Published in final edited form as:

Ann Surg Oncol. 2014 October ; 21(10): 3249–3255. doi:10.1245/s10434-014-3960-7.

Use of Prophylactic Postoperative Antibiotics During Surgical Drain Presence Following Mastectomy

Brandy L. Edwards, MD^{1,3}, George J. Stukenborg, PhD, MA², David R. Brenin, MD¹, and Anneke T. Schroen, MD, MPH^{1,2}

Brandy L. Edwards: Ble4n@virginia.edu

¹Department of General Surgery, University of Virginia, Charlottesville, VA

²Department of Public Health Sciences, University of Virginia, Charlottesville, VA

³University of Virginia Health Systems, Charlottesville, VA

Abstract

Background—National guidelines recommend one dose of perioperative antibiotics for breast surgery and discourage postoperative continuation. However, reported skin and soft tissue infection (SSI) rates after mastectomy range from 1–26 %, higher than expected for clean cases. Utility of routine or selective postoperative antibiotic use for duration of drain presence following mastectomy remains uncertain.

Methods—This study included all female patients who underwent mastectomy without reconstruction at our institution between 2005 and 2012. SSI was defined using CDC criteria or clinical diagnosis of cellulitis. Information on risk factors for infection (age, body mass index [BMI], smoking status, diabetes, steroid use), prior breast cancer treatment, drain duration, and antibiotic use was abstracted from medical records. Multivariable logistic regression was used to assess the association between postoperative antibiotic use and the occurrence of SSI, adjusting for concurrent risk factors.

Results—Among 480 patients undergoing mastectomy without reconstruction, 425 had sufficient documentation for analysis. Of these, 268 were prescribed antibiotics (63 %) at hospital discharge. An overall SSI rate of 7.3 % was observed, with 14 % of patients without postoperative antibiotics developing SSI compared with 3.4 % with antibiotics ($p < 0.0001$). Factors independently associated with SSI were smoking and advancing age. Diabetes, steroid use, BMI, prior breast surgery, neoadjuvant chemotherapy, prior radiation, concomitant axillary surgery, and drain duration were not associated with increased SSI rates.

Conclusions—SSI rates among patients who did and did not receive postoperative antibiotics after mastectomy were significantly different, particularly among smokers and women of advanced age. These patient subgroups may warrant special consideration for postoperative antibiotics.

Surgical operations on the breasts are considered clean procedures by the Centers for Disease Control and Prevention (CDC) wound classification system. Despite this, higher than expected surgical site infection (SSI) rates are reported, varying from 1 % to 26 % across contemporary literature.^{1–4} Perioperative prophylactic antibiotics, given in accordance with Joint Commission SCIP (Surgical Care Improvement Project) guidelines, significantly reduce the risk of SSI after breast surgery but the value of postoperative prophylactic antibiotics is largely unknown.^{5–8} Surgeon practices regarding routine postoperative antibiotic use are mixed.^{2,3,9} In a study by Brahmabhatt, 16 % of surveyed surgeons responded that they always/almost always prescribed postoperative prophylactic antibiotics while 76 % never/almost never prescribed antibiotics beyond the 24-hour postoperative period in the setting of no reconstruction. The duration of postoperative prophylaxis varied between surgeons with some prescribing a predefined regimen of 2–7 days while some elected to continue antibiotics until all drains were removed.⁹

Closed suction drains are routinely used following mastectomy and remain in place for variable duration. The probability of bacterial colonization of the drain has been demonstrated to increase with longer duration and the microorganisms causing SSIs are commonly the same as those colonizing the drain.^{3,8} However, there is conflicting evidence regarding SSI risk in association with both the use and duration of surgical drains after breast surgery.^{1–3,8,10–15}

Current national clinical guidelines recommend a single dose of preoperative antibiotics for breast procedures with postoperative duration of antimicrobial prophylaxis being limited to less than 24 h, regardless of the presence of surgical drains.^{16,17} Similarly, the American Society of Breast Surgeons' position statement on antibiotic use discourages continuation of antibiotics postoperatively without a specific clinical indication.¹⁸ The utility of routine or selective postoperative prophylactic antibiotics following mastectomy remains uncertain and, hence, considerable practice variation exists. This study examines the effect of postoperative prophylactic antibiotics on SSI rate following mastectomy performed by two surgeons with different antibiotic prescription practices in a single large academic health system.

