



ORIGINAL ARTICLE

First Step in Developing a Pediatric Sedation Team: Evaluation of Procedural Sedations Performed for Imaging and Procedures in an Academic Children's Hospital

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Abstract

Objectives: Procedural sedation for children is often necessary because it helps limit pain and anxiety and increases the chance of a successful procedure or diagnostic image. A pediatric sedation team (PST), made of an interdisciplinary team can help ensure safe and timely sedations. Our Children's Hospital (CH) does not have a PST and our goal is to establish one. For this study, our objective was to evaluate sedations performed throughout the CH as part of a longitudinal project to create a PST.

Study design: We performed a retrospective chart review of pediatric procedural sedations performed on children 18 years or younger between July 1, 2018 and June 30, 2020 within our CH. Information collected included agent(s) used, indication, sedation level, and location (inpatient or outpatient). Sedations performed in an operating room or for mechanically ventilated children were excluded.

Results: A total of 639 sedations met inclusion criteria. Sedations for inpatients comprised 8.5% of the cases. Majority (92.6%) of conscious sedations for inpatients were used for procedures, most commonly central line placement and drain placement (22.2% and 18.5% of all inpatient sedations, respectively). Midazolam, Fentanyl, and Ketamine were the most common agents used, 76%, 61%, and 33%, respectively.

Conclusion: We conducted this study as a first step to establish a PST for our CH. Having gathered the above data, our next step will be to approach key stakeholders with this information and our justification of how a PST will be helpful not only to patients, but to our CH.

Keywords

Conscious sedation, Moderate sedation, Procedural sedation, Sedation team

Introduction

For procedures and imaging in pediatric patients, procedural sedation is often necessary. By limiting movement, pain, and/or anxiety, sedation allows for the safe and expeditious performance of many procedures [1]. In addition, sedation is often used to achieve cooperation during advanced imaging studies to ensure that the study is successful [2,3]. Appropriate control of pain in pediatric patients can reduce stress and anxiety for the patient and caregiver(s) [4]. For these reasons, demand for sedations in children has increased during the last twenty years [3,5-7]. Sedation is generally safe, provided that appropriate assessment and monitoring of the patient occurs before, during, and following the procedure [3].

Pediatric procedural sedations can be performed by qualified non-anesthesia physicians and qualified practitioners safely and efficiently outside of the operating room [6-8]. However, care must be taken to follow best practices in terms of medication administration, monitoring, and personnel. One way to accomplish this is by having a dedicated sedation team that follows literature-based protocols and guidelines.

Previous studies have shown that a pediatric sedation team (PST) can lower rates of failed sedations, increase sedation safety, and help improve satisfaction for the patient, family, and the medical team [2,3,6]. Our Children's Hospital (CH) does not currently have a PST. For this study, our objective was to gather information on pediatric sedations performed throughout the CH. This study is part of a longitudinal project where our ultimate goal is to establish a PST in our academic CH. To our knowledge, a series detailing a process to establish a PST has not been published previously, and we hope to rectify this, beginning with this manuscript.

Methods

We performed a retrospective chart review of pediatric procedural sedations performed between July 1, 2018 and June 30, 2020 within our CH. The CH is a 145-bed center located within a tertiary academic medical center. We used ICD-10-PCS and CPT codes to run a Trinetx query to recover encounters. Trinetx is a global health research network that has a query builder which can be used to query millions of de-identified patient records. We collected information on sedation agent(s) used, reason for sedation (procedure or imaging), level of sedation, location within the health system, and service/provider performing the sedation. Approximately one-third of the patient encounters underwent a two-person review to ensure that there was 100% concordance of data collected between the investigators.

We received approval from our Institutional Review Board.

Inclusion and exclusion criteria

Inclusion criteria were any pediatric patient aged 18 years or younger who received procedural sedation during their inpatient, outpatient, or emergency department (ED) visit to the CH. Patients who received general anesthesia, sedation in an operating room, or sedation performed during mechanical ventilation were excluded.

Statistical methods

For statistical analysis, case/variable deletion was used. Any cases with missing values that were pertinent to data collection were not included in analysis. Analysis was conducted using the FREQ procedure.

Results

Data collected from the electronic medical record (EMR) during the timeframe of interest was analyzed to investigate the number and percentage of sedations by location within the CH. A total of 639 sedations fit our inclusion criteria (Table 1). Most conscious sedations occurred within the Children's ED. There were 347 sedations in the ED, compared to 238 outpatient and

Table 1: Number and percentage of sedations completed in the emergency department, inpatient, and outpatient settings.

