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Recommendations for the Use of Antibiotics in Primary and Secondary Esthetic Breast Surgery

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Summary: The use of systemic prophylactic antibiotics to reduce surgical-site infection in esthetic breast surgery remains controversial, although the majority of surgeons prefer to utilize antibiotics to prevent infection. Nonetheless, postoperative acute and subclinical infection and capsular fibrosis are among the most common complications following implant-based breast reconstruction. After esthetic breast augmentation, up to 2.9% of women develop infection, with an incidence rate of 1.7% for acute infections and 0.8% for late infections. After postmastectomy reconstruction (secondary reconstruction), the rates are even higher. The microorganisms seen in acute infections are Gram-positive, whereas subclinical late infections involving microorganisms are typically Gram-negative and from normal skin flora with low virulence. In primary implantation, a weight-based dosing of cefazolin is adequate, an extra duration of antibiotic cover does not provide further reduction in superficial or periprosthetic infections. Clindamycin and vancomycin are recommended alternative for patients with β-lactam allergies. The spectrum of microorganism found in late infections varies (Gram-positive and Gram-negative), and the antibiotic prophylaxis (fluoroquinolones) should be extended by vancomycin and according to the antibiogram when replacing implants and in secondary breast reconstruction, to target microorganisms associated with capsular contracture. All preoperative antibiotics should be administered <60 minutes before incision to guarantee high serum levels during surgical procedure. *(Plast Reconstr Surg Glob Open 2020;8:e2590; doi: 10.1097/GOX.0000000000002590; Published online 24 January 2020.)*

INTRODUCTION

Breast augmentation is one of the most popular procedures in plastic surgery worldwide. In 2017, 333.392 patients underwent breast augmentation, thus, making it the most commonly performed surgical procedure in the United States.[1] A particularly devastating postoperative complication is surgical-site infection (SSI), occurring in 2%–2.5% of patients following breast augmentation.[2] Importantly, one has to distinguish between early and late infection, the latter believed to be associated with the development of capsular contracture.[3–7]

Acute infections occur between the first and the sixth week postoperatively. Clinical signs include erythema, edema, and pain, in addition to changes in laboratory parameters, including leukocytosis and elevated c-reactive protein and procalcitonin. In contrast, late infections manifest months to years after implant placement and are often subclinical.[8] In light of the devastating consequences of SSI, the issue of prophylactic antibiotic administration deserves special attention. The importance of this topic, however, is contrasted by the lack of widely accepted evidence-based guidelines addressing the issue of perioperative antibiotic prophylaxis. An unsolved problem remains prevention of capsular contracture. A variety of theories have been proposed related to its underlying pathomechanism, including immunologic factors and biofilm formation.[4,9] Given these theories, prophylactic antibiotic administration, in addition to surgical technique (Bill Adams paper-14-point plan), appears to be a critical intervention.[6] It is, therefore, not surprising that an increase in the use of antibiotics has been noted over time.[10] Yet, it is important to acknowledge that antibiotics can have serious adverse drug events, including allergic reactions, bacterial resistance, and clostridium difficile infection.[11] Furthermore, it is unclear if antibiotics can effectively prevent biofilm formation following implant placement.[12]

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Several studies have demonstrated that bacterial contamination is present in up to 66% of patients with high-grade capsular contracture.[13] In fact, studies of patients with breast implants have demonstrated that many implant pockets contain Gram-positive bacteria with the predominant species being local skin flora (coagulase-negative staphylococci [CNS], *Propionibacterium acnes*, *Corynebacterium* species). In light of this bacterial spectrum, the use of prophylactic cefazolin seems justified.[14] Recent studies hypothesize a discrepancy between antibiotic activity of commonly used antibiotics for preoperative prophylaxis of SSIs in patients with implant replacement and microorganisms found by sonication on breast implants, suspected to trigger the formation of capsular contracture.[15]

In several studies, an ultrasound bath of the explanted breast implants to create a fluid targeted with microorganisms was used (sonication).[16] A significant correlation between degree of capsular contracture and culture positivity after sonication[17] was targeted. The main group of bacteria found was *Propionibacterium* species and CNS[18,19] (Fig. 1).

