

Preoperative Anxiety in Patients Undergoing Outpatient Cancer Surgery

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ABSTRACT

Objective: Our primary research aim was to determine the prevalence of preoperative anxiety in patients undergoing outpatient cancer surgery. Our secondary aim was to examine the association between preoperative anxiety and negative intraoperative and postoperative outcomes in patients undergoing outpatient cancer surgery, including increased anesthesia requirements, postoperative nausea and vomiting (PONV), extended overnight stay, total length of stay (LOS), transfer to hospital, surgical complications, and postoperative visits to urgent care centers (UCC). **Methods:** We conducted a retrospective cohort study to investigate the prevalence of preoperative anxiety and its association with postoperative outcomes in patients undergoing outpatient cancer surgery. Our retrospective cohort included 10,048 outpatient procedures performed on 8683 patients at a large comprehensive cancer center between January 1, 2016, and April 30, 2018. **Results:** The analysis included 8665 patients undergoing procedures at an outpatient facility over 16 months; 16.7% had preoperative

anxiety. In patients with preoperative anxiety, higher rates of adverse outcomes were seen, including PONV (adjusted difference 1.8%, 95% confidence interval [CI] 0.12%, 3.4%, $P = 0.029$), unplanned overnight admission (adjusted difference 1.1%, 95% CI 0.07%, 2.0%, $P = 0.021$), and urgent care visits within 30 days (adjusted difference 1.5%, 95% CI 0.44%, 2.6%, $P = 0.002$). **Conclusions:** Even assuming a causal relationship between preoperative anxiety and postoperative outcomes, preventing one instance of PONV would require treating at least 30 patients for anxiety, and preventing longer-term outcomes such as urgent care visits or readmissions within 30 days would require treating even larger numbers of patients. Future studies should attempt to elucidate the causal pathway between preoperative anxiety and postoperative adverse events in outpatients undergoing outpatient cancer surgery.

Key words: Ambulatory surgery, nursing assessment, oncology, patient outcomes, postoperative nausea and vomiting

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Introduction

Cancer diagnosis and treatment can evoke anxiety related to death, pain, disfigurement, disability, and disruption of relationships.^[1] For many types of cancer, surgery remains the primary treatment option, serving as an additional source of anxiety for some patients. Most surgeries in the United States are performed in ambulatory settings with no hospital admission. Many types of cancer surgeries are almost entirely performed on an outpatient basis including lumpectomies of the breast (97%), plastic reconstruction procedures (79%), and gynecology procedures (72%).^[2] As the number of outpatient surgeries increases, there is less time for health-care providers to support the anxiety of the perioperative cancer patient, leaving a gap in our understanding about the impact of this anxiety during the perioperative period.

In this study, anxiety describes the anticipation of a future threat manifested in muscle tension, vigilance, and avoidance behaviors in preparation for future danger.^[3,4] Medications frequently used to treat anxiety such as benzodiazepines may produce anesthesia and sedation, making them inappropriate in the preoperative setting when patients need to provide informed consent and vital information such as medical history.^[5]

Preoperative anxiety in patients may cause physiological and psychological adverse effects resulting in postoperative complications.^[6,7] Although the literature suggests that preoperative anxiety levels vary by type of surgery, gender, and age, no studies have specifically examined the prevalence of preoperative anxiety and the effects of other factors in the population of patients undergoing outpatient cancer surgery. There is a gap in the literature regarding the type, kind, and amount of anxiety experienced by patients undergoing outpatient cancer surgery.

Previous studies demonstrated that anxiety in the preoperative setting could lead to increased anesthesia requirements and complications during the intraoperative period.^[8,9] Another study concluded that patients with increased preoperative anxiety had more than average intraoperative movement requiring larger doses of propofol to maintain a clinically acceptable level of sedation.^[10] Increased anesthesia requirements may contribute to negative postoperative outcomes including longer length of stay (LOS), postoperative nausea and vomiting (PONV), and unplanned admissions.

Nurses have a holistic view of patients and focus care to improve outcomes while reducing symptoms associated with disease progression and psychosocial distress. In the perioperative setting, nurses are often the primary members of the health-care team tasked with assessing for anxiety and implementing care plans to improve patients' psychosocial well-being.

