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Emergency Pages Using a Computer-Based Anesthesiology Paging System in Ambulatory Surgical Centers: A Retrospective Review

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Abstract

Background—The nature of pages associated with periprocedural emergency events in ambulatory centers has never been examined. Our institution has a proprietary anesthesiology paging system with hierarchical paging capabilities (emergency versus routine) and maintains a log of all events. Here we describe emergency pages in our ambulatory surgery centers.

Methods—We identified all emergency page activations between June 1, 2008, and December 31, 2012 in our ambulatory surgical centers. Electronic medical records were reviewed for rates and characteristics of pages such as primary cause, interventions performed, and outcomes.

Results—During the study time frame, 120,618 procedures were performed and 93 emergency pages were recorded (7.7 *per* 10,000 cases, 95% CI, 6.2 – 9.4), of which 51 originated in the procedure room and 42 outside the procedure room (16 before and 26 after the procedure). Among those 14/93 were associated with serious events (1.2 *per* 10,000 cases). Among emergency pages for bradyarrhythmias (N=35, 2.9 *per* 10,000 cases), 15 occurred during intravenous line placement in the preprocedural area, 11 during postprocedural recovery, and 9 during the procedure. Bradyarrhythmias accounted for 60.4% of pages outside the procedural room. In contrast, respiratory and airway events (N=31, 2.6 *per* 10,000 cases) typically occurred in the procedural room (28 *vs.* 9, *P* = 0.0006). Only one patient sustained permanent injury, myocardial infarction and death 4 months later. Another patient died after 8 days from unrelated causes.

Conclusion—The rates of emergency page activations, especially those representing critical events, in our surgical ambulatory center are rare. Many emergency pages originated outside the procedural room, therefore providers within these areas should be trained to promptly recognize and treat these events.

Introduction

Ambulatory surgery centers (ASC) generally serve patients who are healthier and undergoing less invasive procedures than patients receiving care in traditional hospital surgical practices. Though there is limited data on the safety of these centers compared to hospitals, it is felt that serious complications occur very rarely in ASCs.¹ An analysis of American Society of Anesthesiologists (ASA) Closed Claim Project data suggests that there are fewer malpractice claims arising from adverse events occurring in ASC from traditional hospital based surgery, and that those claims are typically for lesser damages.²

In most clinical practices, communication modalities rely on alphanumeric paging or overhead paging.^{3,4} While such modes are available at our institution, our practice universally uses a proprietary computer-based anesthesiology paging system (CAPS), which

has been previously described⁵ and is briefly summarized in Methods of present paper. In the event of an emergency any care provider can activate an emergency page via CAPS which displays ubiquitously the location of the emergency event.⁶ The aim of our descriptive study is to report the frequency, indications, and major outcomes of perioperative emergency pages among outpatients undergoing procedures in an ASC. We hypothesized that the occurrence of these events in patients undergoing procedures at ASCs were infrequent and without long-term sequelae.

Methods

This study was approved by the Institutional Review Board (IRB) of Mayo Clinic, Rochester, MN. Consistent with Minnesota Statute 144.335 Subd. 3a. (d), we included only patients who have provided authorization for research use of their medical records. Five patients without prior research authorization, and who had an emergency page during care at our ACS, were not included.

Study design

This retrospective cohort design study was conducted to determine the rate, nature, and outcome of emergency pages using a proprietary paging system for surgical patients in ambulatory surgical centers on the campus of a major tertiary academic center.

