Section: Miscellaneous

Original Research Article

ANESTHESIA FOR PEDIATRIC GASTROINTESTINAL ENDOSCOPY IN A TERTIARY CARE TEACHING HOSPITAL

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ABSTRACT

Background: Paediatric gastrointestinal endoscopy (GIE) is a procedure for diagnosis and treatment of GI Abnormalities. It can be performed without sedation, with intravenous sedation or with general anaesthesia. The methods by which a child is anesthetized remain controversial. **Objective**: To evaluate the clinical efficacy of anaesthesia/sedation for paediatric GIE in a tertiary-care teaching hospital.

Materials and Methods: Retrospectively analysed the children on whom GI endoscopy had been performed during the period of January, 2024 to June, 2025. The patients' characteristics, pre-anaesthetic problems, anaesthetics techniques, agents, time and complications, as well as endoscopic procedures were assessed and summarized by using descriptive statistics.

Results: There were 258 cases and 274 endoscopic procedures; i.e. esophagogastroduodenoscopy (EGD) (87.2%), colonoscopy (5.4%), EGD and colonoscopy (6.2%) and others (1.2%). Mean age was 8.2 (SD, 4.6) years and ranged from 4 months to 17 years. The majority of them were classified in ASA class III (37.2%). Patients most often had esophageal varice (22.5%), abdominal pain (15.5%), and upper gastrointestinal hemorrhage (12.8%), anaemia (10.5%), corrosive esophagitis (6.2%) and others. Most common pre-anaesthetics problems were hematologic diseases (63.4%), liver diseases (45.9%) and electrolyte imbalance (20.9%). Intravenous sedation (65.5%) and general anaesthesia with endotracheal tube (15.9%) were the main anaesthetics techniques. The main anaesthetics agents used were propofol, fentanyl and midazolam. Mean duration of endoscopy was 30.2 minutes and ranged in time from 10 to 110 minutes. Overall complication rate was 17.8%. Hypotension (12.8%) was the most frequent anaesthetics complication.

Conclusion: Anaesthesia / sedation performed by anaesthetics personnel for paediatric GIE is relatively safe and effective. Serious adverse events are rare.

Keywords: Anaesthesia / sedation, Children, Gastrointestinal endoscopy, Teaching hospital.

INTRODUCTION

Gastrointestinal endoscopy (GIE) has become a common procedure performed in patients requiring evaluation of a variety of gastrointestinal disorders. With the availability of newer, smaller endoscopes, the usefulness of fiberoptic endoscopy in children is unquestioned. Providing anaesthesia techniques during the performance of diagnostic and therapeutic GIE procedures on them decreases anxiety, discomfort and pain, In addition, it reduces the child's movement and thus may increase the success rate of the procedures required. Because children are not simply young adults, optimal performance of endoscopy in these patients requires an adequate knowledge and understanding of paediatrics and a thorough understanding of the child's medical background. GIE can be completed without sedation or using intravenous sedation (IVS) or with general anaesthesia (GA). Highly co-operated paediatric

patients can undergo endoscopy without sedation. However, IVS and GA are the primary methods used to sedate children for endoscopic procedures. In our Hospital, we uniformly perform GIE with children under some forms of IVS. Large studies investigating paediatric GIE anaesthesia do not exist and therefore, we aimed to retrospectively investigate the efficacy and safety profile of anaesthesia for these paediatric endoscopy procedures.

MATERIALS AND METHODS

This retrospective study was approved by the Institutional Review Board, data were collected prospectively on all children younger than aged 18 years referred to GI Endoscopy Centre at our Hospital. All endoscopies were performed by a paediatric gastroenterologist. The following data were obtained: age, gender, weight, ASA physical status, diagnosis, preanaesthetic problems, endoscopic procedure, procedural time, and anaesthetics technique and agents. Accordingly, adverse events were recorded: hypotension (decrease by 20% from baseline and below normal for age), hypertension (increase by 20% from baseline and above normal for age), and bradycardia (decrease in heart rate by 30% from baseline and below normal for age), and oxygen desaturation (SpO < 90%). The efficacy of anaesthesia was defined as a success of the complete procedure. Results were expressed as mean (SD) or percentage (%), when appropriate. The statistical software package SPSS for window version 11 (SPSS Inc., Chicago, IL) was used to analyse the data. A significance level of 5% was used throughout the study.

