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Returns to the operating room after breast surgery at a tertiary care medical center

Brittany L. Murphy^{a, b}, Amy E. Glasgow^b, Elizabeth B. Habermann^{a, b}, Tina J. Hieken^{a, *}^a Departments of Surgery, Mayo Clinic, Rochester, MN, USA^b The Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery Surgical Outcomes Program, Mayo Clinic, Rochester, MN, USA

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ABSTRACT

Background: Evaluation of returns to the operating room (RORs) may spur practice modifications to improve patient outcomes and hospital practices. We determined the frequency and indications for RORs after breast operations.

Methods: We identified patients ≥ 18 years who underwent a breast operation at our institution 1/1/14–1/13/17 and assessed ROR within 45-days. RORs were categorized as unplanned/planned, staged/unstaged, or unrelated procedures. Univariate and multivariable analyses compared variables between patients who did and did not have an ROR.

Results: 2,914 patients underwent a breast operation of whom 117 (4.0%) had 121 RORs. Planned staged procedures accounted for 48 RORs (39.7%), while unplanned complications accounted for 65 (53.7%). On multivariable analysis, ROR was more common among patients undergoing total, skin-sparing, or nipple-sparing mastectomy (versus lumpectomy) all $p < 0.03$, while immediate breast reconstruction did not increase RORs.

Conclusions: RORs following breast operations occurred in 4% of patients, with approximately one-third for a staged oncologic procedure. Implementation of ROR documentation tools should be encouraged, as these data provide benchmarks for clinical practice improvement initiatives to improve the quality of patient care.

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Introduction

Surgical resection continues to be the mainstay of treatment for the ~250,000 patients diagnosed annually in the US with breast cancer and breast procedures also are performed for benign disease to control symptoms or establish a definitive diagnosis.¹ Overall, breast surgery is considered rather safe with a low reported rate of morbidity and mortality.^{2,3} Complications do occur, however, that require a return to the operating room (ROR).² Additionally, it is not uncommon for breast cancer patients to require a ROR for additional oncologic excisions.^{4,5}

RORs are important to patients and providers as they increase cost, patient time away from work and family, may delay adjuvant cancer treatments, compromise breast reconstruction and decrease patient satisfaction with care. RORs are also important to hospitals,

as patients with unplanned RORs have longer lengths of stay, and RORs may be used as a quality indicator.^{6–9} Evaluation of RORs may spur practice modifications to improve patient outcomes. While many studies have evaluated complication rates after breast operations, the majority report from national databases, which do not allow for detailed case review.^{2,3,5,10–28} Thus, we sought to evaluate the use of an institutional electronic ROR documentation tool and use it to determine the frequency and indications for RORs after a breast operation at a tertiary care medical center.

Materials and methods

Patient selection

After Institutional Review Board approval, all patients ≥ 18 years of who underwent a diagnostic or therapeutic surgical breast procedure at Mayo Clinic-Rochester between January 1, 2014 and January 13, 2017 were identified using Current Procedural Terminology (CPT) codes ([Supplemental Table 1](#)). Patients who did not provide research authorization were excluded from the study

* Corresponding author. Mayo Clinic, 200 First Street Southwest, Rochester, MN, 55905, USA.

E-mail address: hieken.tina@mayo.edu (T.J. Hieken).

(n = 2). A total of 2,914 patients met inclusion criteria.

Categorizing return to the operating room (ROR)

An institutional specific perioperative nursing documentation tool called Surgical Systems Nurse+ (Mayo Clinic), was used to identify the RORs.^{9,29} This electronic documentation system was developed within Mayo Clinic-Rochester to meet the needs of a high-volume surgical practice and was modified to include RORs in March 2013 in as part of a Quality and Patient Safety Initiative. As part of implementation of the tool, if a patient has two or more operations within 45 days of each another, the system will prompt the operating room nurse for a required statement (obtained from the surgical resident or consulting surgeon) regarding the relationships of the procedures. Options, as previously published from our institution, include:⁹

- 1) Planned staged return: current case is related to the prior procedure and is required for ongoing patient care as part of a planned procedure.
- 2) Planned return due to complications: current case is related to a previous procedure as the result of an event/complication during the initial procedure. The ROR was planned after OR entry, but before OR exit, during the initial procedure.
- 3) Unplanned ROR: current case is related as an event/complication, but the ROR was not identified until after OR exit of the initial procedure.
- 4) Unrelated case: current case has no relation to the prior procedure.
- 5) Other: does not meet criteria for the other options.