Paging System and Patient Identification

For the anesthesia team at our institution, the primary mode of communication is a proprietary computer-based anesthesiology paging system (CAPS). The CAPS consists of keypad controllers which are located at all anesthesia care locations. Keypad controllers interface with LED display screens conspicuously mounted throughout the procedural environment. By using the controller, the CAPS system generates visual messages directing personnel (anesthesiologist, nurse anesthetist, etc.) to needed locations. Specifics of this activation have been previously described.^{5,6} In addition to routine messaging, CAPS can be used to send an emergency page by a single button on any keypad controller which results in bright red flashing display indicating the location of the emergency page across the LED screens that is accompanied with an audible alarm. Response to an emergency page is prompt and summons all nearby anesthesia providers. Since June 1, 2008, all pages in the ASCs on the Mayo Clinic Rochester MN campus made with the CAPS are stored in a Microsoft SQL Server (Microsoft Corp, Redmond, Washington) database. This permanently maintained computer log of all CAPS pages provided us with a unique ability to identify patients who experienced an acute adverse event that resulted in emergency page (CAPS activation) in our ASC from June 1, 2008, to December 31, 2012.

Study Setting

At our institution, there are three distinct ASCs with 31 surgical and procedural suites (with 12, 11, and 8 surgical and procedural suites). Each ACS is served by 21 rooms which serve as preprocedural preparation (placement of intravenous line and monitors) and postoperative recovery rooms. Each of these preparation/recovery rooms is equipped with a CAPS keypad. The three ASCs are physically connected to one of the two tertiary hospitals on our

institution's campus. Because of this arrangement the ASCs do serve some hospitalized patients. Namely these patients undergo procedures that require specialized equipment only available in the ASC. Examples include photo-selective vaporization or green-light laser resection of the prostate and interventional radiology and gastroenterology procedures that require specialized imaging equipment. Also hospitalized patients with hematological disorders undergoing bone marrow biopsy may have this procedure performed in the ASC because of patient preference (monitored anesthesia care by nurse anesthetist with propofol versus bedside nurse sedation with midazolam and fentanyl). The ASC in-room providers are certified registered nurse anesthetists for patients undergoing general anesthesia, regional anesthesia or monitored anesthetic care. Registered nurses monitor patients who are administered light sedation or local anesthetic only, as well as during the pre and postprocedural episode of care. A supervising anesthesiologist is present at all times and evaluates all patients preoperatively. The anesthesiologist is available to assist during perioperative and postoperative management. Each ASC is staffed with two supervising anesthesiologists until the majority of cases are completed and one anesthesiologist is dismissed, typically after 3:00 PM. A supervising anesthesiologist is present until all patients are discharged from the ASC. Further, the supervising anesthesiologist performs all regional peripheral nerve blocks as well as administers propofol during surgeon-performed peribulbar or retrobulbar anesthesia for ophthalmologic surgery. Once the patient has recovered from the brief propofol anesthetic for retrobulbar anesthesia the intraoperative care is assumed by a registered nurse.⁷

Data Abstraction

All data were abstracted from the electronic medical records and entered manually into the web-based Research Electronic Data Capture (REDCap[®]) system (Version 3.6.7, Vanderbilt University, Nashville, Tennessee).⁸ Data abstracted included demographics, American Society of Anesthesiologist Physical Status (ASA-PS) score, specific comorbidities, intraoperative and postoperative events and major outcomes. Information regarding comorbid conditions was abstracted including hypertension (pharmacologically treated); cardiovascular (e.g., coronary artery disease, congestive heart failure, peripheral vascular disease) and respiratory (e.g., moderate to severe asthma or chronic obstructive lung disease, or other debilitating pulmonary conditions) diseases; diabetes mellitus (pharmacologically treated); and neurologic conditions (e.g., stroke, developmental delay). The anesthetic record was reviewed for anesthetic techniques (general anesthetic, monitored anesthesia care, regional, or surgeon infiltration with local anesthetic only).