METHODS

The study population included all female patients older than age 18 years who had undergone mastectomy with or without axillary surgery at a single academic institution performed by two surgeons between 2005 and 2012. Data were collected for each patient by review of the electronic medical record and existing paper charts. Patients undergoing immediate breast reconstruction were excluded, because this population uniformly receives postoperative antibiotic prophylaxis at our institution based on local plastic surgery recommendations. Patients with missing documentation of postoperative evaluation were excluded due to inability to determine SSI occurrence.

A diagnosis of SSI entailed one of the following CDC criteria: 1) purulent drainage from the incision; 2) organisms isolated from an aseptically obtained culture of fluid or tissue; 3) deliberate opening of the incision by a surgeon in patients having either tenderness,

localized swelling, redness, or warmth; or 4) diagnosis of SSI by the surgeon or office nurse practitioner. Patients clinically diagnosed and documented with cellulitis were also categorized as having an SSI.

The two surgeons with cases included in this study had divergent practices for prescribing prophylactic postoperative antibiotics. During the entire study period, one surgeon never prescribed and the other surgeon always prescribed postoperative prophylactic antibiotics for the duration of drain presence. A few patients in each surgeon group varied in this regard when the discharging resident either prescribed or did not prescribe postoperative antibiotics in opposition to the surgeon's specific preference. Patients in both groups were uniformly instructed to call the outpatient clinic when drainage was less than 30 ml per 24 h to arrange for drain removal. Patients who were prescribed prophylactic antibiotics were instructed to continue the medication until all drains were removed and to call for refills if needed.

Information on patient clinical factors potentially relevant to SSI risk was collected. Smoking status was categorized as never smoker, current smoker, or prior smoker, including patients who had quit at least 2 months before surgery. Patient age and body mass index (BMI) at time of surgery as well as diagnosis of diabetes and current corticosteroid use (oral vs. inhaled) were abstracted. Breast cancer-related therapies included prior ipsilateral breast surgery, receipt of neoadjuvant chemotherapy, and prior radiation therapy to ipsilateral breast. Surgery type was defined as unilateral versus bilateral mastectomy and as having associated axillary surgery (none, sentinel lymph node biopsy, or axillary dissection). Procedure length was recorded in minutes from the start of incision to completion of skin closure. Length of hospital stay (LOS) and drain duration were reflected in number of days.

Certain continuous variables were additionally evaluated as dichotomous categorical variables, including BMI >30, LOS >1 day, having >1 drain in situ, and drain duration >14 days. BMI >30 was chosen as the defining threshold for obesity. LOS > 1 day was selected for comparison given that most patients are discharged the day after mastectomy at our institution. Age was additionally evaluated categorically by decade.

The association between SSI following mastectomy and postoperative antibiotic use, patient clinical factors, surgery type, procedure length, length of hospital stay, and drain duration was assessed using Pearson χ^2 test for categorical variables and the Student's *t* test or analysis of variance for continuous variables. Variables individually found to have a significant association with SSI risk were then analyzed using multivariable logistic regression. Subgroup analyses were performed to further explore the relationship between SSI and antibiotic prophylaxis among patients with certain clinical factors. Statistical significance was attributed for *p* value < 0.05. All calculations were performed with SAS 9.3 software (SAS Institute, Cary, NC). This study was approved by the University of Virginia Institutional Review Board (HSR-IRB #17053).

RESULTS

A total of 480 women who underwent mastectomy without immediate reconstruction during the study period were identified. Fifty-five were excluded due to insufficient postoperative

documentation, leaving 425 eligible for analysis. All patients received perioperative antibiotic prophylaxis consisting of one dose of cefazolin or clindamycin within 1 h prior to surgical incision and continued up to 24 h postoperatively in accordance with SCIP guidelines. Forty of 168 patients under the care of one surgeon were prescribed postoperative antibiotics, whereas 29 of 257 patients under the care of the other were not prescribed antibiotics against their usual practice standards. A total of 268 (63.1 %) patients were prescribed prophylactic postoperative antibiotics at the time of discharge with 97.4 % of patients being prescribed oral cephalexin or clindamycin. Patient characteristics for those who received only perioperative antibiotics were compared with those who received both perioperative and postoperative antibiotic prophylaxis (Table 1). Patients in the postoperative prophylaxis group were more likely to have longer drain duration (14.3 ± 7.7 vs. 11.9 ± 4.5 days, $p = 0.0005$) and to have had neoadjuvant chemotherapy (31 vs. 20.4 %, $p = 0.0177$). Patients in the group who received only perioperative antibiotics had longer procedure times (182.6 ± 76.3 vs. 152.3 ± 58.6 min, $p < 0.0001$) and longer lengths of stay (1.4 ± 0.9 vs. 1.1 ± 0.4 days, $p < 0.0001$).