Our primary research aim was to determine the prevalence of preoperative anxiety in patients undergoing outpatient cancer surgery. Our secondary aim was to examine the association between preoperative anxiety and negative intraoperative and postoperative outcomes in patients undergoing outpatient cancer surgery, including increased anesthesia requirements, PONV, unplanned overnight stay, total LOS, transfer to hospital, surgical complications, and postoperative visits to urgent care centers (UCC).

Theoretical framework

The theoretical framework for this study is Peplau's Theory of Interpersonal Relations.^[11] The theory posits that with mild and moderate levels of anxiety, the individual focuses on the immediate task of reducing the stressor. Patients experiencing mild anxiety demonstrate visible symptoms such as restlessness, repetitive questions, and seek attention, reassurance, or approval. If the threat cannot be managed, the individual's anxiety increases. At moderate-to-severe levels of anxiety, the individual may have psychosomatic symptoms and use coping mechanisms to adapt. With severe-to-panic levels of anxiety, the individual becomes overwhelmed by the stressor and standard coping mechanisms will not work.

Peplau suggests that as anxiety progresses in severity, the patient's perceptual awareness narrows primarily to the symptoms and discomfort associated with anxiety. Peplau's theory recognizes the role of nurses in managing patients' anxiety. Peplau asserts that nurses help patients convert mild anxiety into productive activity and observe for more severe degrees of anxiety.^[11]

Methods

After institutional review board approval, we retrospectively obtained data extracted from the electronic medical record (EMR). Our retrospective cohort included 10,048 outpatient procedures performed on 8683 patients at a large comprehensive cancer center between January 1, 2016, and April 30, 2018. For patients with multiple surgeries, only the first procedure was included in the analysis ($n = 1365$ subsequent procedures excluded). Patients with the American Society of Anesthesiologists (ASA) Score 4 were excluded from the analysis ($n = 18$ patients). A total of 8665 outpatient procedures were included in the analysis. Characteristics of patients with and without preoperative anxiety were compared using Chi-square tests for categorical variables and Wilcoxon rank sum tests for continuous variables. We calculated the prevalence of preoperative anxiety as the proportion of patients with an anxiety care plan initiated before surgery.

Next, we assessed whether preoperative anxiety was associated with intraoperative and postoperative outcomes including postoperative LOS, unplanned conversion from Monitored Anesthesia Care (MAC) to general anesthesia, PONV, reoperation on the same day, extended overnight stay, admission to the main hospital, or a Grade 3 complication, UCC visit, or readmission within 30 days of surgery.

To assess the association between preoperative anxiety and postoperative LOS, we used a multivariable linear regression model that included preoperative anxiety, perioperative use of midazolam (any/none), Apfel score, operative time, age, anesthesia type (MAC/general anesthesia), type of surgery (robotic/open), and surgery start time. Patients were excluded from this analysis if they were transferred to an inpatient setting ($n = 21$), had a reoperation on the same day ($n = 39$), or stayed overnight ($n = 238$). We also investigated whether the association between anxiety and LOS differed based on surgical service by including an interaction term between surgical service and preoperative anxiety. To assess the association between preoperative anxiety and unplanned conversion from MAC to general anesthesia requiring an advanced airway device for breast service patients not undergoing axillary dissection ($n = 4786$), we used multivariable logistic regression adjusting for body mass index (BMI), age, and ASA score. To assess the association between preoperative anxiety and PONV, we used a multivariable logistic regression model adjusting for perioperative use of midazolam, Apfel score, operative time, age, anesthesia type, and surgery type. To assess the associations between preoperative anxiety and extended overnight stay, UCC visit within 30 days, and readmission within 30 days, we built separate multivariable logistic regression models for each outcome. Each of these models included age, ASA score, type of anesthesia (MAC/general anesthesia), and type of surgery (robotic/open) as covariates. The model for extended overnight stay also included use of postoperative rescue antiemetic medication as a covariate. For the outcomes of reoperation, admission to the main hospital, and Grade 3 or higher complications within 30 days, we created a multivariable logistic model adjusted for age only, due to a limited number of events.

All analyses were performed using Stata 15 (StataCorp, College Station, TX, USA). Alpha was set at 0.05.

Operational definitions

Preoperative anxiety was identified if the patient had an anxiety care plan initiated by nursing staff in the preoperative setting and recorded in the EMR, indicating that the patient's anxiety was significant and required additional nursing intervention. The Department of

Nursing's standard of care for anxiety in the perioperative setting is the initiation of a nursing care plan. According to the protocol, the anxiety can be related to the plan of care, presurgical care routine, postanesthesia care unit (PACU) routine, uncertain prognosis, and anticipated loss, pain, suffering, or adverse consequences. Anxiety related to the surgical procedure is stress evidenced by clinician assessment, altered vital signs, or the verbalization of anxiety.