Indications for the emergency page were identified from notations in the medical records, or by changes in vital signs, and medications, interventions or blood products administered. The probable primary cause was attributed to 1 of 4 main categories: 1) *cardiovascular* which include 3 subcategories: a) *bradyarrhythmias* (categorized as asystole, bradycardia, or vasovagal reaction [defined as signs and symptoms consistent with vasovagal episode but when the patient was not being monitored with a pulse oximeter or electrocardiogram, as might occur in the pre- and postprocedural areas], b) other *dysrhythmias*, c) *hypotension* (decrease of systolic blood pressure not explained by a dysrhythmia); 2) *respiratory or airway related events* which included 3 subcategories based on airway management

specifically during use of: a) *laryngeal mask airway*, b) *endotracheal tube* or c) airway not manipulated (e.g., during use of nasal cannula); 3) *miscellaneous causes*; and 4) *unknown etiology* (unable to determine etiology of events from review of medical records or physiologic variables). Timing of pages was recorded as: preoperative (defined as events occurring before patient was brought to procedural suite), anesthetic induction (defined as patient entry to procedural suite until 10 minutes after induction for general anesthetic cases or in sedation cases to the time anesthesia personal completed preparing patient for procedure), maintenance, emergence (defined as procedural completion to the time patient left the procedural suite), or recovery (in postprocedural recovery room). When available, interventions undertaken in response to the emergency pages were recorded. Events were categorized as “critical” if the patient required cardiopulmonary resuscitation (CPR), other advanced interventions (e.g. chest tube placement), or resulted in admission to the intensive care unit (ICU). We recorded whether the procedure was aborted or continued, as well as all major morbidities and 30-day mortality. Finally we noted whether the patient was transferred to the emergency department for further evaluation, hospitalized or admitted to the ICU.

Statistical Analyses

The frequency of emergency pages (per 10,000 anesthetics) was calculated overall using number of pages as the numerator and total number of cases performed as the denominator. The median days and number of cases between emergency pages were large (12 [4, 25] days and 896 [212, 1840] cases), thus the assumption was made that events were independent. Confidence intervals were calculated using Poisson approximation to the binomial. Comparisons between continuous variables were made with a two-tailed student t-test or Wilcoxon Rank Sum test, and categorical variables with Fisher’s exact or Chi Square test. Analyses were performed using SAS, version 9.2, statistical software (SAS Institute, Inc).

Results

During the study time frame, 120,618 procedures were performed in our ASCs, with 18,383 performed under general anesthesia, and 4,865 patients being inpatient preoperatively. A total of 93 emergency pages were recorded at an overall rate of 7.7 emergency pages per 10,000 cases (95% CI, 6.2 – 9.4) of which 51 originated in the procedure room and 42 outside the procedure room (16 before and 26 after the procedure). Two of these patients were inpatient preoperatively. Demographics and surgical characteristics of study subjects and comparisons to the ACS practice are summarized in Table 1.

There were no immediate deaths. One patient died within 30 days of the procedure for reasons unrelated to the emergency event. There were no events that resulted in permanent injury with the exception of a patient who developed acute myocardial infarction due to occlusion of previously stented coronary artery with thrombus (Supplemental Digital Content). This patient never recovered and ultimately died after a 4 month hospitalization from cardiogenic and septic shock.

Etiology, interventions, adverse outcomes and if the procedure needed to be discontinued are summarized in Table 2. The fourteen events categorized as critical (1.2 per 10,000 cases)

are further presented as Supplemental Digital Content. Details regarding timing and location of the emergency paging activation are summarized in Table 3. Among emergency pages for cardiovascular causes (N = 39, 41.9%), 35 were bradyarrhythmias. Bradyarrhythmias accounted for 60.4% of pages outside the procedural room (Figure 1). Fifteen bradyarrhythmia events occurred preoperatively during placement of an intravenous line, 11 during the recovery period, and 9 during the procedure. In contrast, respiratory and airway events (N=31, 2.6 *per* 10,000 cases) typically occurred in the procedural room (28 *vs.* 9, $P < 0.0001$).

We made additional observations for further research. Eighty-eight emergency pages (94.6%) occurred before 3:00 PM when the ACSs were typically staffed with 2 supervising anesthesiologists. Patients who experienced respiratory or airway events were younger than those experiencing bradyarrhythmias (45 ± 18 *vs.* 57 ± 18 years, $P = 0.0077$), however, disease burden as evidenced by ASA-PS score was similar (2 [2, 3] *vs.* 2 [2, 3], $P = 0.8868$).

