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Concise Communication

Surgeon choice in the use of postdischarge antibiotics for prophylaxis following mastectomy with and without breast reconstruction

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Abstract

Multiple guidelines recommend discontinuation of prophylactic antibiotics <24 hours after surgery. In a multicenter, retrospective cohort of 2,954 mastectomy patients ± immediate breast reconstruction, we found that utilization of prophylactic postdischarge antibiotics varied dramatically at the surgeon level among general surgeons and was virtually universal among plastic surgeons.

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The Centers for Disease Control and Prevention guidelines for the prevention of surgical site infections (SSIs) recommend discontinuation of prophylactic antibiotics in clean surgeries after the surgical incision is closed.[1] In contrast, the American Society of Plastic Surgeons guidelines for implant breast reconstruction recommend that prolonged antibiotic prophylaxis when surgical drains are present be left to surgeon preference.[2] In practice, postdischarge prophylactic antibiotic use is common after mastectomy with reconstruction.[3,4]

We determined the prevalence of postdischarge prophylactic antibiotic use and patient, operative, and surgeon factors associated with antibiotic use among women undergoing mastectomy with and without immediate breast reconstruction at 6 hospitals from 3 academically affiliated sites.

Methods

We conducted a retrospective cohort study using electronic health record (EHR), manual record review, and billing data from 6 hospitals at 3 US sites. Site 1 included 1 academic and 1 community hospital; site 2 included 1 academic hospital; and site 3 included 1 academic and 2 community hospitals.

We identified mastectomy admissions among women aged ≥18 years from July 1, 2011, to June 30, 2015, using *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) procedure codes 85.33–85.36 and 85.41–85.48. Mastectomy was verified using current procedural terminology (CPT) coding for mastectomy (19303–19307, 1 site) and by review of surgeon description and anesthesia duration (2 sites).

We excluded admissions likely to have antibiotics prescribed at discharge for therapeutic indications, based on ICD-9-CM diagnosis codes during the mastectomy admission (eg, SSI, pneumonia), or intravenous antibiotic at discharge (Appendix Table 1 online). We also excluded admissions lacking ICD-9-CM diagnosis codes, those with length of stay (LOS) >90 days, and those ending in death.

Prophylactic antibiotics were defined as oral antibiotics prescribed at surgical discharge in the absence of an infectious diagnosis (Appendix Table 2 online). If the patient was admitted on oral antibiotic therapy and the same antibiotic was prescribed at discharge, it was not considered prophylactic.

Factors associated with prophylactic antibiotic use included patient (eg, comorbidities), operative, and surgeon factors with clinical plausibility for antibiotic use and/or SSI risk (Appendix Table 3 online). Comorbidities were defined by ICD-9-CM diagnosis codes[5] and operative factors by diagnosis and procedure codes (Appendix Table 4 online). Surgeon specialty was determined using the institution and Medicare physician directories. Low-, medium-, and high-volume surgeons were defined by the annual number of cases per surgeon per specialty (Fig. 1).

Potential SSIs were identified using diagnosis and procedure codes suggestive of infection for encounters within 90 days after mastectomy (Appendix Table 5 online), and they were verified using the 2015 National Healthcare Safety Network criteria.[6]

Statistical analyses

Univariate analyses were performed using χ^2 and Mann-Whitney U tests, as appropriate. We used a modified Poisson regression model to estimate adjusted relative risks of prophylactic antibiotic

