



Guideline for Antimicrobial Prophylaxis in Breast Surgery

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ABSTRACT

The American Society of Health-System Pharmacists (ASHP) published the 2012/2013 edition of the book entitled “Best Practices for Hospital & Health-System Pharmacy: Position and Guidance Documents of ASHP” with Bruce Hawkins as the editor. (ISSN: 15558975). Pages 582-667 of this book contain the section: “Therapeutic Guidelines on Antimicrobial Prophylaxis in Surgery”. This section includes current clinical developments, evidence and recommendations on the application of standard and effective antimicrobial prophylaxis in adult and pediatric patients, and has significant differences compared to the previous 1999 edition. On pages 632-633, antimicrobial prophylaxis in breast and plastic surgery practice is addressed in detail. This article contains a summary of the recommendations made in ASHP 2012/2013 Report regarding the antimicrobial prophylaxis in breast and plastic surgery applications.

Key words: Breast, antibiotic prophylaxis, surgery

Introduction

Currently breast surgery has a wide range of procedures including plastic surgery operations. The risk of wound infection is below 5% in surgical procedures including breast reduction and reconstruction surgery, in a patient without additional risk factors for infection (1-12). In addition to patient specific conditions that are known to increase the risk of infection in all kinds of surgical wounds in general, the use of implants in breast surgery (13) and preoperative radiotherapy application (14, 15) further increase the risk of wound infection.

Antimicrobial prophylaxis should be applied in clean wounds at high risk of wound infection, clean-contaminated wounds and contaminated wounds. In clean wounds without a risk, there is no indication for prophylaxis (16). In dirty-infected wounds treatment is planned, not infection prophylaxis.

Factors Increasing the Risk of Surgical Wound Infection

Antimicrobial prophylaxis has an important role in reducing surgical wound infection rates. Besides prophylaxis; basic infection control mechanisms implemented in the clinic (17), the surgeon's experience and technique, duration of operation, hospital and operating room conditions, instrumentation, preoperative preparation including body-washing, skin antisepsis and shaving, peri-operative management of temperature and blood glucose regulation, and the patient's existing co-morbidities all play an important role (16, 18). Patient-related risk factors for surgical wound infections are 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 microorganisms.

Microorganisms

In breast and plastic surgery procedures, usually *S. aureus* is responsible for the wound infection (2, 6, 7, 10, 11, 15, 19, 20). In axillary region procedures, obese patients prone to maceration, procedures at sweating areas *P. aeruginosa*, *Serratia marcescens*, Enterobacteriaceae including *E. coli* and gram-negatives like *Klebsiella* can be isolated (20, 21).

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Efficiency

In retrospective placebo-controlled trials it has been shown that antimicrobial prophylaxis did not significantly reduce rate of infection in surgical applications with clean wounds such as augmentation mam-moplasty (9), reduction mammoplasty, lumpectomy, mastectomy, and axillary lymph node dissection (19, 22-24). However, a Cochrane

review evaluating 7 randomized controlled trials and including 1984 patients with primary non-reconstructive breast surgery and axillary dissection due to breast cancer (25), showed that there was a significant reduction in infection rates with prophylaxis when groups with (995 patients) or without (989 patients) prophylaxis were compared (8% versus 10.5%, RR 0.72, 95% CI: 0.53-0.97). In this study, it

Table 1. Recommended doses and dose interval for antimicrobial agents frequently used in surgical prophylaxis

Antimicrobial	Recommended dose		Half-life in adults with normal renal functions h (19)	Recommended 2.Dose administration interval (The preoperative dose accepted as the first dose) h (c)
	Adult (a)	Pediatric (b)		
Ampicillin-Sulbactam	3g (ampicillin 2 g/ sulbactam 1 g)	50 mg/kg of Ampicillin component	0.8-1.3	2
Ampicillin	2 g	50 mg/kg	1-1.9	2
Aztreonam	2 g	30 mg/kg	1.3-2.4	4
Cefazolin	2 g, 3 g for patients more than 120 kg	30 mg/kg	1.2-2.2	4
Cefuroxime	1,5 g	50 mg/kg	1-2	4
Cefotaxime	1 g (d)	50 mg/kg	0.9-1.7	3
Cefoxitin	2 g	40 mg/kg	0.7-1.1	2
Cefotetan	2 g	40 mg/kg	2.8-4.6	6
Ceftriaxone	2 g (e)	50-75 mg/kg	5.4-10.9	NA
Ciprofloxacin (f)	400 mg	10 mg/kg	3-7	NA
Clindamycin	900 mg	10 mg/kg	2-4	6
Ertapenem	1 g	15 mg/kg	3-5	NA
Fluconazole	400 mg	6 mg/kg	30	NA
Gentamicin (g)	5 mg/kg (tek doz)	2.5 mg/kg	2-3	NA
Levofloxacin (f)	500 mg	10 mg/kg	6-8	NA
Metronidazole	500 mg	15 mg/kg Single 7.5 mg/kg dose for newborns <1200 g	6-8	NA
Moxifloxacin (f)	400 mg	10 mg/kg	8-15	NA
Piperacillin-Tazobactam	3.375 g	80 mg/kg of piperacilin component in 2-9 months infant; 100 mg/kg of piperacilin component for infants older than 9 months and less than 40 kg	0.7-1.2	NA
Vancomycin	15 mg/kg	15 mg/kg	4-8	NA
Oral antibiotics used for prophylaxis in colorectal surgery (for mechanical bowel preparation)	1 g	20 mg/kg	0.8-3	NA
Erythromycin				
Metronidazole	1 g	15 mg/kg	6-10	NA
Neomycin	1 g	15 mg/kg	2-3 (3% absorbed in the normal GI tract)	NA