Discussion

In this audit of emergency pages in ASCs we found that these events occurred infrequently. Whereas the rate of our previous published audit of emergency page activations in our hospital based surgical practice was 14.3 per 10,000 anesthetics, 95% C.I. 12.9 – 15.9, the rate of emergency pages in the ASCs was at most 9.4 per 10,000 anesthetics.⁶ The rate of events during procedures that did not require general anesthetic was low. A large proportion of events in this study occurred outside the procedural suite. The rate of pages that were associated with “critical events” in the current study was also low, and specifically the rate of events requiring CPR. Further, there were no immediate deaths associated with emergency pages. However, one patient died from cardiogenic and septic shock four months following a myocardial infarction associated with an emergency page.

Our institutional reliance upon the CAPS system as a primary mode of communication within the anesthesia care team provides us with a unique ability to analyze communication patterns of the perioperative health care team. Importantly, CAPS prioritizes the urgency of pages as well as keeps a log of all communications. This allows for identification of all patients for whom the healthcare provider was alarmed by a perceived or actual acute deterioration of health status. Emergent page sent *via* the CAPS is somewhat analogous to healthcare team members initiating rapid response team calls for hospitalized patients.⁹

There are interesting differences between patients who had emergency pages in this, ambulatory setting, and our previous audit of patients who had emergency paging in our hospital based practice.⁶ Patients in this study were younger (53 versus 61 years), had fewer comorbidities as evidenced by fewer patients with ASA-PS 3 (31% versus 60%), and underwent fewer procedures that required general anesthesia (58% versus 96%).⁶ The overall rate of emergency pages in our hospital based study was approximately twice that of present study.⁶ However, if that study cohort was limited to just ambulatory adult surgical patients, the rate of emergency pages was similar to present study (5.7 emergency pages per 10,000 cases, 95% C.I., 4.1 – 7.7). An important difference with our previous report (which included only emergency pages in the operating room)⁶ was that CAPS activation in the

current study also included pages from outside the procedural suite, which comprised a large proportion of events. In both studies,⁶ both hemodynamic and respiratory or airway causes were the predominant etiologies for emergent pages. However, the reasons for the emergency paging in the hospital setting was more severe, as evidenced by higher rates of CPR (22.7% vs. 8.6%). The overall rate of cardiac arrests in ASC in present study was lower than the overall rate of cardiac arrests in patients undergoing noncardiac surgery between 1990 and 2000 in our institution (4.2 *per* 10,000), and could be compared to the rate of cardiac arrests during monitored anesthesia care that for that period (0.7 *per* 10,000).¹⁰ We believe this difference may be attributed to the both increased morbid-acuity and more invasive procedures that are typically conducted in inpatient settings. Another difference between these studies⁶ is that in the hospital practice the supervising anesthesiologist covered 2 rooms in the beginning of the day but would increase to 3 to 4 rooms by the end of the day while in the ASC practice 2 anesthesiologists cover 12, 11, or 8 rooms in the beginning of the day but by late afternoon 1 anesthesiologist remains in each of the three ASCs. However, the majority of emergency pages in present study occurred when two anesthesiologists covered each ASC.

Direct comparisons to series describing complication rates in ASC settings should not be done because emergent pages do not necessarily represent complication. In fact, the explicit purpose of the overwhelming audiovisual message generated by an emergent page with CAPS is to rapidly direct all available personal to the needed location to intervene and hopefully prevent complications. However, comparisons between present study to reports of complications from ASCs demonstrate that cardiovascular complications predominate followed by respiratory or airway complications.¹ There have been two reports of closed claim analysis from lawsuits arising from care at ASC, but these reflect only the most serious complications that triggered malpractice lawsuits.^{*±} For example, the closed claim series present serious injuries with approximately 20% resulting in death and 20% resulting in permanent disability, while only one patient in the present study died within 30 days though from unrelated causes. The closed claim analyses found higher rates of respiratory complications, which suggests the majority of bradyarrhythmias we witnessed do not result in permanent injury. Lastly, a portion of malpractice suits (as well as published series of ASC complications) report complications that do not result from acute paging emergencies, such as nerve and eye injuries, which are typically diagnosed after surgery.