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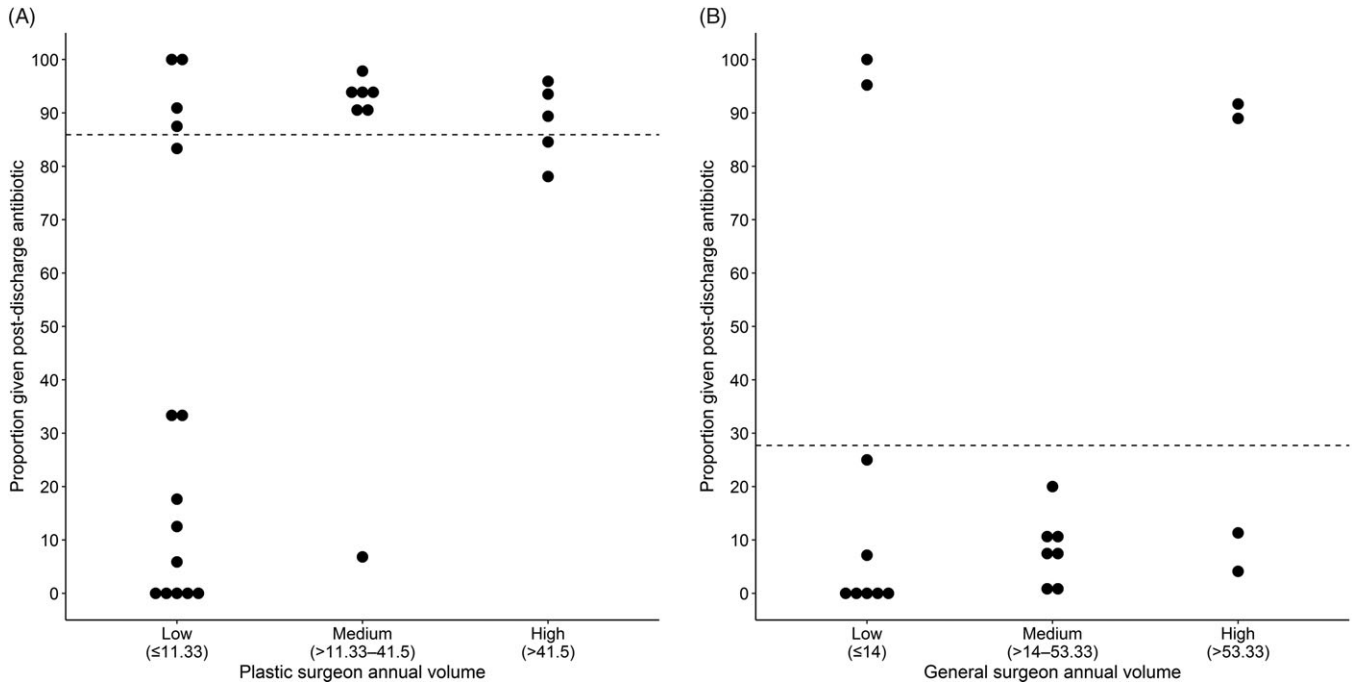

Fig. 1. Proportion of individual surgeon's mastectomy patients prescribed prophylactic postdischarge antibiotics stratified by surgeon volume and specialty (plastic surgeon [A] versus general surgeon [B]). The dashed line represents the overall proportion of postdischarge antibiotics among procedures overseen by a plastic and general surgeon, respectively. Plastic and general surgeon annual volume thresholds were based on the distribution of annual volume within the surgeon specialty and are displayed in the *x* axes of the plots.

utilization with backward selection using $P < .10$ in univariate analysis for entry and $P < .05$ for retention. REDCap and SAS version 9.4 software (SAS Institute, Cary, NC) were used for data management and analysis. The study was approved by the local human research protection offices.

Results

We initially identified 3,164 mastectomy admissions. However, 31 admissions were excluded due to infection coded during admission, 157 were excluded with no evidence for mastectomy, 18 were excluded due to conflicting information regarding breast reconstruction, 3 were excluded with no information on discharge antibiotics, and 1 was excluded due to intravenous antibiotics at discharge. The final cohort included 2,954 mastectomy admissions: 1,546 (52.3%) at site 1; 846 (28.6%) at site 2; and 562 (19.0%) at site 3.