Procedures that are categorized as a planned return due to complication or an unplanned ROR have a system generated email sent to the surgeon who performed the initial operation, with the option to amend or clarify the classification if indicated.

All ROR cases were reviewed in the electronic medical record and were further characterized as staged procedures (further cancer-related surgery) or unplanned with type of complication (bleeding, tissue necrosis, infection, compromised flap perfusion, implant issues, wound issues, and seroma).

Data collection

Retrospective chart review was performed to ascertain the reason for the ROR and the type of mastectomy (total, skin-sparing (SSM), nipple-sparing (NSM)), if applicable. Lumpectomies and excisional biopsies were analyzed together. Age and body mass index (BMI) were identified using an institution specific clinical note search tool that has previously been described.³⁰ Tobacco use was documented based on patient provided information including current, former, and non-smoker, recorded up to ten-years prior to the breast surgery date; the most recent status was used for analysis. Diabetic patients were identified from a glycemic control institutional database. Bilateral procedures were indicated by a modifier *50 code.

Statistical methods

Student's t-tests, Chi-squared, and Fisher's exact tests were performed to compare variables between patients who had an ROR and those who did not, as appropriate. Multivariable logistic regression analyses were performed to evaluate the associations related to RORs for all patients and for unplanned RORs. The alpha-level was set at 0.05 for statistical significance. All analyses were performed with SAS version 9.4.

Results

We identified 2,914 (99.3% female) patients who underwent a diagnostic or therapeutic breast procedure (1,572 lumpectomy, 1,342 mastectomy) during the study period, of which 117 patients (4.0%) underwent 121 RORs within 45 days of the index procedure. The procedures requiring a ROR included: total mastectomy 20 (16.5%), SSM 33 (27.3%), NSM 30 (24.8%), and lumpectomy 38 (31.4%). A total of 52/2,914 patients had an inpatient readmission in 30 days, of whom 16/52 (30.8%) had a ROR.

Classification of RORs

RORs included: planned staged return in 48 (39.7%), planned staged return for complications 6 (4.9%), unplanned ROR 65 (53.7%), and unrelated 2 (1.6%), [Table 1](#). On univariate analysis, patients who had a planned staged return had a greater number of days before their ROR, compared to unplanned RORs, $p = 0.02$. Surgical procedure was also statistically significant, with a greater proportion of lumpectomy patients undergoing planned staged returns and a greater proportion of mastectomy patients undergoing unplanned returns, $p < 0.0001$, [Table 2](#). ROR rates were overall rather similar for patients undergoing mastectomy, independent of the type of mastectomy (no ROR proportion varied between 91.0% and 96.2% for all unilateral, bilateral, total, SSM, and NSMs).

Factors related to ROR

On univariate analysis, patients who had a ROR were slightly younger (average age 57.8 years versus 55.5 years for no ROR and ROR respectively, $p = 0.04$), and underwent a more extensive operation (mastectomy versus lumpectomy $p < 0.01$, immediate reconstruction versus no immediate reconstruction $p = 0.01$) than those who did not have a ROR (data not shown). On multivariable analysis, mastectomy (versus lumpectomy) was statistically

Table 1
Classifications of returns to the operating room.

		N	%
Planned Stage Return	Total	48	39.7
	Oncologic - margins	31	
	Oncologic - ALND	8	
	Oncologic - SLNB	5	
	Open wound – preoperatively planned for a staged repair with plastics	1	
Planned Return due to Complications	Reconstruction - implant exchange	3	
	Total	6	4.9
	Skin necrosis – noted intraoperatively	3	
Unplanned Return to OR	Reconstruction - delayed due to poor perfusion	3	
	Total	65	53.7
	Hematoma evacuation	31	
	Skin necrosis – not noted intraoperatively	12	
	Infection	9	
	Seroma	4	
	Wound dehiscence	4	
	Venous congestion	3	
	Reconstruction - deflated implant	1	
	Fat necrosis	1	
Unrelated Return	Total	2	1.6
	Port-a-cath removal	1	
	Reconstruction	1	

Table 2
Characteristics of patients with associated return to the operating room types.

