

Review

Infection prevention in breast implant surgery – A review
of the surgical evidence, guidelines and a checklist



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Abstract

Introduction: As a result of increasing use of implant-based breast reconstruction, complications such as infection are being encountered more frequently. Surgical Site Infections (SSIs) cause morbidity for the patient, can lead to capsular contracture or implant loss and are costly to healthcare systems. National Guidelines suggesting methods to reduce SSI related complications have been produced, but are limited in the scope of interventions covered and underlying evidence presented.

Methods: We performed a literature review encompassing a wide variety of possible SSI prevention strategies. We aimed to present summaries of the available evidence and give pragmatic recommendations as to their validity to use as guidelines for infection prevention strategies for implant-based breast reconstruction.

Results: A lack of high quality data relating to the benefit of SSI prevention strategies in implant-based breast reconstruction exists. Many papers relate to orthopaedic implant surgery, or clean surgery in general. Following review of the evidence, sufficient data exists to support use of perioperative antibiotics at implant-based breast reconstruction, with continuation for an extended period in “high risk” patients. Alcohol containing skin preparations should be used over aqueous solutions. Laminar air flow use is suggested. Theatre traffic should be kept to a minimum, as should duration of operative procedure. The implant pocket should be washed prior to implantation. Double gloving and conductive warming are also endorsed.

Conclusions: We have produced a perioperative “Theatre Implant Checklist” for SSI prevention in implant-based breast surgery, with a set of pragmatic up to date guidelines, which allows the reader to evaluate the evidence upon which our recommendations are based.

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Keywords: Infection; Prevention & control; Breast implants; Neoplasms

Abbreviations: U.S., United States; U.K., United Kingdom; SSI, Surgical Site Infection; CC, Capsular Contracture; S. Epidermidis, Staphylococcus Epidermidis; S. Aureus, Staphylococcus Aureus; RR, Relative Risk; MRSA, Methicillin Resistant Staphylococcus Aureus; MSSA, Methicillin Sensitive Staphylococcus Aureus; PCR, Polymerase Chain Reaction; NICE, National Institute for Health and Clinical Excellence; ABS, Association of Breast Surgery; NNT, Number Needed to Treat; CI, Confidence Interval; PVI, Povidone iodine; UCV, Ultra Clean Ventilation; LAF, Laminar Air Flow; RCT, Randomised Controlled Trial; ARR, Adjusted Risk Reduction; CFU, Colony Forming Units; OR, Odds Ratio; SD, Standard Deviation; TIC, Theatre Implant Checklist.

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Introduction

The rising incidence of breast cancer and the psychosocial benefit of breast reconstruction have seen increasing numbers of breast-reconstructive procedures over recent years.^{1,2} In the United States (U.S.), the number of breast reconstructions increased from 78,832 in the year 2000 to 95,589 in 2013.³ In the United Kingdom (U.K.), implant-based reconstructions now account for approximately 85% of immediate breast reconstructions.⁴ Implant-based breast reconstructions are popular due to the benefits of reduced operating/recovery time, lack of donor site morbidity, an increase in breast surgeons being trained in their use and the availability of a variety of acellular dermal matrices (or similar types of internal meshes) which can be used to provide an internal hammock and improve aesthetic outcome compared to complete sub-muscular placement of the implant.⁵

The surgical site is the most common focus for infection after an operation and this can be attributed to multiple confounding preoperative, intra-operative and post-operative factors. The most frequent source for infection is the patient's own skin at the time of surgery.⁶ Surgical Site Infection (SSI) is a significant problem in implant-based breast reconstruction, with infection rates of approximately 5%.⁷ Risk factors for SSI include smoking, radiotherapy, chemotherapy and skin necrosis.⁷ SSI can lead to prolonged hospital admission, re-operation, multiple outpatient visits and implant loss (which has been reported as high as 19% in implant-based reconstruction).⁸ The cost of SSI is significant; one U.S. study published in 2008 showed that the average cost of a SSI in breast surgery was \$4091.⁹

Infections in implant-based reconstruction pose the additional complication of increasing the incidence of capsular contracture (CC) – a leading cause of implant revision.¹⁰ The aetiology of capsular contracture is multifactorial, but subclinical infection in particular with a *Staphylococcus epidermidis* (*S. epidermidis*) biofilm has been implicated in its pathogenesis.¹¹

U.K. guidelines for breast reconstruction were published in 2012 and include recommendations for reducing reconstruction related infections, however, the evidence for these guidelines is not clearly referenced and no mention is made of the quality of the data on which they are based. Suggested measures include preoperative *Staphylococcus aureus* (*S. aureus*) screening, antibiotic use, the use of ultra clean ventilation (UCV) and chlorhexidine skin preparation.¹² Specific guidance for breast implant use includes a suggested wash of the implant cavity and the use of a “minimal touch” implant insertion technique, with a glove change prior to handling the implant. The American Society of Plastic Surgeons has produced guidance for implant-based reconstruction, but in terms of infection prevention only covers the use of a perioperative antibiotics, with a recommendation that antibiotics be given on induction and discontinued within 24 hr of surgery (unless a drain is present).¹³

SSI rates post implant-based reconstruction of between 3 and 6.1% compare unfavourably to both cosmetic augmentation, with infection rates of between 0.9 and 1.7%^{14,15} and orthopaedic joint replacement surgery, where SSI is as low as 0.7% for knee and 1% for hip replacements.¹⁶ Orthopaedic SSI rates can be seen as the “gold standard” to which breast implant-based reconstruction should aspire. Due to unpreventable risk factors for infection such as poor skin flap perfusion following mastectomy (compared to cosmetic augmentation), patient co-morbidities and the need for adjuvant chemotherapy and/or radiotherapy, this may be hard to achieve. These factors need to be considered preoperatively when assessing individual patient suitability for an implant-based reconstruction. There are many modifiable risk factors for SSIs. This review presents the evidence (and lack thereof) behind commonly used and recommended infection prevention measures.

Methods

We searched Embase, Medline, PubMed, Scopus and The Cochrane Library in May 2015 for articles printed in English and based on human populations. Articles that could inform practice in infection prevention were analysed. Our search terms included infection and augmentation or breast implants or prosthesis with: Antibiotics, laminar air flow, operative team size, scrub type, chlorhexidine, iodine, pocket irrigation, surgical approach, implant type, nipple shields, perioperative warming, drains, surgeon grade, double glove, Methicillin-resistant *Staphylococcus aureus*, *S. aureus*, showering and operative time.

We examined the references of articles for additional papers of interest. The primary search focus was implant-based breast reconstructions. Where data was limited we widened this to include breast augmentation (acknowledging that aesthetic augmentations carry a lower infection rate and are a different patient population who lack some risk factors of the oncological cohort for infection such as a need for radiotherapy or lymph node dissection).^{15,17} Where evidence was still lacking we expanded our search to orthopaedic implant surgery and finally surgery as a whole.

The infection prevention methods were categorised into preoperative, environmental/equipment and surgical technique related and each one was evaluated and a recommendation made with regard to its use. Where the evidence was weak, the measure was “suggested” rather than recommended. Tables were also produced for each category to summarise the evidence, including levels of evidence and relevant statistics.¹⁸

Pre-operative factors (Table 1)

Pre-operative methicillin sensitive and resistant S. aureus screening and treatment

S. aureus is the commonest cause of SSI with most cases being caused by commensal bacteria brought to hospital by

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