Prophylactic antibiotics were prescribed after 85.3% and 36.2% of mastectomy admissions with and without breast reconstruction, respectively. The utilization of prophylactic antibiotics and type of antibiotics prescribed varied by site (Table 1). Prophylactic discharge antibiotic prescribing was more common after procedures performed by plastic (85.9%) versus general surgeons (27.7%, $P < .001$) (Fig. 1). Practice variation in prescribing was evident: 2 high-volume general surgeons used postdischarge prophylactic antibiotics in >85% of their cases and 11 of 12 medium- to high-volume plastic surgeons prescribed postdischarge prophylactic antibiotics in >75% of their cases (Fig. 1).

Overall, 103 SSIs were identified among mastectomy admissions (rate, 3.5%). Among these SSIs, 21 (2.0%) occurred after mastectomy alone and 82 (4.3%) occurred after mastectomy with reconstruction. In addition, 74 SSIs (72%) were classified as deep or organ-space infections. Of 80 SSIs for which a culture was performed, 76 were culture positive, including 5 patients with MRSA. Postdischarge prophylactic antibiotic use was not associated with SSI following mastectomy alone: 7 SSIs occurred in 373 cases (1.9%) in which postdischarge prophylactic antibiotics were used versus 14 SSIs in 657 cases (2.1%) without postdischarge antibiotics ($P = .781$). Similarly, for mastectomies with reconstruction, there were 69 SSIs in 1,641 cases (4.2%) in which postdischarge prophylactic antibiotics were used versus 13 SSIs in 283 cases (4.6%) without postdischarge antibiotics ($P = .765$).

We conducted a multivariable analysis to determine risk factors associated with prophylactic postdischarge antibiotics. Among mastectomy with reconstruction patients, for study site 3 versus site 1 relative risk [RR] was 1.40 (95% confidence interval [CI], 1.30–1.51). For study site 3 versus site 2, RR was 0.62 (95% CI, 0.52–0.73). Regarding length of stay (LOS), RR was 0.88 (95% CI, 0.83–0.93) for stays of 3–4 days versus 1–2 days. The RR was 0.74 (95% CI, 0.68–0.80) for stays of 5–6 days versus 1–2 days, and the RR was 0.55 (95% CI, 0.45–0.66) for stays ≥7 days versus 1–2 days. Intraoperative antibiotic type was associated with the following relative risk versus cefazolin only or clindamycin only: any vancomycin (RR, 0.75; 95% CI, 0.60–0.94); single antibiotic besides vancomycin, cefazolin, or clindamycin or >1 antibiotic (RR, 1.42; 95% CI, 1.16–1.75); and no antibiotic documented (RR, 0.56; 95% CI, 0.35–0.89). Similarly, neoadjuvant chemotherapy had an RR of 1.05 (95% CI, 1.00–1.09) versus no adjuvant chemotherapy. Among mastectomy-only patients, LOS >2 days (RR, 1.36; 95% CI, 1.15–1.62) and surgery ≥90 minutes (RR, 1.51; 95% CI, 1.23–1.86) were the only factors associated with prophylactic postdischarge antibiotics in our multivariable analysis.

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Table 1. Proportion of Mastectomy Admissions with Prophylactic Discharge Antibiotics and Top Antibiotic Choices by Immediate Reconstruction and Study Site

	Mastectomy With Reconstruction					Mastectomy Without Reconstruction				
Variable	Total	Site 1	Site 2	Site 3	*P* Value[a]	Total	Site 1	Site 2	Site 3	*P* Value[a]
Mastectomy admissions, no.	1,924	1,009	732	183		1,030	537	114	379	
Prophylactic discharge antibiotics, no. (%)	1,641 (85.3)	847 (83.9)	698 (95.4)	96 (52.5)	<.001	373 (36.2)	163 (30.4)	44 (38.6)	166 (43.8)	<.001
Most commonly used antibiotics no. (%)[b]					<.001					<.001
Cefadroxil	552 (33.2)	2 (0.2)	535 (76.2)	15 (14.4)		33 (8.7)	0 (0.0)	33 (73.3)	0 (0.0)	
Cephalexin	287 (17.3)	242 (28.3)	8 (1.1)	37 (35.6)		246 (65.1)	114 (69.5)	2 (4.4)	130 (76.9)	
Clindamycin	133 (8.0)	32 (3.7)	90 (12.8)	11 (10.6)		27 (7.1)	9 (5.5)	4 (8.9)	14 (8.3)	
Trimethoprim/sulfamethoxazole	644 (38.8)	554 (64.8)	54 (7.7)	36 (34.6)		60 (15.9)	36 (22.0)	3 (6.7)	21 (12.4)	

