Postoperative and Postdischarge Nausea & Vomiting following Ambulatory Surgery: A Retrospective Cohort Study comparing Incidence and Associated factors

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Abstract

Background

Ambulatory surgery is often followed by the development of nausea & vomiting (N/V). Although risk factors for postoperative nausea & vomiting (PONV) are often studied, PONV is not well understood in context of a patient's home. This is especially troublesome given the potential consequences of postdischarge nausea & vomiting (PDNV), which include major discomfort and hospital readmission.

Methods

In this retrospective cohort study, data from 10,231 adult patients undergoing ambulatory surgery with general anesthesia were collected and analyzed. Multivariable multinomial logistic regression was used to assess the association between patient & operative characteristics (including age, body mass index (BMI), American Society of Anesthesiologists (ASA) classification, current smoker status, and intra & postoperative opioid usage) and the odds of experiencing N/V only in the postanesthesia care unit (PACU), only at home, or in the PACU and at home, as compared to not experiencing N/V at all.

Results

In this study, 17.8% of all patients developed N/V in at least one location following ambulatory surgery with general anesthesia. Patients who experienced N/V in the PACU had 3.05 (95% confidence interval: 2.55-3.65) times the risk of reporting N/V at home than those who did not. Multivariable multinomial logistic regression found that younger age, greater hydromorphone use, and female sex were associated with increased likelihood of experiencing N/V in all settings. Increased morphine usage was found to be associated with greater odds of experiencing Home only and PACU plus Home N/V, but not PACU only N/V. Greater oxycodone and volatile anesthetic usage were associated with lower and higher odds of experiencing PACU only N/V respectively, but neither were significantly associated with Home only and PACU plus Home N/V.

Conclusions

Patients experiencing N/V in the PACU are observed to develop PDNV disproportionately. N/V at home and N/V in the PACU, while having some overlap, are associated with several unique indicators, including usage of oxycodone, morphine, and volatile anesthetics. More investigation into PDNV specific indicators and prevention strategies is warranted.

Trial Registration

N/A

Background

Postoperative nausea & vomiting (PONV) is one of the most frequent complications to follow ambulatory surgery, with an incidence rate upwards of 80% in certain high-risk patient groups and an overall rate ranging from 20–30%[1–3]. Despite being seemingly commonplace, a previous survey revealed that patients are more averse to PONV than pain and other highly undesirable postoperative complications[4]. Additionally, even moderate instances of

PONV can lead to significant consequences, including delayed discharges, disrupted postanesthesia care unit (PACU) workflow, increased medical expenses, and diminished patient satisfaction[5–7].

PONV occurrence in hospitals has been widely investigated and many risk factors have been identified, including female sex, history of PONV, nonsmoker status, and intraoperative usage of opioid analgesics among others[8–11]. Other factors include surgery type: otolaryngologic, ophthalmic, and gynecological procedures may be associated with a 4–6 times increased risk of PONV[11,12]. However, current literature does not adequately distinguish PONV, often solely referring to nausea & vomiting (N/V) in the PACU, from postdischarge nausea & vomiting (PDNV), which occurs at home. (Some sources define PONV as N/V in the PACU or within 24 hours of a procedure; for clarity purposes, and given the importance of locality, we delineate N/V based on occurrence before (N/V in the PACU) or after (N/V at home) discharge. Further elaboration can be found in the methods section.) The difference in environment, notably the distance from medical staff and services, may have consequential effects on patient wellbeing. Patients experiencing PDNV have few means to alleviate their discomfort and are observed to be disproportionately involved in hospital readmittance[13,14]. As such, the prediction and mitigation of such postdischarge complications are of great interest. This is especially relevant for ambulatory surgeries as patients spend shorter durations in the PACU and less time under skilled nurse supervision before being sent home. An updated analysis of new, robust data that differentiates N/V assessed at home from occurrence in the PACU is necessary to further guide clinical practice.

In this retrospective cohort study, we seek to compare the risk factors for and incidence of N/V in the PACU and at home. 10,231 patients who received ambulatory surgeries with general anesthesia were assessed for N/V in the PACU and reassessed at home via telephone on postoperative day one (POD1). Previous literature has found increased frequency of PONV following ophthalmic and otolaryngologic procedures[15]. Given their salience as potentially high-risk services, we focus our analysis on these two types of procedures. Our goal was to determine if there are any factors that are linked to the time and setting of N/V occurrence.

