this study.

Written informed consent was obtained from a consecutive series of patients presenting to the senior author's local practice (Grand Rapids, MI) undergoing breast reconstruction with tissue expansion followed by long term implant placement from 11/2011 to 4/2013. A total of 25 patients (39 breasts) met inclusion criteria. Any ruptured expanders prior to exchange were excluded from the study. Thirty six of 39 breasts underwent first stage immediate reconstruction with saline-filled tissue expanders and acellular dermal matrix (ADM). Two breasts underwent delayed reconstruction with tissue expanders placed deep to a latissimus dorsi mycutaneous flap. One patient underwent delayed tissue expander placement with ADM following fat necrosis of a previous TRAM flap reconstruction. Inamed Style 133 MV® textured saline-filled tissue expanders were used in all patients included in the study (Inamed/Allergan™, Irvine, CA, USA).

Surgical technique and fluid aspiration

All patients underwent first stage reconstruction following standard surgical technique either using subpectoral placement of tissue expanders with ADM (Alloderm®, LifeCell™, Bridgewater, NJ, USA) or latissimus dorsi flap coverage. All patients received a pre-operative dose of intravenous antibiotics (cefazolin or clindamycin if penicillin allergic).

Patients then underwent weekly expansion until desired volume reached. The introducer port was localized with a magnetic device, the skin was prepped with isopropyl alcohol, and skin and muscle were then infiltrated with 2cc of 1% lidocaine. Expansion was then performed using a closed loop system technique and a 21-gauge needle. The time period to full expansion was recorded.

Tissue expanders were then removed by standard technique at time of implant exchange after receiving a pre-operative dose of antibiotics. A small area of the tissue expander surface was prepped with isopropyl alcohol following removal. A sterile, 21-gauge needle then passed through the prepared surface and approximately 20 mL of intraluminal fluid was aspirated. The sample was then transferred to a sterile red top vacutainer and sent for microbiological analysis at Saint Mary's Mercy Health Hospital, Grand Rapids, MI, USA. The remaining expander fluid was discarded.

Cultures

Specimens were prepared following the established protocol of the microbiology department at Saint Mary's Mercy Health Hospital, Grand Rapids, MI, USA. Gram stain and smear, aerobic, anaerobic, fungal and AFB cultures were performed on all collected fluid samples.

One milliliter of specimen was cytofuged for 10 min at 2500 rpm. The slides were then fixated with alcohol and stained with Gram crystal violet, iodine, decolorizer, and