Are Breast Surgical Operations Clean or Clean Contaminated?

Kamal Kataria · Amit Bagdia · Anurag Srivastava

Received: 4 December 2014 / Accepted: 18 February 2015 / Published online: 13 March 2015
© Association of Surgeons of India 2015

Abstract The breast surgeries are classically taught as *clean* surgical procedures. The infection rates following breast surgery ranges from 3 to 15 %, which is much higher than infection rates after clean surgery (ranging from 1.5 to 3 %). This high infection rate following breast surgery can be explained by opening of the ductal system to outside world through nipple similar to the gastrointestinal and genitourinary system. We conducted a systematic review of infection following breast surgeries. We searched various randomized controlled trials, meta-analysis, and Cochrane Reviews over PubMed and Medline via the Internet. These evidences were found to support the thesis, “Breast surgeries need to be reclassified as clean-contaminated”. We recommend the use of prophylactic antibiotics in breast surgery.

Keywords Breast surgery · Clean contaminated · Wound infection · Surgical site infection · Milk ducts · Bacteria

Introduction

Breast surgery is described in the surgical literature as a *clean* surgical procedure. The operations on hernia, thyroid, and breast are taught as classic examples of clean surgical procedures. A surgery is called clean contaminated whenever there is entry into the gastrointestinal tract, genitourinary tract, gynecologic tract, respiratory tract, or nasal, oral, or pharyngeal cavity, without gross contamination, e.g., cholecystectomy; choledocholithotomy; urinary stone removal from the kidney, ureter, or urinary bladder; hysterectomy; and oral and nasopharyngeal surgery.

The breast is made up of glandular tissue with racemose type of ductolobular system (like bunch of grapes). This ductal system is opening to the outside world through the nipple (Fig. 1). In this regard, it is akin to the gastrointestinal or genitourinary tract. There is no known bacterial warding mechanism to prevent the movement of organisms from the skin to ductal tissue. In this essay, we provide the readers evidence to support the thesis, “Breast surgeries need to be reclassified as clean-contaminated”.

Prevalence of Surgical Site Infection with Breast Surgery The wound infection risk after clean surgery usually should be less than 5 % (ranging from 1.5 to 3 %) [1]. However, in patients undergoing breast surgery, the infection prevalence ranges from 3 to 15 % [2–4]. A study at our institute has demonstrated that risk of infections in breast surgeries (Figs. 2 and 3) was 8.5 %, which is more than what can be expected in clean surgery [5].

Microbial Flora of Mammary Milk Ducts Microbiological studies have demonstrated that endogenous bacteria from the patient’s own body are the most important source of surgical site infection (SSI) than exogenous bacteria. Throckmorton et al. in their study of surgical site infections after breast operations found that *Staphylococcus* was the most commonly isolated bacterium (60 %). Other isolates (40 %) included gram-negative bacilli and anaerobes [6, 7]. These were the most common organisms likely to be cultured from milk ducts. In one study from Canada and Ireland, 121 bacterial species (operational taxonomic units) were identified within the breast tissue of 81 patients, by 16S RNA sequencing technique [7].

A very interesting study using PCR amplification and pyrosequencing of first 500 bp of the 16S rRNA genes, amplified with the universal eubacterial primers 27F and 533R by using high-fidelity AB-Gene DNA polymerase, has been reported to identify a plethora of microbiota present in human

This paper has not yet been presented in part as a speech.

K. Kataria · A. Bagdia · A. Srivastava (✉)
Department of Surgical Disciplines, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110029, India
e-mail: dr.anuragsrivastava@gmail.com

Fig. 1 A bunch of grapes (racemose) like arrangement of milk ducts and acini in the breast

milk. More than 700 operational taxonomic units were detected in milk. *Weissella* and *Leuconostoc* were found to be the main flora in colostrum followed by *Staphylococcus*, *Streptococcus*, and *Lactococcus*. The milk sample at 1 and 6 months after birth demonstrated an increase in *Veillonella*, *Leptotrichia*, and *Prevotella*. In the milk samples at 1 and 6 months, inhabitants of oral cavity such as *Veillonella*, *Leptotrichia*, and *Prevotella* increased significantly [8].

It is well known that using antibiotic prophylaxis can reduce risk of postoperative infection in clean-contaminated wounds. Historically, the use of prophylactic antibiotics in breast surgery was thought to be unnecessary as breast was considered as soft tissue organ with no direct connection to any body cavity or visceral structure. Various randomized controlled trials, meta-analysis, and Cochrane Reviews have established the role of preoperative prophylactic antibiotics in reducing the wound infection rates after breast surgeries. Gulluoglu et al. [9] studied 369 breast cancer surgeries and

concluded that antibiotic prophylaxis significantly reduced the SSI rate (4.8 %) in the prophylaxis group when compared with that in the control group (13.7 %). A cost analysis was also done, and prophylaxis was proved to be cost-effective in obese breast cancer patient.