In this audit, the most common etiology of emergency events was related to bradyarrhythmias. Eight patients were categorized as having vasovagal signs or symptoms based on clinical notes when bradycardia or asystole were not documented. All those patients experienced their event outside the procedural room where heart rate was not electronically monitored at the time of the event. We speculate that many of the bradyarrhythmias resulted from vagal (parasympathetic) overstimulation, which is supported by the high proportion of events occurring during placement of intravenous lines outside the procedural suite. This suggests that staff involved in patient care in pre- and postprocedural rooms may benefit from training to quickly recognize and treat signs and symptoms of

*Posner KL. 2000. Liability Profile of Ambulatory Anesthesia. ASA Newsletter. 64: 10-2.

±Domino KB. 2001. Office-Based Anesthesia: Lessons Learned from the Closed Claims Project. ASA Newsletter. 65: 9-11.

bradyarrhythmia. Further, therapies to treat bradyarrhythmias (vagolytic drugs) should be immediately accessible in these areas and should be administered without delay in order to prevent precipitous deterioration. There were no immediate deaths associated with the critical paging events, which reflects our previous study of intraoperative cardiac arrests which found that when cardiac arrests are secondary to anesthetic factors (i.e., asystole or extreme bradycardia secondary to increased parasympathetic tone) survival is high.¹⁰

Respiratory and airway causes were the second leading etiology of emergency pages. Not surprising, the majority of these events occurred in the procedural room when the airway was being manipulated. These patients were younger than patients who had bradyarrhythmias which is similar to our previous analysis of intraoperative emergency pages in the hospital setting.⁶ However, in the previous study 20% of the subjects were pediatric patients including neonates where only 3 patients in this study were under the age of 12 and all 5 years or older.

Limitations of the Study

As previously mentioned our study cannot be equated to the rate of periprocedural complications or emergencies. Similarly, these paging events cannot be equated to the rate of true emergencies, as some events captured by CAPS may include an element of healthcare provider perception that an event was an emergency, when it was not. In addition, emergency pages can be triggered erroneously or for reasons unrelated to patient care (e.g., syncopal episode of a care provider). Such activations may account for some pages where we could not identify any information in respective patient's medical records. Furthermore, the rate of emergency pages may represent an *underestimate* of emergency events because the attending anesthesiologist may have been either present in the operating room during the critical event or was paged in a less urgent fashion. This may account for the lack of emergency pages associated with placement of regional blocks, as the anesthesiologist would be performing the procedure. Further, we cannot account for emergencies where the anesthesiologist was summoned using alternative forms of communication such as alphanumeric pages or verbal calls for help. Our institution does not have a "STAT" page function on our pagers nor is a log of alphanumeric pager communications kept. However, in most serious situations (i.e., cardiac arrest), even if present in the room, anesthesiologists typically activate the emergency page to summon additional resources; therefore, for cardiac arrests present audit provides a reasonable estimate. Finally, CAPS is a proprietary paging system; therefore, our experience may not be generalizable to other settings with different communication systems. Another limitation that may limit the generalizability of our results to free-standing ASCs is the physical proximity of our ASCs to a tertiary hospital which results in the treatment of a small number of hospitalized patients as well as may increase the acuity of treated patients (greater security because of availability of resources).

In conclusion, rates of emergency page activation, especially those representing critical events, in our ASCs are lower than those seen in our previously reported hospital-based surgical practice and this may be attributed mostly to the nature of procedures which are less invasive and majority conducted without general anesthesia. The rate of emergency pages due to cardiac arrests was low. The most common emergencies were related to

bradyarrhythmias often associated with starting intravenous lines. Thus, healthcare staff outside of the procedure room should be trained to promptly recognize and treat bradyarrhythmias.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Patient and procedural characteristics of ambulatory surgical center cases where emergency paging system was activated as compared to the institutional ambulatory surgical center practice.