An overall SSI rate of 7.3 % (31/425) was observed, with 14 % of patients without postoperative antibiotics developing SSI compared with 3.4 % of patients with postoperative antibiotics ($p < 0.0001$). SSI was defined as cellulitis in 14 patients and by CDC criteria in 17 patients. Thirteen patients were diagnosed with severe infections categorized by the presence of pus, opening the surgical wound, need for debridement, or inpatient admission. Of these 13 patients, 3 received prophylactic antibiotics while ten did not ($p = 0.0057$). Seven of these 13 patients had wound dehiscence or required surgical debridement, none of whom received prophylactic antibiotics and five were current smokers. Of the three patients who developed significant infections while taking prophylactic antibiotics, their infections resolved after changing antibiotic agents.

Clinical and procedural characteristics of patients diagnosed with SSI were compared with those who were not (Table 2). Patients who developed SSI were more likely to be older (63.8 ± 11.1 vs. 59.2 ± 12.0 years, $p = 0.0426$) and to be current smokers (41.9 vs. 11.2 %, $p < 0.0001$). Diabetes, steroid use, BMI, prior ipsilateral breast surgery, prior radiation therapy, surgery type ($\pm$ axillary component), LOS, and drain duration were not associated with increased SSI rate. Patients receiving neoadjuvant chemotherapy appeared to be less likely to develop SSI than those who had not but this difference did not reach statistical significance ($p = 0.0654$).

When certain continuous variables were dichotomized, analysis demonstrated 180 (42.4 %) patients having a BMI >30 , 81 (19.1 %) having >1 day length of hospital stay, 213 (50.1 %) having >1 drain in situ, and 142 (33.4 %) having drain duration >14 days. These variables were each analyzed for overall SSI rate and were found not to be statistically significant (data not shown). In total, 366 (86.1 %) patients underwent axillary surgery (sentinel lymph node biopsy and/or axillary lymph node dissection) at the time of mastectomy; this also was found to have no association with increased risk of SSI. When patient age was evaluated categorically, no specific age cutoff was identified that clearly demarcated patients to be at higher risk.

In the multivariable logistic regression model adjusting for age, current smoking, procedure length, and neoadjuvant chemotherapy, the use of postoperative prophylactic antibiotics was found to be significantly associated with decreased SSI risk with an odds ratio [OR] = 0.19 (95 % confidence interval [CI] 0.08–0.47; Table 3). Other significant factors included current smoking (OR = 10.79; 95 % CI 3.99–29.18) and advancing age (OR = 1.05; 95 % CI 1.01–1.09).

A subgroup analysis exploring the relationship between the development of SSI in patients with certain clinical factors and the receipt of antibiotics was then performed to further characterize the association between SSI and antibiotic prophylaxis in these groups. The small number of affected patients in these subgroups precludes representation of some of these variables in the multivariable regression model. Procedure length >75 % percentile (188 min), LOS >1 day, receipt of neoadjuvant chemotherapy, and the use of corticosteroids remained insignificant. However, SSI rates in patients not receiving prophylactic antibiotics were significantly higher among patients with drain durations >14 days, BMI >30, having axillary surgery with mastectomy, diabetes, previous radiation therapy or surgery to the affected breast, and current smokers (Table 4).

DISCUSSION

Surgical site infections following mastectomy were found to be less common in patients receiving, as opposed to not receiving, postoperative prophylactic antibiotics. This difference was noted especially among current smokers and patients of advancing age. Whereas drain duration >14 days, BMI >30, axillary surgery, diabetes, previous radiation therapy, and previous surgery to the affected breast were not found to be associated overall with the development of SSI, a statistically significant decrease in the rate of SSI was noted within each subgroup when prophylactic antibiotics were given.