Methods

The study was conducted at Massachusetts Eye and Ear (MEE) with MEE Institutional Review Board (IRB) approval (1199654-1/(18-026H)) and Massachusetts General Brigham IRB approval (Protocol # 2019P00194). The study was conducted in accordance with all rules and regulations laid out by the IRB and human studies committee. This manuscript adheres to applicable STROBE guidelines. A waiver of written informed consent was obtained for this study. Electronic medical records (EMR) of procedures performed by the otolaryngology and ophthalmology services between April 4, 2016, and May 4, 2020 were analyzed. Initial inclusion criteria were patient age 18 years or older, ambulatory surgery procedures, services provided by otolaryngology and ophthalmology, and general anesthesia as the primary anesthetic type. PACU N/V status was positive if nursing observed, or patient reported, nausea or emesis, or if additional antiemetics were administered in the PACU (ondansetron, metoclopramide, haloperidol, famotidine, dexamethasone, promethazine, or scopolamine patch antiemetics). Home N/V status was positive if patients reported nausea or emesis during their POD1 follow-up phone call. Data regarding antiemetic use at home was not available nor analyzed. Cases with incomplete records were excluded. Additional procedures performed on the same patient were excluded so that only each patient's first procedure was included. In the end, a total of 10,231 procedures were identified and included in our analyses.

Statistical Analysis

The primary outcome of N/V status consisted of four categories: No N/V, PACU only N/V, Home only N/V, and PACU plus Home N/V. An *a priori* determined list of potential factors associated with the odds of N/V in the PACU and/or at home included age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) class, current smoker status, prophylactic antiemetic administration, otolaryngology vs. ophthalmology procedure type, scopolamine patch applied any time on the day of surgery before the end of surgery, intraoperative inhalational anesthesia duration, intraoperative nitrous oxide duration, intraoperative total anesthesia duration, cumulative hydromorphone consumption intraoperatively through PACU, cumulative fentanyl consumption intraoperatively through PACU, cumulative oxycodone consumption intraoperatively through PACU, cumulative morphine consumption intraoperatively through PACU, PACU phase I duration, and PACU phase II duration. These factors were compared between each of the three groups who experienced any N/V versus the No N/V group using two-sample t-tests for continuous variables, Wilcoxon rank-sum tests for ordinal variables, and $\chi 2$ or Fisher's exact test for nominal categorical variables, as well as standardized differences. The percentage of patients who reported N/V in the PACU who also reported N/V at home is presented as a point estimate with 95% Wald asymptotic confidence interval. This percentage was compared to 50% using a one sample Z-test for proportion. The adjusted association of each factor on the *a priori* defined list with the odds of being in each of the three groups who experienced any N/V versus the No N/V group was assessed using multivariable multinomial logistic regression. Convergence was not obtained for multilevel models accounting for multiple surgeries on the same patient, so only the first surgery on each patient was included in the final analysis. All statistical hypothesis tests were evaluated at a two-sided alpha level of 0.05, with no correction for multiple testing. Statistical analyses were performed using SAS software version 9.4 (SAS Institute, Cary, NC).

Sample Size Justification

Assuming that at least 60% of patients who report N/V in the PACU also report N/V at home, it was estimated that a total of 194 patients with PACU N/V would provide 80% power at a two-sided alpha level of 0.05 to determine whether the percentage of patients with N/V in PACU who also reported PDNV at home was different from 50% with a one sample Z-test for proportion.

The goal of building a multivariable multinomial logistic regression for PONV status was to identify predictors, not develop a prognostic model. However, De Jong et al. recommend at least 10 patients in the smallest outcome category per model parameter estimated in large sample to obtain adequate multinomial prediction model performance[16]. A minimum of 180 patients in the smallest outcome category would be adequate to test the total of 18 parameters of interest identified *a priori*.

Results

Figure 1 depicts a flow diagram for study inclusion. Information from a total of 13,789 adult, ambulatory, otolaryngologic or ophthalmic surgeries with general anesthesia was collected through POD1. To eliminate any correlation caused by patients who underwent multiple procedures, our analysis only included data from each patient's first procedure. Observations with missing information were excluded. Data from a total of 10,231 unique patients were analyzed.