Our research included patient characteristics and intraoperative factors that may have influenced these outcomes. We classified patient comorbidities according to the ASA Physical Status Classification System Score. The ASA is a subjective assessment of health status ranging from ASA I, "a normal healthy patient," to ASA V, "a moribund patient who is not expected to survive without the operation."^[12] Postoperative LOS was defined as time from entry into the PACU to discharge home from the PACU in hours. The Apfel PONV score predicts the risk of PONV using a four-point scale with points added for female sex, history of PONV or motion sickness, nonsmoking status, and opioid administration.^[13] Higher scores indicate increased risk of PONV.

We defined PONV as postoperative administration of rescue antiemetic in the PACU. Patients undergoing general anesthesia received standard prophylactic antiemetics (dexamethasone and ondansetron) and all patients with an Apfel Score of 4 received aprepitant. Patients undergoing MAC received prophylactic antiemetics based on clinician judgment. In the PACU, antiemetics were administered for treatment of nausea or vomiting based on a standard-of-care treatment protocol. Prophylactic antiemetics were not administered prior to opiate administration in the PACU.

Grade 3 or higher complications were defined based on the Clavien–Dindo classification system which standardizes morbidity assessment and included any Grade 3 or higher complication within 30 days of surgery.^[14]

Results

A total of 8665 outpatient procedures were included in our analysis. Most patients were female (96%) and treated by the breast service (58%). Other patient characteristics are presented in Table 1. Overall, 16.7% (95% confidence interval [CI] 15.9%, 17.5%) were identified as experiencing preoperative anxiety.

The median LOS in this cohort was 2.6 hours (quartiles 2.0, 3.4). We did not find a significant association between preoperative anxiety and LOS after adjusting for midazolam use, Apfel score, operative time, age, type of anesthesia, type of surgery, and surgery start time (t statistic 1.52, $P = 0.13$, [Table 2]). We also found no

Table 1: Characteristics of patients with and without preoperative anxiety (n=8665)

Characteristics	No preoperative anxiety (n=7221)	Preoperative anxiety (n=1444)	P	Test statistic
Male (%)	316 (4.4)	40 (2.8)	0.005	7.9
Age at surgery (years)	55 (46-65)	54 (45-64)	0.028	2.2
ASA score (%)				
1	252 (3.5)	56 (3.9)	0.6	0.94
2	4299 (59.5)	869 (60.2)		
3	2670 (37.0)	519 (35.9)		
Anesthesia type (%)				
General	3434 (47.6)	677 (46.9)	0.6	0.22
MAC	3787 (52.4)	767 (53.1)		
Robotic-assisted procedure (%)				
No	7117 (98.6)	1427 (98.8)	0.4	0.60
Yes	104 (1.4)	17 (1.2)		
Operating room time (min)	55 (35-80)	56 (37-83)	0.13	-1.5
Service (%)				
Breast	4173 (57.8)	824 (57.1)	0.068	10.3
Gastric mixed tumor	149 (2.1)	21 (1.5)		
Gynecology	947 (13.1)	180 (12.5)		
Head and neck	191 (2.6)	33 (2.3)		
Plastics	1719 (23.8)	383 (26.5)		
Urology	42 (0.6)	3 (0.2)		
Preoperative or intraoperative midazolam use (%)	5769 (79.9)	1154 (79.9)	>0.9	0.0005
Apfel score (%)				
0	7 (<0.1)	0	0.039	10.1
1	56 (0.8)	9 (0.6)		
2	736 (10.2)	119 (8.2)		
3	5127 (71.0)	1023 (70.8)		
4	1295 (17.9)	293 (20.3)		
Surgery start time (n=8626)	10:56 am (9:02 am-1:12 pm)	10:47 am (8:48 am-12:56 pm)	0.081	1.7

Data reported as frequency (%) or median (quartiles: Q1-Q3). Patient characteristics were compared between patients with and without preoperative anxiety using Chi-squared tests for categorical variables (Pearson Chi-squared test values reported) and Wilcoxon rank sum tests for continuous variables (Z statistic reported). ASA: American Society of Anesthesiologist, MAC: Monitored anesthesia care