Sedation Location	Number of Sedations	Percentage of Total Sedations
ED	347	54.3
Inpatient	54	8.5
Outpatient	238	37.2
Grand Total	639	100.0

Table 2: Number and percentage of inpatient sedations based on indication.

Indication for inpatient sedation		Number of sedations	Percentage of total sedations
Procedure		50	92.6
	Central line placement	12	22.2
	Drain placement	10	18.5
	Lumbar Puncture	5	9.3
	Miscellaneous	5	9.3
	Gastric and Jejunostomy tube insertion, change, or conversion	4	7.4
	Peripheral venous access	4	7.4
	Biopsy	2	3.7
	Ocular exam	2	3.7
	Pain control	2	3.7
	Chest tube placement	1	1.9
	Incision and drainage of an abscess	1	1.9
	Ventriculoatrial shunt adjustment	1	1.9
	Multiple procedures (percutaneous tracheostomy, EGD, and PEG)	1	1.9
Imaging		4	7.4
	CT	3	5.6
	MRI	1	1.9

54 inpatient; accounting for 54.3%, 37.2%, 8.5% of the sedations, respectively.

With our end objective being to establish a PST for our CH, with plans for initial rollout aimed for inpatients, we chose to focus further analysis on this group. Inpatient sedations were further divided based on two categories of indication: Procedure or imaging. The overwhelming majority (92.6%) of conscious sedations were used for procedures, while sedation for imaging was the minority (7.4%) (Table 2). Next, we examined more specific indications for sedation and determined the frequency and percentage. Central line placement and drain placement represented the most common reasons for sedation at 22.2% and 18.5% of all inpatient sedations, respectively.

We then analyzed sedation agents and rates of use for inpatient sedations (Table 3). Midazolam and Fentanyl were the most frequently used agents with utilization rates of 76% and 61% respectively, followed by Ketamine (33%).

Discussion

Our goal is to establish a PST for our CH. Reviewing the use of conscious sedations in our CH was a valuable first step in achieving this goal because we learned several things that are pertinent to this longitudinal project. First, inpatient sedations represent a minority of the sedations throughout our CH. This is important because while establishing the PST, we want to be much targeted in our efforts and avoid embarking on a task that our team and our institution cannot handle.

Second, we learned that the vast majority of inpatient sedations are conducted to aid in successful completion of a procedure and that many of these procedures are common, such as central line placement, drain placement, and lumbar puncture. As we review the literature and discuss with medical professionals at institutions that already have a PST, we are realizing that the physician and provider team administering the sedatives will likely need to be from multiple specialties and subspecialties within our center. Knowing that our team will likely be acquainted with the majority of procedures that require sedation may be assistance in recruiting team members.

Lastly, we noted that the most common sedation agents used were Midazolam, Fentanyl, and Ketamine.

Table 3: Count of sedation agent use and percentage of use for inpatients sedations.

Sedation Agent	Count of Use	Utilization Rates
Midazolam	41	76%
Fentanyl	33	61%
Ketamine	18	33%
Propofol	2	4%
Demerol	1	2%

This is extremely important because as part of the development of a PST, we will need to have protocols for use of sedatives and we can focus on these three agents to start.

Limitations

There are potentially some limitations of our study. First, using a convenience sample, which we did by performing a retrospective chart review, does not allow for randomization and could also contribute to inclusion bias. Since this was a single-site study at an academic institution, it lends itself to spectrum bias and the results may not be generalizable to every institution or hospital. However, our goal is to establish a PST at our institution, so we felt that only using data from our CH was justified.

In addition, since this was a retrospective chart review, there were missing data points in the medical records that we could not ascertain and thus were excluded from analysis. We also noted a lack of homogeneity in documentation of sedations performed in the CH. This could potentially have affected data collected. However, we tried to overcome these factors by having more than one investigator review some charts to ensure data collected showed concordance between investigators as we stuck strictly to our data collection protocol.

Conclusion

We conducted this study as a first step to establish a PST for our CH. After reviewing charts and specifically focusing on inpatient sedations, we learned multiple things: Inpatient sedations are a small number of the overall sedations performed, sedations are mostly used to aid in procedures, these procedures are very common and widely known, and the agents used to sedate are accompanied by an expansive literature base. Our next step in establishing a sedation team here will be to approach our inpatient teams and anesthesia colleagues with this information and our justification of how a PST will be helpful not only to patients, but to our CH.

Authors Declaration

Authors have no conflict of interest to disclose. There were no study sponsors. Authors wrote the first draft of the manuscript and there was no honorarium, grant, or other form of payment received.

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