Characteristics	Total Cases	Emergency Page* # (rate per 10000)	P value
Overall	120,618	93 (7.7)	-
Age (y)[†]			0.0096
80 or greater	12,486	1 (0.8)	
70 – 79	23,816	16 (6.7)	
60 – 69	25,654	14 (5.5)	
50 – 59	22,206	25 (11.2)	
40 – 49	13,043	12 (9.2)	
30 – 39	8,061	12 (14.9)	
20 – 29	6,292	6 (9.2)	
13 – 19	6,541	4 (6.1)	
<13	2,519	3 (11.9)	
Sex	57,215	49 (8.6)	0.3101
Male	63,403	44 (6.9)	
Female			
Operation/Procedure type			<0.0001
Bone marrow biopsy	13,461	2 (1.5)	
General surgery	3,423	8 (23.4)	
Gastrointestinal	4,595	10 (21.8)	
Interventional radiology	7,845	6 (7.6)	
Oral surgery	16,165	4 (2.5)	
Ophthalmology	15,253	10 (6.6)	
Orthopedic	11,626	18 (15.5)	
Pain	34,346	3 (0.9)	
Urology	9,038	19 (21.0)	
Gynecology	3,260	9 (27.6)	
Otorhinolaryngology	486	2 (41.2)	
Plastics	1,082	2 (18.5)	
Anesthesia type			<0.0001
General	20,442	54 (26.4)	
Regional [‡]	2,349	3 (12.8)	
Monitored anesthesia care	61,564	24 (3.9)	
Local only	36,263	12 (3.3)	

Data are number (%).

* Of the patients who had an emergency page the mean body mass index was $29.0 \pm (\text{SD}) 7.8 \text{ kg/m}^2$; and 31 (33.3%) had cardiovascular disease, 28 (30.1%) hypertension, 18 (19.4%) respiratory disease, 7 (7.5%) neurologic disease, and 10 (10.8%) diabetes mellitus. The number of patients with

an American Society of Anesthesiologists (ASA) Physical Status score equal to I was 13 (14.0%), II was 51 (54.8%), III was 23 (24.7%), and IV was 6 (6.5%).

[†]The median age [interquartile range] of patients who required an emergency page was 53 [5, 89] years and of the entire surgical population 61 [46, 72] years.

[‡]None of the events were directly related to placement or a consequence of a regional technique (i.e., local anesthetic toxicity reaction, high spinal, etc.).

Table 2

Emergency paging system event summary.