[a]*P* per χ^2 test.
[b]Top 4 most commonly used prophylactic discharge antibiotics among mastectomy admissions. 1,661 antibiotics were prescribed at discharge without evidence of infection following 1,641 mastectomy with reconstruction admissions with discharge antibiotics; a total of 378 antibiotics were prescribed at discharge without evidence of infection following 373 mastectomy without reconstruction admissions with discharge antibiotics. Column percentages do not add up to 100% as only utilization of the top 4 antibiotics are shown.

Discussion

In this study, the postdischarge prophylactic antibiotic utilization rate was 36.2% among mastectomy without reconstruction and it was 85.3% for mastectomy with reconstruction patients, consistent with prior plastic surgeon surveys.[3,4] Postdischarge prophylactic antibiotic use varied considerably by study site, ranging from 30.4% to 43.8% after mastectomy alone and from 52.5% to 95.4% after mastectomy with reconstruction. Prescribing practices varied substantially among general surgeons; plastic surgeons had consistently high utilization of postdischarge prophylactic antibiotics.

Factors associated with postdischarge prophylactic antibiotic use included intraoperative antibiotic type, study site, receipt of neoadjuvant chemotherapy, as well as short LOS after mastectomy with reconstruction and longer LOS and surgery duration after mastectomy without reconstruction. Comorbidities known to be associated with SSI risk (eg, morbid obesity, smoking, diabetes) were not associated with the use of postdischarge antibiotics. We have revealed the variability in the type of antibiotics prescribed by study site. These findings suggest that factors other than underlying comorbidities influence postdischarge prophylactic antibiotic prescribing practices.

Our study has several limitations. Our study sites may not reflect all community practices, particularly in non–academically affiliated hospitals. Our study did not have power to detect differences in SSI rates by postdischarge antibiotic use; a larger-scale study to assess SSI rates and adverse events is warranted. Antibiotic prescribing was identified in the EHR, therefore, surgeon rationale could not be determined, and we cannot rule out the assessment of patient SSI risk in the decision-making process.

Evidence in the literature is lacking regarding the benefit of postdischarge prophylactic antibiotics after surgery[2,7] and the potential for harm due to unnecessary antibiotic use.[8,9] We showed that prophylactic antibiotics were commonly prescribed after discharge in mastectomy patients with and without reconstruction. Given the variation in discharge antibiotic prescribing by individual physicians, improved communication between infection prevention and surgeons as part of a stewardship intervention to improve antibiotic prescribing is important in preventing the development of antimicrobial resistance and adverse events from unnecessary antibiotic use.[10]

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/ice.2020.462.

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Conflicts of interest. M.A.O. reports consultant work with Pfizer and grant funding through Pfizer, Merck, and Sanofi Pasteur for work outside the submitted manuscript. V.J.F. reports her spouse is the Chief Clinical Officer at Cigna Corporation. D.K.W. reports consultant work with Centene, PDI, Pursuit Vascular, Homburg & Partner, and Carefusion/BD and is a subinvestigator for a Pfizer-sponsored study for work outside the submitted manuscript. J.H.H. reports that the present work was conducted during her affiliation with the University of Pennsylvania. J.H.H. is currently an employee of, and holds shares in, the GSK group of companies. No other authors report conflicts of interest relevant to this article.

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