(All Tables And Figures Are Attached Again At The End Of The Manuscript)

The total incidence of PONV, both pre and postdischarge, summed to 17.8%. As previously stated, the cases were broken down into four groups based on the presence of N/V in the PACU and at home: No N/V in both the PACU

and at home (No N/V), N/V in the PACU but not at home (PACU Only), N/V at home but not in the PACU (Home Only), and N/V occurring in both settings (PACU plus Home).

Table 1 shows the number of patients in each of the four outcome groups for the patient and procedure characteristics considered, and the corresponding univariate p-values and standardized differences when compared to the No N/V group. It also contains independent variable information per outcome, including mean, standard deviation, count, and percentage when relevant. Table 2 reports the Adjusted Odds Ratio (AOR) and 95% confidence intervals for each of the three N/V occurrence outcome groups in comparison with the No N/V group, using the variables described in Table 1, as derived by multivariable multinomial regression (age, ASA status, BMI, smoker status, hydromorphone, fentanyl, inhalational time, sex, morphine, nitrous time, oxycodone, PACU 1&2 times, prophylactic antiemetic usage, scopolamine usage, surgery type, and total anesthesia time). For continuous variables, the AOR is based upon the unit increases defined in Table 2. Table 3 depicts the overall number and percent of patients that fall into each outcome group.

Table 1
Patient and Operative Factors by N/V Status

	Measure[a]				Standardized difference[b]			p-value		
	No N/V[c] (n = 8415)	PACU[d] only (n = 1333)	Home only (n = 317)	PACU and Home (n = 166)	PACU only vs. No N/V	Home only vs. No N/V	PACU and home vs. No N/V	PACU only vs. No N/V	Home only vs. No N/V	PACU and home vs. No N/V
Age (years)	51.5 ± 17.8	47.7 ± 16.2	47.4 ± 17.5	46.3 ± 16.1	-0.223	-0.231	-0.306	< 0.001	< 0.001	< 0.001
ASA Classification[e], n (%)										
1	1375 (16.3)	287 (21.5)	65 (20.5)	39 (23.5)	-0.160	-0.119	-0.215	< 0.001	0.036	0.006
2	5824 (69.2)	903 (67.7)	214 (67.5)	111 (66.9)						
3	1216 (14.5)	143 (10.7)	38 (12)	16 (9.6)						
Body Mass Index (kg/m^2)	27.2 ± 5.6	27.3 ± 5.8	26.6 ± 5.4	26.3 ± 5.3	0.015	-0.113	-0.177	0.608	0.051	0.027
Current smoker, n (%)	789 (9.4)	91 (6.8)	23 (7.3)	8 (4.8)	-0.094	-0.077	-0.178	0.003	0.202	0.045
Hydromorphone (mg)	0.3 ± 0.5	0.5 ± 0.7	0.4 ± 0.6	0.5 ± 0.7	0.296	0.134	0.340	< 0.001	0.016	< 0.001
Fentanyl (mcg)	68.1 ± 72	83.1 ± 74.9	77.9 ± 68.2	87.7 ± 73.3	0.222	0.183	0.297	< 0.001	0.002	< 0.001
Inhalational time (minutes)	56.9 ± 59.9	88.7 ± 75	59.4 ± 63.2	87.9 ± 81.5	0.470	0.034	0.427	< 0.001	0.557	< 0.001
Male, n (%)	4265 (50.7)	449 (33.7)	118 (37.2)	50 (30.1)	-0.349	-0.274	-0.429	< 0.001	< 0.001	< 0.001
Morphine (mg)	1.2 ± 2.3	1.4 ± 2.6	1.9 ± 2.8	2.2 ± 3.1	0.121	0.278	0.381	< 0.001	< 0.001	< 0.001
Nitrous time (minutes)	6.7 ± 22.6	12.9 ± 34.5	7.3 ± 25.8	10.6 ± 30.4	0.177	-0.010	0.145	< 0.001	0.863	0.046
Oxycodone (mg)	2.0 ± 3.1	2.0 ± 3.1	2.5 ± 3.3	2.1 ± 3.1	-0.015	0.175	0.034	0.602	0.002	0.663
PACU phase 1 time (minutes)	63.8 ± 38.5	79.7 ± 31.9	66.1 ± 28	80.8 ± 31.5	0.617	0.128	0.700	< 0.001	0.028	< 0.001
PACU phase 2 time (minutes)	74.0 ± 45.4	106.4 ± 64.9	83.5 ± 57.3	123.5 ± 95.1	0.731	0.230	1.013	< 0.001	< 0.001	< 0.001
Prophylactic antiemetic use	8113 (96.4)	1287 (96.5)	302 (95.3)	161 (97)	0.008	-0.057	0.032	0.801	0.286	0.692