Table 2: Differences in postoperative length of stay, anesthesia conversion, and postoperative adverse events between patients with and without preoperative anxiety

Adverse events	No preoperative anxiety	Preoperative anxiety	Adjusted difference (95% CI)	P	Test statistic
Postoperative LOS (n=8373)	2.9 h (1.3)	3.0 h (1.3)	2.9 min (-0.84 min-6.7 min)	0.13	1.52
Conversion from MAC to general anesthesia (n=4786), n (%)	505 (13.0)	83 (11.0)	-1.8% (-4.0%-0.44%)	0.13	-1.50
Any use of postoperative PONV medication (n=8665), n (%)	715 (9.9)	181 (12.5)	1.8% (0.12%-3.4%)	0.029	2.19
Same day resurgery (n=8665), n (%)	27 (0.4)	12 (0.8)	0.45% (-0.034%-0.94%)	0.022	2.29
Transfer from Outpatient Surgery Center (n=8665), n (%)	17 (0.2)	4 (0.3)	0.048% (-0.25%-0.34%)	0.7	0.33
Overnight stay (n=8626), n (%)	184 (2.6)	54 (3.8)	1.1% (0.07%-2.0%)	0.021	2.32
Grade 3 or higher complication within 30 days (n=8665), n (%)	11 (0.2)	8 (0.6)	0.40% (0.007%-0.79%)	0.006	2.77
UCC visit within 30 days (n=8665), n (%)	183 (2.5)	58 (4.0)	1.5% (0.44%-2.6%)	0.002	3.16
Readmission within 30 days (n=8665), n (%)	104 (1.4)	34 (2.4)	0.97% (0.13%-1.8%)	0.008	2.65

Postoperative LOS in each group reported in h as mean (SD) with adjusted difference in postoperative LOS between groups in minutes with 95% CI; test statistic reported is t statistic from multivariable linear regression model. Anesthesia conversion and postoperative adverse event rates reported as frequency (%) in each group and adjusted difference in rates between groups reported with 95% CI; test statistic reported is Z statistic from multivariable logistic regression model. The adjusted difference is positive, if LOS, anesthesia conversion, or adverse event rates were higher in patients with preoperative anxiety, and negative, if lower in patients with preoperative anxiety. SD: Standard deviation, CI: Confidence interval, LOS: Length of stay, MAC: Monitored anesthesia care, PONV: Postoperative nausea and vomiting, UCC: Urgent care center

evidence that the association between preoperative anxiety and LOS differed based on surgical service (*F* statistic 1.19, *df* [5, 8354], *P* = 0.3).

In breast service patients who were not undergoing axillary dissection (*n* = 4786), we found no significant association between preoperative anxiety and conversion from MAC to general anesthesia after adjusting for BMI,

age, and ASA score [*z* statistic-1.50, *P* = 0.13, Table 2]. The prevalence of anxiety in this group was 16% (*n* = 785).

Ten percent of patients (*n* = 896) required rescue antiemetics for PONV, and preoperative anxiety was significantly associated with PONV in multivariable analysis (*z* statistic 2.19, *P* = 0.029) [Table 2]. However, the difference in effect observed between patients with

and without preoperative anxiety was small. The adjusted rate of PONV was only 1.8% higher in patients who had preoperative anxiety (95% CI 0.1%, 3.4%). Assuming that the increased rate of PONV is caused by preoperative anxiety, based on the upper bound of the 95% CI, this would require that 30 patients be treated for anxiety to prevent one patient requiring rescue antiemetics for PONV.

Rates of adverse postoperative outcomes were low in this cohort. There were 39 patients who had a reoperation the same day (0.5%) and 21 who were transferred to the main hospital (0.2%). After adjusting for age, we found that patients with preoperative anxiety were significantly more likely to undergo a reoperation on the same day (z statistic 2.29, $P = 0.022$) [Table 2]. Again, the adjusted difference in rates was small. Patients with preoperative anxiety had only a 0.5% higher risk of reoperation (95% CI -0.03%, 0.94%). We found no evidence that preoperative anxiety was associated with admission to the main hospital after surgery (z statistic 0.33, $P = 0.7$) [Table 2].