Type of event	Pts (n = 93)	Intervention(s)	Adverse Outcome(s)	Outcome of procedure*
Cardiovascular events (n= 39, 41.9%)				
Bradyarrhythmias				
<i>Asystole</i>	10	CPR (7) Endotracheal intubation (1) Epinephrine (2) Atropine (2) Glycopyrrolate (2) Cardiac catheterization (1)	ICU admission (4) ER transfer (2) Myocardial infarction (1)	Continued (2) Discontinued (3) Completed (5)
<i>Bradycardia</i>	17	CPR (1) Atropine (3) Glycopyrrolate (7) Naloxone (1)	ICU admission (2) ER transfer (1)	Continued (9) Discontinued (1) Completed (8)
<i>Vasovagal symptoms</i>	8	Observation (8)		Continued (7) Discontinued (1)
Supraventricular tachycardia	2	Beta-adrenergic blockers (1) Adenosine (1)	None	Continued (2)
Hypotension	2	Slowed vancomycin administration (1) Ephedrine (1) Phenylephrine (2)	Hospital admission (1) [†]	Continued (2)
Respiratory or airway event (n= 31, 33.3%)				
According to type of airway management				
Laryngeal mask airway [‡]				
<i>Difficult placement</i>	1	Videolaryngoscopic intubation (1)	None	Continued (1)
<i>Difficulty ventilation</i>	6	Endotracheal intubation (3) LMA removal, mask ventilation (1) Change in ventilator settings (1) Bite block placed (1)	None	Continued (3)
<i>Aspiration</i>	1	Suction, endotracheal intubation	ICU admission (1)	Continued (1)
Endotracheal tube in situ**				
<i>Difficult placement</i>	2	Fiberoptic intubation (1) Videolaryngoscopic intubation(1)	None	Continued (2)
<i>Accidental extubation</i>	1	Reintubation	None	Continued (1)
<i>Bronchospasm</i>	1	Albuterol nebulizer (1)	None	Discontinued (1)
<i>Pneumothorax</i>	1	Chest tube placement (1)	Hospital admission (1)	Completed (1)
Airway not secured				
<i>Laryngospasm</i>	8	Bag mask ventilation (7) Succinylcholine (3) Endotracheal intubation (1)		Continued (4) Completed (4)
<i>Oxyhemoglobin desaturation</i>	7	Bag mask ventilation (2) Placement of LMA (1) Endotracheal intubation (1) Increased oxygenation (3)	None	Continued (4) Completed (2)
<i>Allergic reaction/airway edema</i>	1	Epinephrine Diphenhydramine Steroids	ICU admission (1)	Completed (1)

Type of event	Pts (n = 93)	Intervention(s)	Adverse Outcome(s)	Outcome of procedure*
<i>Aspiration</i>	2	Endotracheal intubation (2)	Hospital admission (1)	Continued (2)
Miscellaneous events (n= 12, 12.9%)				
Air embolism (suspected)	1	Observation	None	Continued (1)
Neurological event				
<i>Sedation</i>	1	Observation	None	Completed (1)
<i>Agitation</i>	3	Benzodiazepine (1) Supportive (2)	Died 8 days postprocedure	Continued (1) Completed (2)
<i>Seizure</i>	4	Benzodiazepine (4) Antiepileptics (1)	Hospital admission (1) ICU admission (2)	Continued (1) Discontinued (1) Completed (2)
<i>Headache</i>	1	Opioid (1)	None	Continued (1)
Nausea and vomiting	2	Antiemetics (2)	Hospital admission (1) [†]	Completed (2)
No documentation (n=13, 14%)	13	None	None	Continued (5) Completed (8)

* Indicates if following the event if the procedure continued or was discontinued, or if the event occurred after procedure completion during emergence or recovery. Emergency room transfer is a mechanism for admission to hospital from outpatient facility to hospital ward at Mayo Clinic.

[†] Hospital admission was planned.

[‡] 12,599 cases were managed with a laryngeal mask airway (LMA) with a rate of 6.4 emergencies per 10,000 LMA cases (95% CI, 2.7 – 12.5).

** 5,828 cases were managed with an endotracheal tube (ETT) with a rate of 8.6 per 10,000 ETT cases (95% CI, 2.8 – 20.0).

Abbreviations: CPR = cardiopulmonary resuscitation; ICU = intensive care unit; LMA = laryngeal mask airway.

Table 3

Time of emergency events by event category.

Location and Time of Page Occurrence	Event Category			
	Cardiovascular N = 39	Respiratory N = 31	Miscellaneous N = 11	No Documentation N = 12
Preprocedural & Recovery Room	26 (67%)	3 (10%)	8 (73%)	5 (42%)
Preoperative * (Location of IV placement)	14	0	2	0
Recovery	12	3	6	5
Procedure room	13 (33%)	28 (90%)	3 (27%)	7 (58%)
Induction	3	13	0	0
Maintenance	7	11	3	4
Emergence	3	4	0	3

Abbreviation: IV = intravenous line.

* Preoperative events were mostly associated with intravenous line placement except seizure (N=1), severe headache (N=1), and asystole with eye drop application (N=1).