The overall SSI rate in our study of 7.3 %, regardless of postoperative antibiotic prophylaxis, falls within the reported range of 1–26 % for breast surgery, higher than expected for clean cases.^{1–4} The mechanism for this is not clearly understood but may be related to use of closed-suction drains and bacterial colonization of the drainage tube.^{3,8} We observed that patients who are prescribed postoperative prophylactic antibiotics were significantly less likely to develop SSI compared with those receiving only perioperative antibiotics (3.4 and 14 %, respectively). This differs from the study by Throckmorton that did not observe a significant reduction in SSI rate among patients receiving postoperative antibiotic prophylaxis while closed-suction drains were in place.² It should be noted that changes in CDC criteria for SSI in 2010, specifically excluding cellulitis, could contribute to substantial differences and potential under-reporting of infection rates.¹⁹ When our analysis was limited to patients with severe infections, the association between SSI development and the receipt of postoperative prophylactic antibiotics remained statistically significant.

SSIs are associated with significant costs and morbidity; yet consideration also must be given to the risk of complications associated with prophylactic antibiotics, including allergic reactions, medication intolerance, *Clostridium difficile* infection, and increasing microbial resistance.^{20,21} While drug-related complications are uncommon after a single dose of

perioperative antibiotics, the risk of adverse events associated with prophylaxis are more frequent with prolonged courses of antibiotic administration. In a study by Throckmorton, 5.5 % of patients receiving postoperative prophylactic antibiotics after breast surgery developed an antibiotic-related complication compared with 0 % of patients who had only received a single preoperative dose.²¹

Our study has several limitations. These results reflect the practices and outcomes of only two surgeons. However, both surgeons adhered to a consistent practice regimen during an 8-year period. A selection bias with preferentially prescribing postoperative antibiotics to high-risk patients therefore was not instilled into this study. While the group receiving perioperative antibiotics alone had increased procedure times and LOS, and the prophylactic antibiotic group tended to have longer drain durations, these factors were not found to be significantly associated with the development of SSI. Fifty-five patients had to be excluded due to limited or absent postoperative documentation. This can be attributed to reasons, such as patients following up with primary care providers due to travel distance or destruction of paper records after adoption of an electronic medical record. The 425 eligible patients were seen in follow-up by four different providers who may have differing thresholds for diagnosing and treating SSI. Possibly patients who were not prescribed prophylactic postoperative antibiotics were diagnosed with SSI at a lower threshold than those already taking antibiotics. Because this study was performed at an academic institution, our patients were discharged from the hospital by many different resident physicians who prescribed varying durations of antibiotic prophylaxis. However, patients were uniformly instructed to take antibiotics until all drains were removed and to call for refills, if necessary. While significant effort was made to determine the exact duration of prophylactic antibiotics for each patient, information regarding medication refills was limited. This analysis assumes that patients who were prescribed antibiotics took them as directed.

Our results demonstrating a significant difference in SSI rate in patients by receipt of prophylactic postoperative antibiotics may challenge guidelines recommending against the use of postoperative prophylactic antibiotics following mastectomy. Based on our current findings, women of advanced age and smokers may warrant special consideration for postoperative antibiotic prophylaxis. While our subgroup analysis highlights several patient populations in which the SSI rate significantly varied among patients by antibiotic receipt, the small number of patients in each subgroup limit the ability of these results to influence current clinical practice and should be viewed cautiously.

Our findings need to be balanced with the potential for adverse events and increasing microbial resistance with broad use of antibiotics. A prospective study is needed to establish actual benefit of postoperative prophylactic antibiotics after breast surgery, and if identified, to define criteria for selective antibiotic use. Given the significantly higher risk of SSI with breast surgery than expected for other clean cases, conflicting evidence regarding the utility of postoperative prophylactic antibiotics, and the potential for adverse events and increasing microbial resistance with broad use of antibiotics, further study is necessary and timely to determine if exceptions to current guidelines foregoing postoperative prophylactic antibiotics after mastectomy are appropriate.