h: Hour

(a) Adult doses are those stated for every system. In case of discrepancy, an experienced senior was consulted to determine the recommendation dose.

(b) The maximum pediatric dose should not exceed the adult dose.

(c) Antimicrobials with short half-life (cefazolin, cefoxitin etc.) should be applied prior to the surgical procedure, and should be repeated during the operation according to their half-life in patients with normal renal function. Recommended interval stated as NA (not applicable) depends on the length of the procedure and repetition may be required in very long surgeries. (d) Although the FDA approved label states 1g, experts recommend 2g for obese patients.

(e) In colorectal procedures when used as a single dose in combination with metronidazol

(f) Although floroquinolons increase the risk of tendinitis/tenosynovitis in all ages, single dose administration is safe.

(g) In general, use of gentamicin in surgical prophylaxis is limited to preoperative single dose. Dose is adjusted according to the patient's weight. If the patient's weight is 20% more than his ideal body weight (IBW), the dose (D) is calculated with this formulation: D = IBW + 0.4 (actual weight - IBW)

was concluded that in order to reduce the risk of wound infection, antimicrobial prophylaxis should be used in breast cancer patients undergoing non-reconstructive surgery.

Antibiotic Choice

There is no consensus about the choice of antibiotics for antimicrobial prophylaxis in clean wounds with risk factors, and clean contaminated wounds in breast and plastic surgery procedures (12, 26). The general application is selecting the antibiotic that will cover gram positive organisms and common gram-negatives according to the surgical area. In most cases, cefazolin or ampicillin-sulbactam is sufficient. In case of beta-lactam allergy, clindamycin and vancomycin are alternatives. If vancomycin or clindamycin is being used and gram-negative organisms are suspected then aztreonam or gentamicin or the addition of a single dose fluoroquinolone is suggested. There isn't any high-level evidence for oral antimicrobial prophylaxis or different applications in methicillin-resistant *Staphylococcus aureus* (MRSA) infection (2, 3, 11, 27).

Dose Adjustment

Data regarding dose adjustment according to weight in overweight patients and dose repetition in long surgeries have been updated. Obesity poses a high risk for surgical wound infection. The pharmacokinetics of the drug may vary in obese patients. That is why, dose should be adjusted according to body weight in these patients. If the procedure continues 2 times longer than the half-life of the drug, or if there is a considerable amount of blood loss during the procedure, intraoperative dose repetition is required in all patients, to make sure that the serum and tissue concentrations of the drug are sufficient (Table 1).

Timing of Preoperative Dose

The best time for preoperative medication is 60 minutes before surgical incision. This is a more specific timeframe than the previous suggestion of application 'during induction of anesthesia'. Some agents, such as fluoroquinolones and vancomycin need to be applied 1-2 hours prior to the operation. Therefore, these agents should be initiated 120 minutes before the surgical incision.

Duration of Prophylaxis

In order to prevent the development of side effects and resistance, antimicrobial prophylaxis should be discontinued as soon as possible even if drains, catheters or implants have been used in breast and plastic surgery operations (4, 5, 11, 16, 19, 28). In breast surgery, any significant differences were not found between single dose antimicrobial prophylaxis regimens and extended protocols in terms of wound infection (5, 11, 19). In addition, side effects such as nausea, diarrhea, itching and skin rash were reported more in the group with more than a single dose of prophylaxis.

Summary Recommendations

- Unless there are no factors increasing the risk, antimicrobial prophylaxis is not required in clean wounds.
- Although no significant antimicrobial activity has been shown in studies, antimicrobial prophylaxis should be applied in clean wounds with risk factors based on expert opinion.
- In clean contaminated wounds, antimicrobial prophylaxis should be administered in breast cancer patients.

- The antimicrobial prophylaxis should be done with single-dose cefazolin or ampicillin-sulbactam, or in the presence of beta-lactam allergy, clindamycin or vancomycin.
- If there is risk of Gram-negative microorganisms, prophylaxis should be done with cefazolin, or in the presence of allergy with gentamicin or aztreonam or fluoroquinolone.
- The post-operative prophylaxis period should be kept less than 24 hours regardless of the presence of catheters, drains, or implants.

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