	Measure[a]				Standardized difference[b]			p-value		
Perioperative scopolamine use	881 (10.5)	255 (19.1)	36 (11.4)	24 (14.5)	0.246	0.029	0.121	< 0.001	0.613	0.098
Surgery type										
Otolaryngology	6672 (79.3)	1165 (87.4)	261 (82.3)	146 (88)	0.219	0.077	0.236	< 0.001	0.188	0.006
Ophthalmology	1743 (20.7)	168 (12.6)	56 (17.7)	20 (12)						
Total anesthesia time (minutes)	117.8 ± 61.4	135.8 ± 70.6	114.2 ± 62	130.5 ± 75.5	0.262	-0.084	0.146	< 0.001	0.142	0.059

a. Described as mean ± SD or n(%)

b. A standardized difference with absolute value > 0.1 can be taken to indicate a greater difference between groups than would be expected by chance.

c. Nausea/Vomiting

d. Postanesthesia Care Unit

e. American society of anesthesiologists physical status classification

Table 2
Multivariable Adjusted Odds Ratio

	PACU[a] only vs. No N/V[b]		Home only vs. No N/V		PACU and Home vs. No N/V	
Comparison	AOR[c] (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Age (per 1 year increase)	0.99 (0.99, 0.99)	< 0.001	0.99 (0.98, 1.00)	0.012	0.99 (0.98, 1.00)	0.010
ASA[d] 2 vs. ASA 1	0.80 (0.68, 0.94)	0.008	0.94 (0.69, 1.28)	0.712	0.83 (0.55, 1.25)	0.381
ASA 3 vs. ASA 1	0.74 (0.58, 0.96)	0.022	1.02 (0.64, 1.61)	0.939	0.77 (0.39, 1.49)	0.434
Body Mass Index (per 1 kg/m^2 increase)	1.01 (1.00, 1.02)	0.268	0.98 (0.96, 1.00)	0.107	0.97 (0.94, 1.00)	0.061
Current smoker (yes vs. no)	0.74 (0.58, 0.94)	0.014	0.75 (0.48, 1.16)	0.192	0.49 (0.24, 1.01)	0.054
Hydromorphone[e] (per 1 mg increase)	1.31 (1.18, 1.45)	< 0.001	1.39 (1.15, 1.68)	< 0.001	1.58 (1.26, 1.98)	< 0.001
Fentanyl[e] (per 1 mcg increase)	1.00 (1.00, 1.00)	0.015	1.00 (1.00, 1.00)	0.060	1.00 (1.00, 1.00)	0.078
Inhalational time (per 1 minute increase)	1.01 (1.00, 1.01)	< 0.001	1.00 (1.00, 1.00)	0.692	1.01 (1.00, 1.01)	< 0.001
Sex (male vs. female)	0.46 (0.40, 0.52)	< 0.001	0.56 (0.44, 0.71)	< 0.001	0.36 (0.26, 0.52)	< 0.001
Morphine[e] (per 1 mg increase)	1.01 (0.98, 1.04)	0.446	1.12 (1.07, 1.16)	< 0.001	1.13 (1.07, 1.19)	< 0.001
Nitrous time (per 1 minute increase)	1.00 (1.00, 1.01)	< 0.001	1.00 (1.00, 1.01)	0.693	1.00 (1.00, 1.01)	0.197
Oxycodone[e] (per 1 mg increase)	0.97 (0.95, 0.99)	0.003	1.03 (0.99, 1.06)	0.113	0.97 (0.92, 1.02)	0.240
PACU phase 1 time (per 1 minute increase)	1.01 (1.00, 1.01)	< 0.001	1.00 (0.99, 1.00)	0.594	1.01 (1.00, 1.01)	< 0.001
PACU phase 2 time (per 1 minute increase)	1.01 (1.01, 1.01)	< 0.001	1.00 (1.00, 1.01)	0.001	1.01 (1.01, 1.01)	< 0.001
Prophylactic antiemetic usage (yes vs. no)	0.82 (0.59, 1.15)	0.253	0.65 (0.38, 1.13)	0.126	0.92 (0.37, 2.32)	0.864
Perioperative scopolamine usage (yes vs. no)	1.39 (1.18, 1.64)	< 0.001	0.82 (0.57, 1.19)	0.298	0.90 (0.57, 1.41)	0.634
Service (ENT vs. ophthalmology)	1.14 (0.94, 1.37)	0.185	0.84 (0.61, 1.15)	0.275	0.98 (0.59, 1.62)	0.937
Total anesthesia time (per 1 minute increase)	1.00 (1.00, 1.00)	0.493	1.00 (1.00, 1.00)	0.194	1.00 (0.99, 1.00)	0.176