While patients undergoing outpatient procedures are usually discharged on the day of surgery, there were 238 patients in our cohort who stayed overnight after their outpatient procedure (2.8%). Patients with preoperative anxiety had statistically but not clinically significantly higher rates of overnight stays (z statistic 2.32, $P = 0.021$), with patients with preoperative anxiety having an adjusted increase in the rate of overnight stay of only 1.1% (95% CI 0.07%, 2.0%) [Table 2].

During the 30-day postoperative period, 19 patients had a Grade 3 or higher complication (0.2%), 241 patients had a UCC visit (2.8%), and 138 were readmitted (1.6%). Preoperative anxiety was significantly associated with Grade 3 or higher complications (z statistic 2.77, $P = 0.006$), UCC visits (z statistic 3.16, $P = 0.002$), and readmissions within 30 days (z statistic 2.65, $P = 0.008$). However, the adjusted increases in all four 30-day adverse event outcomes associated with preoperative anxiety were small [Table 2].

Discussion

In our cohort of patients undergoing outpatient cancer surgery, nearly one in five patients was identified by nursing assessments to be experiencing notable levels of preoperative anxiety. The majority of our patients were women who underwent breast or plastic reconstruction surgery. Our results support previous research demonstrating that a nonnegligible proportion of women with breast cancer undergoing surgery experience preoperative anxiety.^[15] Women undergoing breast cancer surgery face significant anxiety related to the future prognosis coupled with their concerns regarding body image.^[16] In another study, women

undergoing cancer-related surgeries had significantly higher levels of state anxiety than those undergoing elective plastic surgery yet no elevation in trait anxiety levels, suggesting the unique nature of cancer-related surgeries in increasing anxiety.^[17]

In a multicenter longitudinal study, researchers recruited women undergoing breast cancer surgery without metastasis and investigated whether specific demographic, clinical, or symptoms predicted their level of preoperative anxiety and their resulting state anxiety over 6 months following surgery.^[18] The results demonstrated that the women in the study experienced moderate levels of anxiety preoperatively and this anxiety continued for months following surgery. These findings suggest women who undergo breast cancer surgery experience moderate levels of anxiety 6 months following a surgical procedure. The authors concluded that women undergoing breast cancer surgery should be screened for anxiety preoperatively to allow for the possibility of further intervention. Fortunately, interventions to reduce preoperative anxiety in the breast cancer surgery population have demonstrated efficacy and feasibility in the pilot setting.^[19]

Our multivariable analysis demonstrated that preoperative anxiety was statistically associated with higher rates of some adverse outcomes, including postoperative PONV, same day reoperation, overnight stay and Grade 3+ complications, UCC visits, and readmissions within 30 days after surgery. To our knowledge, ours is the first study to investigate the relationship between preoperative anxiety and intraoperative and postoperative outcomes in the unique and growing population of patients undergoing outpatient cancer surgery. Previous findings in other populations (hip and knee arthroplasty) suggest that preoperative anxiety and uncertainty correlates with decreased overall well-being, including long-term physical and mental health symptoms, postoperatively.^[20]

Our results showed patients with preoperative anxiety experienced higher rates of PONV and unplanned overnight admissions compared to patients not experiencing anxiety, preoperatively. PONV can contribute to prolonged PACU stay, which along with unanticipated hospital admission can result in cost increases for patients and hospitals.^[21] As the popularity of ambulatory cancer surgery increases, PONV can become a costly setback. However, the increase in PONV associated with anxiety in our cohort would require treating 30 patients for anxiety to prevent one patient from having PONV, and providers must balance the costs and risks of treating anxiety with those with PONV. Rates of adverse events in the entire cohort are low and the adjusted differences in outcomes between patients with and without preoperative anxiety are small.

Postoperative anxiety may be related to postoperative outcomes, but our current study and institutional nursing practice do not include assessment of anxiety following surgery. Our study included a primarily female population, limiting the generalizability of the results. Additional factors may influence the rate of negative postoperative outcomes including surgical technique and patient comorbidities or characteristics.

Conclusion

While the differences in postoperative adverse event rates between patients with and without preoperative anxiety were small, it is unknown if the link between anxiety and postoperative outcomes is causal; clinicians should weigh the potential harms of anxiety reduction interventions against the potential benefits of avoiding postoperative adverse events. Our findings highlight the importance of assessing and recording preoperative anxiety in patients undergoing outpatient cancer surgery so that future studies can attempt to elucidate the causal pathway between preoperative anxiety and postoperative adverse events.

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Conflicts of interest

There are no conflicts of interest.

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