RESULTS

During the study period, a total of 258 patients (134 boys and 124 girls) in 274 procedures, who ranged in age from four months to 17 years, were reviewed. Of these, 199 children (77.1%) underwent the procedure under IVS. Other anaesthetics techniques were GA with endotracheal tube (15.9%), topical anaesthesia (6.2%) and monitored anaesthesia care (0.8%). Of these, there were four outpatient procedures. Patient characteristics are listed in (Table 1).

The 274 procedures studied, 225 (87.2%) were performed with EGD alone, 14 (5.4%) with colonoscopy alone, 16 (6.2%) with EGD and colonoscopy and one procedure was performed with EUS, ERCP and PEG.

The mean endoscopy time was 30.2 minutes (SD, 16.1 minutes; range 10-110 minutes) and was different by procedure type. The mean EGD time was 27.4 minutes (SD, 13.6 minutes; range 10-110 minutes) and the mean colonoscopy time was 42.9 minutes (SD, 13.3 minutes; range 20-75 minutes). No difference was noted in procedure times among different age groups. The diagnoses were esophageal varices (22.5%), abdominal pain (15.5%), UGIH (12.8%), anaemia (10.5%), corrosive esophagitis (6.2%), chronic vomiting (4.3%) and others (15.9%), (Table 2). The majority of children presented with pre-anaesthetics medical problems, as shown in (Table 3). They involved mainly hematologic diseases including anaemia (63.4%), liver diseases including cirrhosis and portal hypertension (45.9%) and electrolyte imbalance (20.9%). Other problems included were neurological diseases, respiratory diseases, renal diseases and cardiovascular diseases.

Cardiovascular monitoring, including blood pressure measurements, electrocardiogram, heart and respiratory rate and oxygen saturation, was performed. No premedication were administered before the procedure. A total of 199 intravenous sedations were given, with propofol, fentanyl and midazolam the most common sedative drugs. Most of them were used in combinations of either two, three or four agents. Subsequently, all procedures concluded satisfactorily for all children, except one patient (age: 6 months) who developed upper airway obstruction which could not be resolved by repositioning and maintaining an opened airway. Consequently, the sedation technique was changed to GA with endotracheal tube. Among the IVS agents, propofol (92.2%), fentanyl (84.9%) and midazolam (65.1%) have frequently been used. The mean dose of propofol was 3.4 mg/kg, of fentanyl was 0.9 mcg/kg and the mean dose midazolam was 0.05 mg/kg. Other medications used were ketamine (23.6%) and pethidine (1.9%). The mean dose of ketamine was 1.5 mg/kg and of pethidine was 0.9 mg/kg. Of the total of the 41 general anaesthesia which were used, succinylcholine, atracurium and sevoflurane were the most common anaesthetics agents. All of them were utilized with endotracheal tubes (Table 4). Overall, 46 patient's experienced adverse events (17.8%). Cardiovascular adverse events arose in 14.7% of patients and consisted mainly of hypotension (86.8% of all cardiovascular adverse events). Respiratory events: upper airway obstruction developed in two patients, both of whom were sedated by using IVS technique. Hypoxia (SpO < 90%) occurred in 2.3% of patients and comprised 13.0% of all adverse events, of which all were under the care of an anaesthesiologist (Table 5).