a. Postanesthesia Care Unit

b. Nausea/Vomiting

c. Adjusted Odds Ratio

d. American society of anesthesiologists physical status classification

e. Cumulative opioid administration/consumption from surgery start through PACU discharge.
When compared to the No N/V group, older age, male sex, and smaller dosages of hydromorphone administration were significant low risk indicators ($p < 0.05$) for all 3 N/V occurrence groups. BMI, service type (otolaryngology vs ophthalmology), prophylactic antiemetic usage, and total time spent under anesthesia were not significantly associated with any of the three no N/V outcomes.

Smoker status was associated with decreased incidence for all three groups and showed significance on a 5% level for the PACU Only group (p-value 0.014) and on a 10% level for the PACU plus Home group (p-value 0.054). Higher ASA class was associated with decreased occurrence of PACU Only; ASA 2 had an AOR of 0.8 (CI: 0.68–0.94, p-value 0.008) and ASA 3 had an AOR of 0.74 (CI: 0.58–0.96 p-value 0.022) when compared to ASA 1 patients. Perioperative scopolamine usage was positively associated with the PACU Only group (AOR 1.39 (CI: 1.18–1.64, p-value < 0.001)). Conversely, morphine was positively associated with the Home Only and PACU plus Home groups (AOR 1.12 (CI: 1.07–1.16, p-value < 0.001), AOR 1.13 (CI: 1.07–1.19, p-value < 0.001), respectively), but not the PACU Only group. Total inhalation time was positively associated with PACU Only and PACU plus Home (AOR 1.01 (CI: 1-1.01, p-value < 0.001)). Home Only patients spent significantly longer in PACU phase 2 than their No N/V counterparts (p-values < 0.001, 0.594 respectively).

The percentage of patients who experienced PACU N/V that also reported Home N/V was 11.1% ($p < 0.001$ for one sample Z-test of whether percentage differs from 50%) (Table 3). In contrast, the percentage of patients who experienced PACU N/V that did not report Home N/V was 3.6% (Table 3). As such, patients who experienced N/V in the PACU had 3.05 (CI: 2.55–3.65) times the risk of reporting N/V at home than those who did not.

Table 3
Incidence of All Outcome Groups

	Home N/V[a]	No Home N/V
PACU[b] N/V		
Count	166	1333
Row %	11.1	88.9
Column %	34.4	13.7
Table %	1.6	13
No PACU N/V		
Count	317	8415
Row %	3.6	96.4
Column %	65.6	86.3
Table %	3.1	82.3

a. Nausea & vomiting

b. Postanesthesia care unit

Discussion

PONV is discussed in a plethora of studies, but there is a lack of literature that distinguishes the risk factors for N/V in the PACU from N/V occurrence at home. Our study finds that such a distinction does exist and may warrant further attention. As some patients experience N/V both in the PACU and at home, we split our N/V positive population into three separate groups, PACU Only, Home Only, and PACU plus Home, as described in the results section. Emphasis is placed on the results from multivariable multinomial analysis (Table 2).

In accordance with the 20–30% incidence rate reported by previous literature[1–3], we found that 17.8% of patients experienced N/V following ambulatory surgery with general anesthesia in at least one setting. Also in line with previous literature, female sex and younger age were observed to be associated with N/V[1], and we found this association to be independent of location of occurrence. However, location proved to be significant for many other associated factors. For instance, the usage of volatile anesthetics and nitrous oxide, known positive risk factors for PONV, were only significant in the PACU setting. The transitory nature of volatile anesthetics may explain this finding; any remnant physiological effects are likely to have faded by POD1. In a similar fashion, our findings suggest that lower ASA status, the effects of which are still contested in literature[11], may only be associated with N/V in the PACU. In contrast to volatile anesthetic usage, morphine dosage was most associated with the Home Only and PACU plus Home groups. Morphine contrasts with inhalational agents as a much longer acting analgesic. Unlike the PACU, a patient's place of residence may be less equipped to prevent opioid induced N/V. Finally, while PACU recovery duration can be considered both an indicator and result of PACU N/V, it is exogenous in the context of the Home Only group; longer durations spent in PACU recovery is associated with incidence of N/V at home.