Hardwicke et al. [10] studied surgical procedures on 5891 breasts and concluded that in cases of reduction mammoplasty, when antibiotics are used as a single preoperative dose, the risk of developing SSI is halved, i.e., it reduced to 9.8 % from 18.9 %. However, following augmentation mammoplasty, there was no effect on infection rates with any antibiotic regimen. It now remains to be answered if this difference is because no ducts were cut during augmentation (as dissection for implant placement is usually done in retro-mammary plane), as opposed to reduction mammoplasty where some milk ducts are severed, liberating their germs into the operative wound.

A large systematic Cochrane Review of nine studies compared preoperative antibiotic with no antibiotic or placebo in breast surgery. Pooling of the results demonstrated that prophylactic antibiotics administered preoperatively significantly reduced the incidence of SSI for patients undergoing breast cancer surgery. Results were presented as risk ratio (RR) where the risk ratio is the risk of infection in the intervention group divided by the risk of infection in the control group. The pooled risk ratio was $RR=0.71$ (95 % confidence interval (CI) 0.53 to 0.94) indicating significant protection from a risk of wound infection after breast cancer surgery [2].

Another meta-analysis by Sajid et al. [11] systematically analyzed nine randomized trials on the effectiveness of preoperative prophylactic antibiotics in patients undergoing breast surgical procedures. The antibiotic group comprised a total of 1857 patients and the non-antibiotics group a total of 1863

Fig. 2 Surgical site infection following breast surgery

Fig. 3 Pus formation following breast surgery

patients. They found that the use of preoperative prophylactic antibiotics reduced the surgical site infection significantly (RR 0.64; 95 % CI 0.50–0.83; $p < 0.0005$).

These benefits derived from preoperative antibiotics in breast surgeries are also good evidence to advocate reclassification of such procedures to *clean-contaminated* rather than *clean surgery*.

Conflict of Interest Kamal Kataria, Amitkumar M. Bagdia, and Anurag Srivastava declare that they have no conflict of interest.

References

1. Lilani SP, Jangale N, Chowdhary A, Daver GB (2005) Surgical site infection in clean and clean contaminated cases. *Indian J Med Microbiol* 23(4):249–252
2. Jones DJ, Bunn F, Bell-Syer SV (2014) Prophylactic antibiotics to prevent surgical site infection after breast cancer surgery. *Cochrane Database Syst Rev* (Issue 3) Art. No.: CD005360
3. Vilar-Compte D, Jacquemin B, Robles-Vidal C, Volkow P (2004) Surgical site infections in breast surgery: case-control study. *World J Surg* 28(3):242–246
4. Tejirian T, DiFronzo LA, Haigh PI (2006) Antibiotic prophylaxis for preventing wound infection after breast surgery: a systematic review and meta-analysis. *J Am Coll Surg* 203(5):729–734
5. Adimulam G, Challa VR, Dhar A, Chumber S, Seenu V, Srivastava A (2014) Assessment of cosmetic outcome of oncoplastic breast conservation surgery in women with early breast cancer: a prospective cohort study. *Indian J Cancer* 51(1):58–62
6. Throckmorton AD, Baddour LM, Hoskin TL, Boughey JC, Degnim AC (2010) Microbiology of surgical site infections complicating breast surgery. *Surg Infect* 11(4):355–359
7. Urbaniak C, Cummins J, Brackstone M, Macklaim JM, Gregory B, Gloor GB et al (2014) Bacterial microbiota of human breast tissue. *Appl Environ Microbiol* 80(10):3007–3014
8. Cabrera-Rubio R, Collado MC, Laitinen K, Salminen S, Isolauri E, Mira A (2012) The human milk microbiome changes over lactation and is shaped by maternal weight and mode of delivery. *Am J Clin Nutr* 96:544–551
9. Gulluoglu BM, Guler SA, Ugurlu MU, Culha G (2013) Efficacy of prophylactic antibiotic administration for breast cancer surgery in overweight or obese patients: a randomized controlled trial. *Ann Surg* 257(1):37–43
10. Hardwicke JT, Bechar J, Skillman JM (2013) Are systemic antibiotics indicated in esthetic breast surgery? A systematic review of the literature. *Plast Reconstr Surg* 131(6):1395–1403
11. Sajid MS, Hutson K, Akhter N, Kalra L, Rapisarda IF, Bonomi R (2012) An updated meta-analysis on the effectiveness of preoperative prophylactic antibiotics in patients undergoing breast surgical procedures. *Breast J* 18(4):312–317