Table 1: Patient Characteristics and Duration of Endoscopy

Variable	Overall (n = 258)
Age (yr) (mean, SD ; min-max)	8.2 (4.6) ; 0.4 - 17
Gender (Male / Female; %)	134/124 (51.9/48.1)
Weight (kg) (mean, SD ; min-max)	27.1 (14.5) ; 2.7 - 80
ASA physical status (I, II, III, IV; %)	82/75/96/5 (31.8/29.1/37.2/1.9)
Duration of endoscopy (min) (mean, SD ; min-max) Overall (258)	30.2 (16.1) ; 10 - 110
EGD (225)	27.4 (13.6) ; 10 - 110

Colonoscopy (14)	42.9 (13.3) ; 20 - 75
EGD and Colonoscopy (16)	55.9 (22.4) ; 25 - 95
EUS (1)	60.0
ERCP (1)	40.0
PEG (1)	25.0

EGD: Esophagogastroduodenoscopy, EUS: Endoscopic ultrasonography, ERCP: Endoscopic retrograde cholangiopancreatography, PEG: Percutaneous endoscopic gastrostomy.

Table 2: Diagnoses

	Number (%)
Esophageal varice	58 (22.5)
Abdominal pain	40 (15.5)
Upper gastrointestinal hemorrhage	33 (12.8)
Anemia	27 (10.5)
Corrosive esophagitis	16 (6.2)
Chronic vomiting	11 (4.3)
Chronic diarrhea	9 (3.5)
Esophageal stricture	7 (2.7)
Gastritis	6 (2.3)
Lower gastrointestinal hemorrhage	5 (1.9)
Colitis	5 (1.9)
Others	41 (15.9)

Table 3: Pre-Anesthetic Problems

Hematologic disease	109 (63.4)
Liver disease	79 (45.9)
Electrolyte imbalance	36 (20.9)
Neurological disease	17 (9.9)
Respiratory disease 15 (8.7) Renal disease	12 (7.0)
Cardiovascular disease	9 (5.2)
Others	31 (18.0)

Table 4: Anesthesia related data

Adverse events	**Overall (46) n (%)**	**EGD (25) n (%)**	**COL (9) n (%)**	**Both (12) n (%)**
Cardiovascular Hypotension	33 (12.8)	14 (5.4)	8 (3.1)	11 (4.3)
Bradycardia	5 (1.9)	4 (1.6)	1 (0.4)	0
Respiratory Hypoxia (SpO < 90%)	6 (2.3)	5 (1.9)	0	1 (0.4)
Upper airway obstruction	2 (0.8)	2 (0.8)	0	0

EGD: Esophagogastroduodenoscopy, **COL**: Colonoscopy

Table 5: Anesthesia related adverse events by procedure type

Variable	**Overall (n = 258)**
Anesthetic techniques (n, %) Topical anesthesia	16 (6.2)
Intravenous sedation	169 (65.5)
Topical anesthesia and intravenous sedation	30 (11.6)
GA with endotracheal tube	41 (15.9)
Monitored anesthesia care	2 (0.8)
Sedative agents Propofol (n, %, mean, SD, mg / kg)	238 (92.2) ; 3.4 (2.4)
Midazolam (n, %, mean, SD, mg / kg)	168 (65.1) ; 0.05 (0.03)
Ketamine (n, %, mean, SD, mg / kg)	61 (23.6) ; 1.5 (2.4)
Opioids Fentanyl (n, %, mean, SD, mcg / kg)	219 (84.9) ; 0.9 (0.3)
Pethidine (n, %, mean, SD, mg / kg)	5 (1.9) ; 0.9 (0.4)
Muscle relaxants (n, %) Succinylcholine	34 (13.2)
Atracurium	8 (3.1)
Inhalation agents (n, %) Isoflurane	14 (5.4)
Sevoflurane	21 (8.1)
Desflurane	1 (0.4)
Local anesthetic agent (n, %) Lidocaine	46 (17.8)

DISCUSSION

We presented data derived from a retrospective data analysis examining pediatric GIE anesthesia in a tertiary academic hospital. The data showed that in the hands of anesthetic personnel, pediatric sedation is reliable, relatively safe and much appreciated by both endoscopists and the children's families. Most GIE is performed by using IVS. In some centers, GA is used in most children less than 5 years of age while in others it is used in all infants, children and adolescents.[4] In our Hospital, pediatric GIE procedures that required some forms of anesthesia be performed on about 1.8% of all GIE procedures.[5] The majority of them were performed by a pediatric gastroenterologist. The decision to utilize GA for an endoscopic procedure, should be based on objective patient conditions, such as age, diagnosis, respiratory compromise and severity of disease. However, personal preference, lack of familiarity with newer medications or concern for patient safety during IVS cause some physicians to use GA exclusively. GA is far more expensive for the patient. Squires and colleages.[4] reported on the cost and safety of GA as compared to deep sedation in endoscopy. They also found that specific doctors use GA exclusively and others only selectively. The reason for this variability could not be explained by patient type or indications for specific procedures.