Characteristic	No ROR	Planned Staged Return	Planned Staged Return due to Complications	Unplanned Return	Unrelated	p-value
N (%)	2797 (96.0%)	46 (1.6%)	6 (0.2%)	63 (2.2%)	2 (0.1%)	
Age Mean (SD)	57.8 (13.7)	55.7 (12.0)	55.2 (16.2)	55.4 (11.5)	56.5 (21.9)	0.35
Sex						0.06
Female	2778 (96.0%)	44 (1.5%)	6 (0.2%)	63 (2.2%)	2 (0.1%)	
Male	19 (90.5%)	2 (9.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Diabetes						0.77
No	2570 (95.9%)	44 (1.6%)	6 (0.2%)	59 (2.2%)	2 (0.1%)	
Yes	227 (97.4%)	2 (0.9%)	0 (0.0%)	4 (1.7%)	0 (0.0%)	
BMI Mean (SD)	28.6 (6.6)	28.6 (6.0)	28.2 (4.9)	29.8 (6.1)	20.8 (6.9)	0.18
Smoking Status						0.76
Current	173 (95.1%)	2 (1.1%)	0 (0.0%)	7 (3.8%)	0 (0.0%)	
Former	770 (95.7%)	14 (1.7%)	2 (0.2%)	19 (2.4%)	0 (0.0%)	
Never	1854 (96.2%)	30 (1.6%)	4 (0.2%)	37 (1.9%)	2 (0.1%)	
Days to ROR Mean (standard deviation)		19.1 (13.1)	13.8 (11.5)	12.7 (13.0)	16.0 (14.1)	0.02
Procedure						<0.0001
Lumpectomy	1005 (97.5%)	22 (2.1%)	0 (0.0%)	4 (0.4%)	0 (0.0%)	
Lumpectomy + IBR	530 (98.0%)	9 (1.7%)	0 (0.0%)	2 (0.4%)	0 (0.0%)	
Total Unilateral Mastectomy	429 (96.2%)	4 (0.9%)	1 (0.2%)	11 (2.5%)	1 (0.2%)	
Total Bilateral Mastectomy	111 (94.1%)	1 (0.8%)	0 (0.0%)	6 (5.1%)	0 (0.0%)	
SSM Unilateral Mastectomy	81 (91.0%)	2 (2.2%)	3 (3.4%)	3 (3.4%)	0 (0.0%)	
SSM Bilateral Mastectomy	223 (92.9%)	1 (0.4%)	1 (0.4%)	15 (6.3%)	0 (0.0%)	
NSM Unilateral Mastectomy	63 (92.6%)	3 (4.4%)	0 (0.0%)	2 (2.9%)	0 (0.0%)	
NSM Bilateral Mastectomy	355 (93.2%)	4 (1.0%)	1 (0.3%)	20 (5.2%)	1 (0.3%)	

SD: standard deviation, IBR: immediate breast reconstruction, ROR: return to operating room, SSM: skin-sparing mastectomy, NSM: nipple-sparing mastectomy.

significant, $p < 0.001$ (data not shown). When type of mastectomy was further evaluated, patients who underwent a total unilateral mastectomy were at no greater likelihood of undergoing an ROR than those who had a lumpectomy, while all other procedures (total bilateral mastectomy, unilateral or bilateral SSM, unilateral or bilateral NSM) had a greater risk, all $p < 0.05$, [Table 3](#).

Planned staged return

Forty-three patients had a ROR for an oncologic related reason. These patients were more likely to undergo a lumpectomy than mastectomy ($p = 0.04$, data not shown). Five patients (11.6%) had a ROR for sentinel lymph node staging, 8 (18.6%) completion axillary lymph node dissection, and 30 (69.8%) needed further resection for positive or close margins, [Table 1](#). On multivariable analysis, females were less likely than males to have a ROR, [Table 4](#). Interestingly, of all procedure types, only patients undergoing a unilateral SSM were more likely than patients undergoing lumpectomy to need a ROR (OR 6.28, $p = 0.001$), [Table 4](#).

Table 3
Multivariable analysis factors associated with an ROR for ALL patients.