References

1. Vilar-Compte D, Jacquemin B, Robles-Vidal C, Volkow P. Surgical site infections in breast surgery: case-control study. *World J Surg.* 2004; 28:242–6.10.1007/s00268-003-7193-3 [PubMed: 14961196]
2. Throckmorton AD, Boughey JC, Boostrom SY, et al. Postoperative prophylactic antibiotics and surgical site infection rates in breast surgery. *Ann Surg Oncol.* 2009; 16:2464–9. [PubMed: 19506959]
3. Degnim AC, Scow JS, Hoskin TL, et al. Randomized controlled trial to reduce bacterial colonization of surgical drains after breast and axillary operations. *Ann Surg.* 2013; 258:240–7. [PubMed: 23518704]
4. Angarita FA, Acuna SA, Torregrosa L, Tawil M, Escallon J, Ruíz A. Perioperative variables associated with surgical site infection in breast cancer surgery. *J Hosp Infect.* 2011; 79:328–32. [PubMed: 22054593]
5. Sajid MS, Hutson K, Akhter N, Kalra L, Rapisarda I, Bonomi R. An updated meta-analysis on the effectiveness of preoperative prophylactic antibiotics in patients undergoing breast surgical procedures. *Breast J.* 2012; 18:312–7. [PubMed: 22617005]
6. Bunn F, Jones DJ, Bell-Syer S. Prophylactic antibiotics to prevent surgical site infection after breast cancer surgery. *Cochrane Database Syst Rev.* 2012; (1):Art. No.: CD005360.10.1002/14651858.CD005360.pub3
7. Specifications Manual for Joint Commission National Quality Core Measures [Version B1, July, 2010].
8. Felipe WAB, Werneck GL, Santoro-Lopes G. Surgical site infection among women discharged with a drain in situ after breast cancer surgery. *World J Surg.* 2007; 31:2293–9. [PubMed: 17917771]
9. Brahmabhatt RD, Huebner M, Scow JS, et al. National practice patterns in preoperative and postoperative antibiotic prophylaxis in breast procedures requiring drains: survey of the American Society of Breast Surgeons. *Ann Surg Oncol.* 2012; 19:1245/s10434-012-2477-1
10. Gao YX, Ye JM, Wang DM, et al. Analysis of risk factors of surgical site infections in breast cancer. *Chin Med J.* 2010; 5:559–62. [PubMed: 20367981]
11. Vilar-Compte D, Rosales S, Hernandez-Mello N, Maafs E, Volkow P. Surveillance, control and prevention of surgical site infections in breast cancer surgery: a 5-year experience. *Am J Infect Control.* 2009; 37:674–9. [PubMed: 19556033]
12. Teija-Kaisa A, Eija M, Marja S, Outi L. Risk factors for surgical site infection in breast surgery. *J Clin Nurs.* 2012; 22:948–57.10.1111/jocn.12009 [PubMed: 23121264]
13. Thomson DR, Sadideen H, Furniss D. Wound drainage after axillary dissection for carcinoma of the breast. *Cochrane Database of Systematic Reviews.* 2013; (10):Art. No.: CD006823.10.1002/14651858.CD006823.pub2
14. Rotstein C, Ferguson R, Cummings KM, Piedmonte MR, Lucey J, Banish A. Determinants of clean surgical wound infections for breast procedures at an oncology center. *Infect Control Hosp Epidemiol.* 1992; 13:207–14. [PubMed: 1593101]
15. Rey JE, Gardner SM, Cushing RD. Determinants of surgical site infection after breast biopsy. *Am J Infect Control.* 2005; 33:126–9. [PubMed: 15761414]
16. Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical practice guidelines for antimicrobial prophylaxis in surgery. *Surg Infect.* 2013; 14(1):73–156.10.1089/sur.2013.9999
17. Hedrick TL, Smith PW, Gazoni LM, Sawyer RG. The appropriate use of antibiotics in surgery: a review of surgical infections. *Curr Probl Surg.* 2077; 44:635–75. [PubMed: 18021817]
18. The American Society of Breast Surgeons. Position statement on antibiotics and surgical site infection. Approved March 19, 2012.
19. Degnim AC, Throckmorton AD, Boostrom SY, Boughey JC, Holifield A, Baddour LM, Hoskin TL. Surgical site infection after breast surgery: impact of 2010 CDC reporting guidelines. *Ann Surg Oncol.* 2012; 29:4099–103. [PubMed: 22732837]

20. Olsen MA, Chu-Ongsakul S, Brandt KE, Dietz JR, Mayfield J, Fraser VJ. Hospital-associated costs due to surgical site infection after breast surgery. *Arch Surg.* 2008; 143:53–60. [PubMed: 18209153]
21. Throckmorton AD, Hoskin T, Boostrom SY, et al. Complications associated with postoperative antibiotic prophylaxis after breast surgery. *Am J Surg.* 2009; 198:553–6. [PubMed: 19800467]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

TABLE 1

Characteristics of patient groups who received perioperative antibiotics only versus patients also prescribed postoperative prophylactic antibiotics at time of hospital discharge