Prophylaxis

Preoperative antibiotics are used to prevent postoperative infections, including SSI[20] and bacteremia-induced joint prosthesis infection or infective endocarditis in high-risk patients.[21]

Breast augmentation is considered a clean procedure. However, breast tissue contains bacteria, thus, presenting a risk for implant contamination and postoperative infection.[22] Preoperative risk factors for developing a SSI after breast surgery include advanced age, poor nutritional status, obesity, diabetes mellitus, smoking, presence of infection, immunodeficiency or immunosuppressive use, steroid use, recent surgery, long preoperative hospitalization, and colonization with microorganisms.[4,23] In addition to patient factors, surgical technique can impact infection rates, as demonstrated by a higher number of SSIs associated with periareolar or transareolar approaches.[24] Glove changes are recommended before treating the implants as well as the use of devices that minimize skin contact during implant insertion ("no touch technique").[17,25] Finally, the plane of implant insertion (subglandular versus subpectoral) and their surface characteristics (smooth versus textured) affect infection rates.[26,27]

Ariyan et al presented the results of an evidence-based consensus conference on antibiotic prophylaxis for preventing SSI in plastic surgery.[28] They concluded that antibiotic prophylaxis (versus control) was associated with a significant risk reduction of SSI (2.5% versus 11.4%; odds ratio, 0.16; 95% CI, 0.04–0.61; $P = 0.01$) for patients following breast augmentation.[28] These findings were, however, not replicated by Hardwicke et al who did not identify a beneficial effect of antibiotics on infection rates following breast augmentation.[29] Given these contradicting reports, a widely accepted consensus on antibiotic prophylaxis in augmentation mammaplasty is still lacking.[30] A reasonable approach might be to administer antimicrobial prophylaxis in clean wounds that are at risk of wound infection due to patient comorbidities or prolonged procedure length, complicated anatomy, choice of surgical technique/approach,[31] and clean-contaminated wounds (implant-based breast cancer reconstruction).[32] There is no evidence that prolonged postoperative antibiotic administration in primary or secondary cosmetic breast augmentation reduces postoperative complication rate, infection, or capsular contracture.[33,34]

Choice of Antibiotics

Most surgeons prefer a first-generation cephalosporine for antibiotic prophylaxis.[35] The Sanford guide to antimicrobial therapy recommends cefazolin 1–2 mg intravenous single shot preoperatively for breast surgery.[36] Early/acute infections occur within the first 6 weeks after surgery and are mainly caused by Gram-positive microorganisms of endogenous breast flora, such as *Staphylococcus aureus*, methicillin-resistant

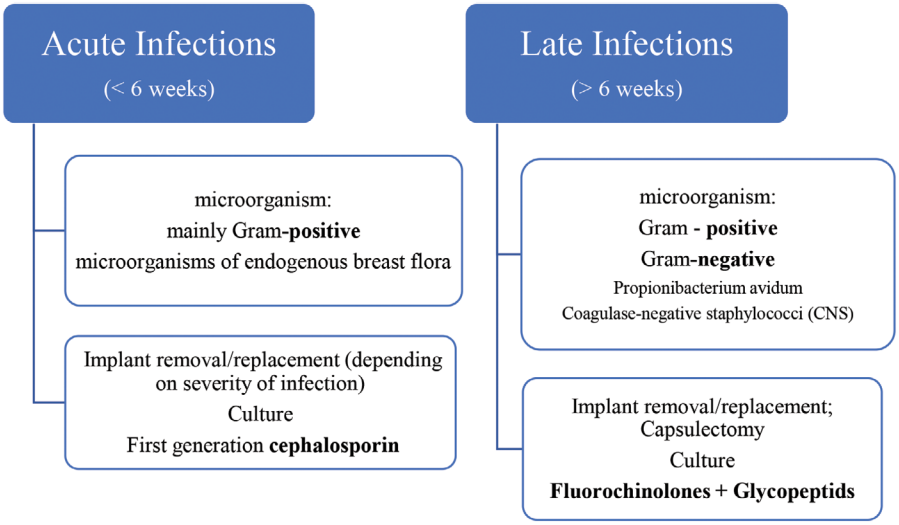

Fig. 1. Differences between acute and late infections.