Variable	Level	Pr > Chi-Square	Odds Ratio Estimate	Lower 95% Confidence Limit for Odds Ratio	Upper 95% Confidence Limit for Odds Ratio
Age		0.88	1.00	0.98	1.02
Sex	Female vs Male	0.16	0.34	0.07	1.53
Diabetes	No vs Yes	0.31	1.56	0.66	3.68
BMI Group	30 + vs < 30	0.09	1.40	0.95	2.06
Smoking Status	Current vs Never	0.30	1.47	0.71	3.04
	Former vs Never	0.52	1.14	0.75	1.74
Type of Surgery	Total Unilateral Mastectomy vs Lumpectomy	0.12	1.61	0.89	2.93
	Total Bilateral Mastectomy vs Lumpectomy	0.03	2.60	1.11	6.10
	SSM Unilateral vs Lumpectomy	0.001	4.16	1.73	9.98
	SSM Bilateral vs Lumpectomy	0.001	3.16	1.56	6.39
	NSM Unilateral vs Lumpectomy	0.02	3.61	1.29	10.09
	NSM Bilateral vs Lumpectomy	<0.001	3.17	1.64	6.14
IBR	Yes vs No	0.91	0.97	0.56	1.68

IBR: immediate breast reconstruction, SSM: skin-sparing mastectomy, NSM: nipple-sparing mastectomy.

Unplanned RORs – complications

Reasons for unplanned RORs included: hematoma evacuation ($n = 31$), skin necrosis ($n = 12$), infection ($n = 9$), seroma ($n = 4$), wound dehiscence ($n = 4$), venous congestion ($n = 3$), deflated implant ($n = 1$), and fat necrosis ($n = 1$), [Table 1](#). On multivariable analysis, current smokers (versus never smokers) and patients undergoing a mastectomy of any kind other than unilateral SSM (total unilateral/bilateral mastectomy, bilateral SSM, and unilateral/bilateral NSM (versus lumpectomy) were more likely to have a ROR, [Table 4](#). Immediate breast reconstruction (IBR) was not independently associated with an increased risk of ROR ($p = 0.32$).

Discussion

Utilization of an institution specific quality tracking tool allowed us to evaluate RORs after a breast operation at our institution to find they are overall rather infrequent, occurring most often for margin re-excision and hematoma evacuation. Patients who had a ROR for oncologic reasons more often underwent lumpectomy than mastectomy, while patients who had a ROR for complications more

Table 4

Multivariable analysis of factors associated with a planned staged return and unplanned return to the operating room.

Variable	Level	Planned Staged Returns				Unplanned Complications			
		Pr > Chi-Square	Odds Ratio Estimate	Lower 95% Confidence Limit for Odds Ratio	Upper 95% Confidence Limit for Odds Ratio	Pr > Chi-Square	Odds Ratio Estimate	Lower 95% Confidence Limit for Odds Ratio	Upper 95% Confidence Limit for Odds Ratio
Age		0.43	0.99	0.97	1.02	0.81	0.99	0.98	1.02
Sex	Female vs Male	0.004	0.10	0.02	0.49	NA	NA	NA	NA
Diabetes	No vs Yes	0.23	3.47	0.46	26.09	0.47	1.56	0.47	5.20
BMI Group	30 + vs < 30	0.48	1.27	0.66	2.44	0.15	1.47	0.87	2.49
Smoking Status	Current vs Never	0.42	0.44	0.06	3.30	0.04	2.47	1.06	5.75
	Former vs Never	0.15	1.63	0.84	3.17	0.51	1.21	0.68	2.14
Type of Surgery	Simple Unilateral	0.64	0.78	0.28	2.16	0.03	2.58	1.13	5.88
	Mastectomy vs Lumpectomy								
	Simple Bilateral	0.58	0.56	0.07	4.278	0.001	5.94	1.99	17.77
	Mastectomy vs Lumpectomy								
	SSM Unilateral vs Lumpectomy	0.001	6.28	2.08	19.01	0.369	2.05	0.43	9.84
	SSM Bilateral vs Lumpectomy	0.96	0.000	0.000	4.17E219	<0.001	4.85	1.96	11.99
	NSM Unilateral vs Lumpectomy	0.79	1.33	0.16	10.87	0.003	6.22	1.83	21.18
	NSM Bilateral vs Lumpectomy	0.82	1.15	0.35	3.82	0.005	3.61	1.46	8.90
IBR	Yes vs No	0.29	0.64	0.28	1.46	0.32	1.43	0.68	3.29

IBR: immediate breast reconstruction, SSM: skin-sparing mastectomy, NSM: nipple-sparing mastectomy.