Characteristic	Perioperative antibiotics only, n = 157	Perioperative + postoperative antibiotics, n = 268	p value
Age (yr), mean $\pm$ SD	59.1 $\pm$ 12.0	59.8 $\pm$ 12.0	0.5595
Procedure length (min), mean $\pm$ SD	182.6 $\pm$ 76.3	152.3 $\pm$ 58.6	<0.0001
Length of stay (d), mean $\pm$ SD	1.4 $\pm$ 0.9	1.1 $\pm$ 0.4	<0.0001
Drain duration (d), mean $\pm$ SD	11.9 $\pm$ 4.5	14.3 $\pm$ 7.7	0.0005
BMI, mean $\pm$ SD	29.3 $\pm$ 7.1	30.0 $\pm$ 7.2	0.3599
Procedure, n (%)			
Mastectomy	18 (11.5 %)	34 (12.7 %)	
Mastectomy + SLNB	65 (41.4 %)	101 (37.7 %)	
Mastectomy + ALND	55 (35 %)	104 (38.8 %)	
Bilateral mastectomy	5 (3.2 %)	2 (0.7 %)	0.2196
Bilateral mastectomy + SLNB	9 (5.7 %)	12 (4.5 %)	
Bilateral mastectomy + ALND	2 (1.3 %)	12 (4.5 %)	
Bilateral mastectomy + SLNB + ALND	3 (1.9 %)	3 (1.1 %)	
Diabetes mellitus, n (%)	21 (13.4 %)	49 (18.3 %)	0.188
Previous breast cancer, n (%)	31 (19.7 %)	47 (17.5 %)	0.5704
Previous ipsilateral chest XRT, n (%)	13 (8.3 %)	28 (10.4 %)	0.4651
Previous ipsilateral breast surgery, n (%)	45 (28.7 %)	64 (23.9 %)	0.2759
Invasive tumor size >5 cm, n (%)	27 (17.2 %)	56 (20.9 %)	0.3533
Current smoker, n (%)	17 (10.8 %)	40 (14.9 %)	0.2316
Neoadjuvant chemotherapy, n (%)	32 (20.4 %)	83 (31.0 %)	0.0177
Corticosteroid use, n (%)			
Systemic	2 (1.3 %)	10 (3.7 %)	0.2949
Inhaled	4 (2.6 %)	9 (3.4 %)	
Postop infection, n (%)	22 (14.0 %)	9 (3.4 %)	<0.0001

SLNB sentinel lymph node biopsy; ALND axillary lymph node dissection; XRT radiation therapy

TABLE 2

Clinical and procedural characteristics of patients based on development of a surgical site infection

Characteristic	No SSI, n = 394	SSI, n = 31	p value
Age (yr), mean $\pm$ SD	59.2 $\pm$ 12.0	63.8 $\pm$ 11.1	0.0426
Procedure length (min), mean $\pm$ SD	161.7 $\pm$ 66.2	185.2 $\pm$ 76.0	0.0611
Length of stay (d), mean $\pm$ SD	1.2 $\pm$ 0.6	1.3 $\pm$ 0.6	0.4504
Drain duration (d), mean $\pm$ SD	13.4 $\pm$ 6.7	14.2 $\pm$ 8.2	0.5016
BMI, mean $\pm$ SD	29.8 $\pm$ 7.2	29.1 $\pm$ 7.1	0.6325
Procedure, n (%)			
Mastectomy	49 (12.4 %)	3 (9.7 %)	
Mastectomy + SLNB	153 (38.8 %)	13 (41.9 %)	
Mastectomy + ALND	147 (37.3 %)	12 (38.7 %)	
Bilateral mastectomy	5 (1.3 %)	2 (6.5 %)	0.3471
Bilateral mastectomy + SLNB	20 (5.1 %)	1 (3.2 %)	
Bilateral mastectomy + ALND	14 (3.6 %)	0	
Bilateral mastectomy + SLNB + ALND	6 (1.5 %)	0	
Diabetes mellitus, n (%)	64 (16.2 %)	6 (19.4 %)	0.6530
Previous breast cancer, n (%)	70 (17.8 %)	8 (25.8 %)	0.2655
Previous ipsilateral chest XRT, n (%)	36 (9.1 %)	5 (16.1 %)	0.2042
Previous ipsilateral breast surgery, n (%)	98 (24.9 %)	11 (35.5 %)	0.1927
Tumor size >5 cm, n (%)	79 (20.1 %)	4 (12.9 %)	0.3338
Current smoker, n (%)	44 (11.2 %)	13 (41.9 %)	<0.0001
Neo-adjuvant chemotherapy, n (%)	111 (28.2 %)	4 (12.9 %)	0.0654
Corticosteroid use, n (%)			
Systemic	11 (2.8 %)	1 (3.2 %)	0.5146
Inhaled	11 (2.8 %)	2 (6.4 %)	
Prophylactic post-op antibiotics, n (%)	259 (65.7 %)	9 (29.0 %)	<0.0001