Current knowledge states that opioid usage generally increases risk of N/V in a dose-dependent manner[17–20]; our findings support an association between increased dosage amongst the opioids tested, excluding oxycodone, and N/V outcomes. The negative association of oxycodone with the PACU Only group may result from N/V patients being unable to swallow a pill. It is also notable that the time of opioid administration, which was not recorded, may be associated with the risk of developing PONV[17]. Our reported insignificance of prophylactic antiemetic usage can be rationalized by the negligible portion of the population that did not receive such treatment (< 5%). Selection bias may also play a role, as greater prophylaxis use is expected in patients with higher risk of PONV.

In terms of surgery, otolaryngologic procedures, as compared to ophthalmic procedures, have been associated with greater incidence of N/V in the PACU[20]. Our findings show no significant increase in risk across all outcomes. Given our inclusion criteria, the earlier findings may be more closely associated with the type of anesthesia (general anesthesia vs monitored anesthesia care) rather than surgical procedure itself, as ophthalmic procedures are predominantly performed under monitored anesthesia care.

Regardless of the setting, nausea & vomiting are highly distressing to patients. PDNV is particularly harmful and is observed as one of the most frequent initial diagnoses at readmission[21]. Although the elimination of PONV is largely unfeasible, hospitals can strive to reduce the number of patients who report symptoms of N/V at home. The overall incidence of PDNV in our study was 4.7%, and we estimate that 11.1% of patients who experience PACU N/V will continue to report symptoms at home. While this number is a relatively small portion of the entire population, it remains that consideration of PDNV, especially for those who fall under higher risk classifications, is underemphasized in PONV risk management. Mindful perioperative treatment may reduce the incidence of PDNV; high-risk PDNV patients may benefit from more generous nitrous oxide and more stringent hydromorphone usage in pain management. Additionally, caution should be exerted when prescribing opioids or other N/V inducing medications to patients who stay long durations in PACU phase 2. Finally, current discharge criteria for patients experiencing N/V may be unsatisfactory and future study to identify risk factors of PDNV more clearly is warranted.

There were two main limitations to this study. Firstly, selection bias could have been introduced as our analysis only included procedures where the patients chose to respond to the POD1 phone call. Secondly, our data has a degree of ambiguity and is suggestive rather than conclusive. Although our study identified some characteristic differences in the indicators of N/V in the PACU and at home, more research is necessary to properly differentiate the two.

Conclusion

In conclusion, the population of patients who develop N/V both in the PACU and at home following ambulatory surgery is relatively small but significant. We observe that these patients have associated factors that are distinct from currently known PONV risk factors, including differing sensitivity to morphine and nitrous oxide. Our findings highlight specific indicators and suggest that PONV management protocol may be optimized by increasing stringency in opioid usage and flexibility in other anesthetic usages. Moving forward, we hope our findings can serve as a basis for further investigation of PDNV.

Abbreviations

N/V; Nausea & vomiting

PONV; Postoperative nausea & vomiting

PDNV; Postdischarge nausea & vomiting

BMI; Body mass index

ASA; American Society of Anesthesiologists

PACU; Postanesthesia care unit

POD1; Postoperative day 1

MEE; Massachusetts Eye and Ear

IRB; Institutional Review Board

EMR; Electronic Medical Records

AOR; Adjusted odds ratio

PACU plus Home; N/V reported in the PACU and at home

PACU Only; N/V reported in the PACU but not at home

Home Only; N/V reported at home but not in the PACU

No N/V; N/V neither reported in the PACU nor at home

Declarations

Ethics approval and consent to participate

The study was conducted at Massachusetts Eye and Ear (MEE) with MEE Institutional Review Board (IRB) approval (1199654-1/(18-026H)) and Massachusetts General Brigham IRB approval (Protocol # 2019P00194). A waiver of written informed consent was obtained for this study.

Consent for publication

N/A

Availability of data and materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request

Competing interests

The authors declare that they have no competing interests.