*Sex model would not converge for unplanned returns to the operating room due to sample size.

often underwent mastectomy than lumpectomy. Immediate breast reconstruction was not independently associated with an increased risk for a ROR. Additionally, current smokers had a higher rate of unplanned RORs. The use of our ROR tool provides far more detailed information than other available ROR tracking databases, such as the American College of Surgeons – National Surgical Quality Improvement Program (ACS-NSQIP) database, which began tracking RORs in 2012.² Currently, this program is only used for internal quality control and is not reported to external sources. As the future of pay-for-performance medicine evolves, tracking the major reasons for RORs and optimizing care to address modifiable factors associated with RORs will assume greater importance. Addressing RORs is poised to both improve patient care and lower costs.

Breast surgery is unique, as most operations are performed for a cancer diagnosis and thus many RORs occur for further oncologic resection. Overall, 1.9% (30/1,572) of lumpectomy patients and 0.97% (13/1,342) of mastectomy patients had a ROR for further oncologic treatment. This is a considerably lower proportion than reported in other studies that have shown RORs rates for further oncologic procedures to range from 13% to 22%.^{5,31,32} One reason for our decreased ROR rate for oncologic reasons includes our intra-operative frozen section pathology practice. It is standard practice at our institution for all breast specimens to be evaluated for margin status and upgrade to invasive disease (for ductal carcinoma in situ cases), and sentinel lymph nodes to be evaluated for metastatic disease. This practice has been shown to decrease RORs in patients undergoing a lumpectomy for cancer; however, it does not influence the rate of RORs for patients undergoing mastectomy for cancer, or lumpectomy for a benign diagnosis.⁴ Others have explored similar or other techniques to reduce RORs for further oncologic treatment, such as excising additional margins at the initial operation, which also has been shown to decrease the ROR rate.³²

For patients having a ROR for complications, hematoma evacuation was the most common indication. In our study, we found this

rate to be 1.0%, which was slightly lower, but similar to previous studies that reported rates of 1.0–1.3%.^{2,5} In the current study, complications occurred most often following mastectomy and IBR did not independently increase the risk; however, a lack of a difference in our findings may be related to the low event rate in both groups. In our mastectomy population, complications requiring a ROR accounted for 80/1,342 (6.0%) of cases, 56/80 (70%) of which had immediate reconstruction. This rate was slightly lower to previous published ROR rates of 7.3–7.5% for mastectomy with immediate reconstruction.^{2,24} Additionally, for most types of mastectomy, patients who underwent a bilateral mastectomy were at a greater than double risk of ROR for complications than those undergoing unilateral mastectomy. This is consistent with a previous study utilizing NSQIP data that found 30-day complication rates were 4.2% for unilateral mastectomy and 7.6% for bilateral mastectomy.²¹ Unexpectedly, we found the likelihood of an unplanned ROR for a complication was greater for unilateral NSM than bilateral NSM, which may be related to a healthier subset of patients undergoing bilateral NSM than unilateral NSM, or differences in tumor stage including extent of axillary operation, which we did not evaluate. As expected, current smoking was associated with an increased risk of a ROR for complication, while there was no statistical difference associated with other potentially modifiable risk factors such as diabetes and obesity.

This study shows the utility of an institutional perioperative nursing documentation tool to help monitor patient outcomes. By identifying our major sources of RORs, we can help focus quality improvements in these areas, helping to advance the quality of health care.² From our findings, as expected, attention should be paid to reducing unplanned RORs due to complications, especially in patients undergoing bilateral mastectomy. We advocate for similar tools to be implemented at all surgical institutions.

Limitations to our study include its retrospective design, relatively low complication event rate, and the inability to capture patient RORs that occur at other institutions or after 45-days. Anecdotally, our breast surgery patients come back to our hospital

for all issues or call to inform us if there is a concern; however, this may not always be the case. Additionally, with breast reconstructive procedures, complications requiring ROR may occur after the 45-day mark. Other studies, however, have evaluated the efficacy of various reconstructive techniques, which we felt to be outside the scope of this paper. Despite these limitations, we feel the use of our institutional ROR documentation tool will help improve quality monitoring at our institution and should be implemented at surgical centers around the country.

Conclusion

Institutional based ROR documentation tools allow for case tracking, reporting on the reason for the ROR. RORs following breast surgery were infrequent, occurring in approximately 4% of patients, with just over one-third of these returns being for a staged oncologic procedure. Implementation of electronic ROR documentation tools should be encouraged at all hospitals, as these data provide benchmarks for clinical practice improvement initiatives to improve the quality of patient care.

Conflicts of interest

All authors disclose no conflicts.

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Appendix A. Supplementary data

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