SLNB sentinel lymph node biopsy; ALND axillary lymph node dissection; XRT radiation therapy

TABLE 3

Multivariable logistic regression analysis of association between SSI following mastectomy, prophylactic postoperative antibiotics, and other risk factors

Covariate	Study population (percent or mean)	OR	95 % CI
Receipt of prophylactic postoperative antibiotics			
Yes	63.1 %	0.19	(0.08–0.47) ^b
No*	36.9 %	1.0	
Smoking status			
Current	13.4 %	10.79	(3.99–29.18) ^b
Former	26.4 %	1.2	(0.388–3.61)
Nonsmoker ^a	60.2 %	1.0	
Age (yr)	59.6	1.05	(1.01–1.09) ^b
Procedure length (min)	164.3	1.01	(1.00–1.01)
Receipt of neoadjuvant chemotherapy			
Yes	27.1 %	0.6	(0.18–2.0)
No*	72.9 %	1.0	

OR odds ratio; CI confidence interval

Adjusted for receipt of postoperative antibiotics, patient age, current smoking status, procedure length, and neoadjuvant chemotherapy

^aReference category for dummy variables used in logistic regression model

^b95 % confidence interval does not include 1.0, indicating statistical significance

TABLE 4

Subgroup analysis comparing surgical site infection rates for those who received postoperative antibiotics vs those who did not receive prophylactic postoperative antibiotics

Variable All procedures (n = 425)	Surgical site infections	p value
All postoperative infections	31/425 (7.3 %)	
ABX Yes, n (%)	9/268 (3.4 %)	<0.001
No, n (%)	22/157 (14.0 %)	
Procedure length > 75 % percentile (188 min; n = 110)	12/110 (10.9 %)	
ABX Yes, n (%)	4/51 (7.8 %)	0.3376
No, n (%)	8/59 (13.6 %)	
LOS > 1 day (n = 81)	8/81 (9.9 %)	
ABX Yes, n (%)	2/31 (5.0 %)	0.7039
No, n (%)	6/50 (12.0 %)	
Drain duration > 14 days (n = 143)	11/143 (7.7 %)	
ABX Yes, n (%)	3/100 (3.0 %)	0.0031
No, n (%)	8/43 (18.6 %)	
BMI > 30 (n = 180)	13/180 (7.2 %)	
ABX Yes, n (%)	3/117 (2.6 %)	0.0018
No, n (%)	10/63 (15.9 %)	
Patients undergoing axillary surgery (n = 366)	26/366 (7.1 %)	
ABX Yes, n (%)	9/232 (3.9 %)	0.0016
No, n (%)	17/134 (12.7 %)	
All patients with diabetes (n = 70)	6/70 (8.6 %)	
ABX Yes, n (%)	1/49 (2.0 %)	0.0080
No, n (%)	5/21 (23.8 %)	
All patients with previous radiation therapy (n = 41)	5/41 (12.2 %)	
ABX Yes, n (%)	1/28 (3.6 %)	0.0284
No, n (%)	4/13 (30.8 %)	
Previous surgery to affected breast (n = 109)	11/109 (10.1 %)	
ABX Yes, n (%)	2/64 (3.1 %)	0.0072
No, n (%)	9/45 (20.0 %)	
All current smokers (n = 57)	13/57 (22.8 %)	
ABX Yes, n (%)	2/40 (5.0 %)	<0.0001
No, n (%)	11/17 (64.7 %)	
All patients receiving neoadjuvant chemotherapy (n = 115)	4/115 (3.5 %)	
ABX Yes, n (%)	2/83 (2.4 %)	0.3089
No, n (%)	2/32 (6.3 %)	
All patients with current corticosteroid use (n = 115)	3/25 (12.0 %)	
ABX Yes, n (%)	2/19 (10.5 %)	1.0
No, n (%)	1/6 (16.7 %)	

ABX antibiotics