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Author Contributions

Mark Xiao: This author helped with study design, methodology, validation, data analysis, writing-original draft, and writing- review & editing. This author approved the final manuscript and attests to the integrity of the case report presented in this manuscript.

Dongdong Yao: This author helped with methodology, data analysis, writing-original draft, and writing- review & editing. This author approved the final manuscript and attests to the integrity of the case report presented in this manuscript.

Kara G Fields: This author helped with methodology, investigation, data curation, validation, formal analysis, writing-original draft, writing- review & editing. This author approved the final manuscript and attests to the integrity of the case report presented in this manuscript.

Pankaj Sarin: This author helped with the coordination of data curation, validation, analysis, and writing- review & editing. This author approved the final manuscript and attests to the integrity of the case report presented in this manuscript.

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Figures

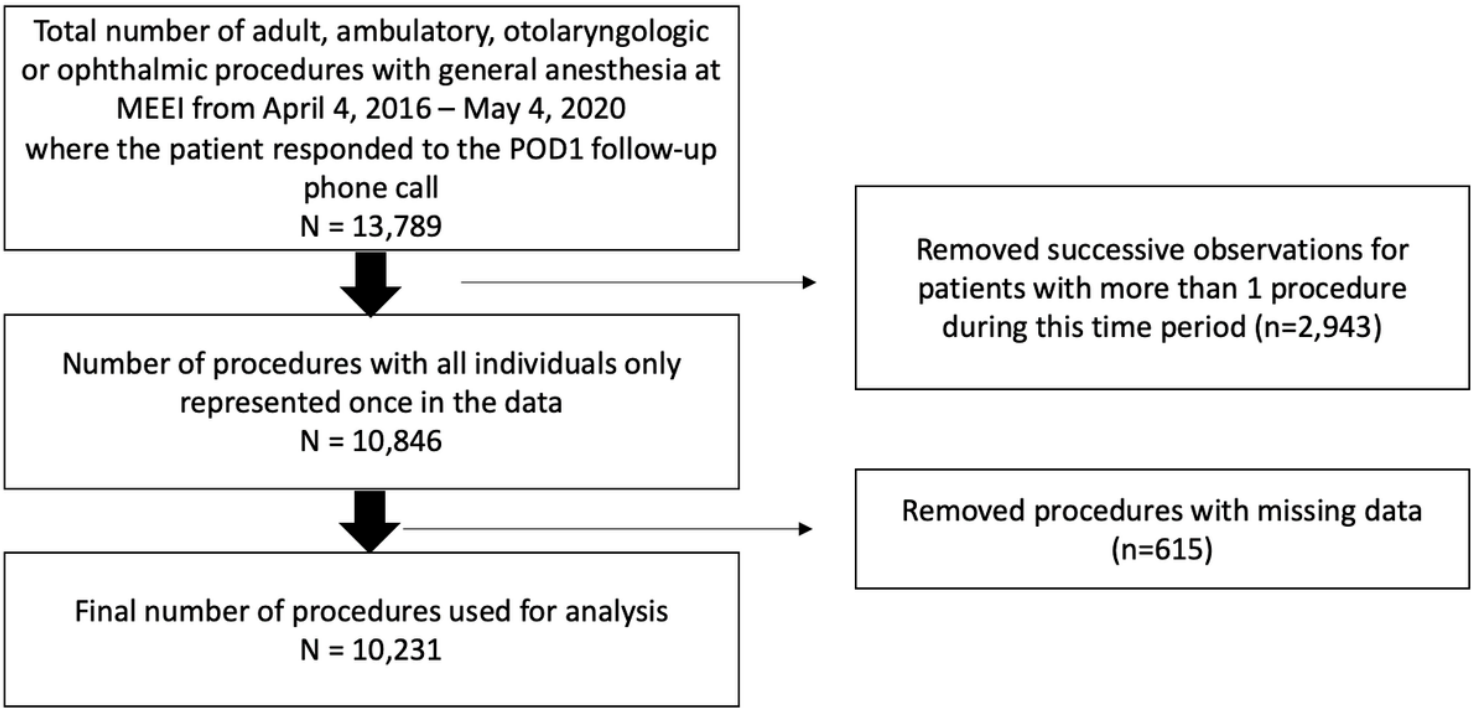

Figure 1

Flow diagram for Study Inclusion