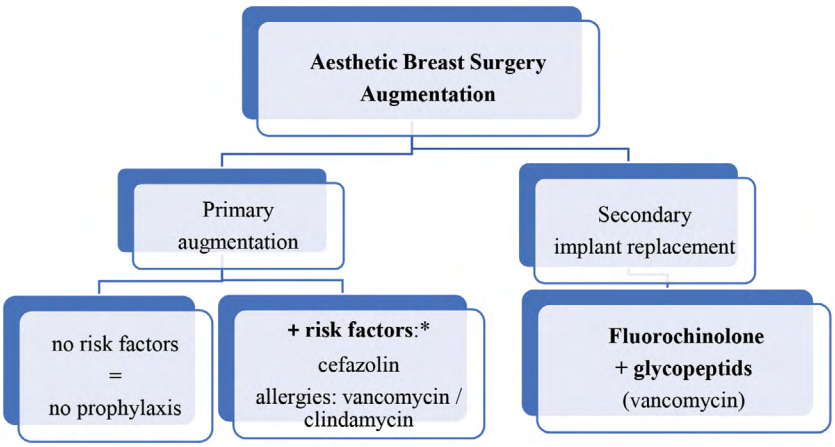

Fig. 2. Algorithm for the choice of antibiotics in esthetic breast surgery—augmentation. *Advanced age, negative nutritional status, obesity, diabetes mellitus, cigarette smoking, presence of infection, immunodeficiency or immunosuppressive use, steroid use, recent surgery, long preoperative hospitalization, and colonization with microorganism.

S. aureus, *Streptococcus pyogenes*, *P. acnes*, *Diphtheroids*, *Lactobacilli*, or *Bacillus* species.[36,37] Clinical studies on capsular contracture as a common endpoint of late infection have identified a different bacterial spectrum, that is, *Propionibacterium avidum* and CNS.[38,39] These species are not particularly susceptible to the commonly used cephalosporin. Hence, glycopeptides (vancomycin) have been proposed for the purpose of reducing the risk of capsular contracture because they are highly effective against Gram-positive organisms like *Propionibacterium* species and CNS.[40,41] In concordance with this hypothesis, Chidester et al[14] challenge the default use of cefazolin in a single-center study with 553 patients showing a relatively high resistance to cefazolin and clindamycin but vancomycin covering 100% of Gram-positive organisms.

For primary augmentation, cefazolin is most commonly recommended and is congruent with a recent report of 97% of plastic surgeons using this regimen.[35] In secondary implant breast reconstruction and when replacing implants, the use of fluoroquinolones and vancomycin is necessary due to extended microbiologic spectrum with Gram-positive and Gram-negative microorganism. When changing implants, it is recommended to obtain specimen for microbiologic examination. In addition to histologic examination of the capsule, seroma fluid (when present) should be examined for CD30 and anaplastic lymphoma kinase to exclude anaplastic large cell lymphoma (Fig. 2).[42,43]

Duration and Timing of Antibiotic Prophylaxis

A single dose of intravenous antibiotic is adequate for prophylaxis in primary breast augmentation surgery and minimizes the risks associated with prolonged antibiotic use.[44] This is particularly important as prolonged antibiotic administration does not reduce postoperative infection rates.[45]

The first dose of antimicrobial should be administered 60 minutes before skin incision. Vancomycin and fluoroquinolones should be administered within 120 minutes before skin incision due to the prolonged infusion times required for these drugs. The longer half-lives of these antibiotics guarantee high serum levels during most surgical procedures.[46]

In primary and secondary breast reconstruction, a perioperative single dose of intravenous antibiotic is enough. The timing should be 60 minutes before surgical incision for cephalosporins. If additional antibiotics are necessary (vancomycin/flourchinolone), administration should be done 120 minutes before incision.

CONCLUSIONS

In primary augmentation, a single dose of intravenous weight-based cefazolin before skin incision appears to be adequate. Clindamycin or vancomycin is recommended for patients with β-lactam allergies. In secondary breast surgery, that is, implant replacement, antibiotic coverage should be broadened to include flourchinolones and vancomycin.

Using the principles of the 14-point-plan by Adams et al[6] to minimize the bacterial load at the time of surgery, the development of subclinical infection and capsulare contracture may be reduced.

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