An excellent safety profile, with more than 20,000 adult patients reported in the literature.[9,10] In the pediatric age group, this anesthesia is administered exclusively by Managing sedated children requires an understanding of the level of sedation that can be achieved. Moderate (conscious) sedation refers to a controlled state of diminished consciousness wherein protective reflexes, the ability to respond to moderate physical or verbal stimuli and the ability to maintain a patent airway are retained. In contrast, deep sedation refers to a controlled state of depressed consciousness from which the patient is not easily aroused, with likely loss of protective airway reflexes and of the ability to maintain a patent airway. Guidelines regarding moderate sedation and monitoring of pediatric patients have been published. IVS in children is most commonly performed by using midazolam and fentanyl, with or without ketamine. Propofol has also been gaining wide acceptance and has anaesthesiologists, which increases the cost of the procedure.

CONCLUSION

We report the performance of clinical efficacy of anesthesia for pediatric GIE in a unit outside the OR from a teaching hospital. The findings of the present study showed that pediatric GIE anesthesias performed by anesthetic personnel are relatively safe and effective. There was no need for special techniques or drugs in anaesthesia. Serious complications are rare.

The American Academy of Pediatrics issued recommendations regarding sedation and monitoring for diagnostic and therapeutic procedures in children.8 these guidelines recommend continuous pulse oximetry and heart rate monitoring in all levels of sedation. However, an individual must be specifically assigned to monitor the patient's cardiac and respiratory status. In deeply sedated children, vital signs should be recorded at least every 5 minutes. Because of the depth of sedation commonly required and the frequency of progression to deep sedation, personnel trained specifically in pediatric rescue maneuvers, including airway management, should be present, and training in pediatric advanced life support is strongly encouraged. Integrating capnography into monitoring protocols may improve the safety of nonintubated pediatric patients receiving moderate sedation.[11]

Pediatric sedation/anesthesia is characterized by two main problems: medical complications related to the sedation and the issues resulting from procedure cancellation, which is usually a result of insufficient sedation. The common complications arising from this relate to control of ventilation, with either airway obstruction, hypoventilation or apnea leading to hypoxemia. The incidence of respiratory complications during pediatric sedation ranges from 0.8% to 9% for hypoxemia.[12-14] and from 1.3% to 6% for airway compromise.[14,15] Undesirable outcome after pediatric sedation has been associated with the use of drug combinations15 or drugs with long half-lives such as pentobarbital and chloral hydrate,[16] the use of nitrous oxide,[16,17] drug overdose, inadequate patient assessment, inadequate monitoring, inadequate recovery procedures and sedation performed by untrained personnel.

In this study, we detected a relatively high overall rate of adverse events in 17.8% of procedures. This rate is higher than that commonly reported because we used very strict criteria in defining adverse events. If only significant respiratory adverse events, such as prolonged desaturation or apnea are counted, the adverse event rate is only 0.8%. In the one largest study describing a 12-year experience with pediatric endoscopy in 2026 patients, minor complications were reported in 0.35% of patients.[18] Arrhythmias may have been underreported, because not all children were monitored with electrocardiography.

Limitations of this study exist. First, there is the wide range in age of the patients in our study. Drug requirements, recovery time and side effects can be related to children's age. Second, inaccurate and incomplete documentation of certain measures, as with many chart reviews, also occurred in this study. Third, the limitation of monitoring such as end-tidal carbon dioxide would result in a lower rate of adverse events. Fourth, many anesthesiologists define complications differently. Finally, because serious complications in our series were low, further studies in larger prospective groups of patients are therefore needed.

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