

Anesthetic Management and Prevalence of Complications in Pediatric Upper Gastrointestinal Endoscopies

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Abstract

Pediatric gastrointestinal endoscopy is emerging as a fundamental component of health care for infants and children. Adults tolerate these procedures well with minimal sedation, however, deep sedation or general anesthesia is mandatory in children to successfully perform these procedures. Adverse events, especially respiratory complications, during diagnostic and therapeutic endoscopy in children are common. Diagnosis, prevention and treatment of complications are crucial while performing pediatric endoscopy. Cooperation between pediatrician, pediatric endoscopist and pediatric anesthesiologist should guarantee quality and safety of the procedure and should help in reducing the perioperative respiratory complications along with surgical complications like bleeding and perforation.

Aims: Goals of this study were to assess prevalence of perioperative complications in pediatric upper gastrointestinal endoscopies. Secondary objective was to study the association between occurrence of perioperative complications with age of the patient and indication for which the child underwent endoscopy.

Methodology: This prospective observational study was conducted using the data of 100 children of ASA grades 1, 2 and 3 between the age group 6 months-15 years, who underwent diagnostic and therapeutic endoscopies in one year at our tertiary care hospital. Data was analyzed using the software Rv 3.5.1. Statistical tests applied were Kruskal-Wallis rank sum test, Chi Square test and descriptive statistics.

Results: Our study showed statistical significance with age and respiratory complications. Respiratory complications noted were primarily bronchospasm and aspirations. These complications were more common in age less than 1.5 years. No statistical significance was found between respiratory complications and type of anesthesia.

Conclusion: From our study we conclude that infants are at increased risk of respiratory complications during endoscopies under general anesthesia.

Keywords: Pediatric Endoscopy; Upper GI endoscopy; Complications; Bronchospasm

Introduction

Pediatric gastrointestinal endoscopy is emerging as a fundamental component of health care for infants and children. Most children who undergo gastrointestinal (GI) endoscopy require anesthesia or procedural sedation for comfort, cooperation, and successful procedure [1]. Upper GI endoscopies in children are performed for either diagnostic or therapeutic indications or sometimes for both. Unlike adults, children do not tolerate these procedures well without anesthesia or procedural sedation. Owing to limited experience of the "endoscopic community" in pediatric patients, ensuring adequate levels of safety during the procedure becomes paramount. An increased skill of the endoscopists and improvements in technology has led to standardization of pediatric endoscopy and protocol based practice. In recent years, development of specialized pediatric endoscopy unit has emerged which ensures adequate monitoring of the patient and brisk response and intervention in case of any complications. Diagnosis, prevention and treatment of

complications in pediatric endoscopy are crucial when dealing with benign diseases in children. The complication rates of diagnostic endoscopies in children are low compared to therapeutic procedures which have a higher rate of adverse events. Maintaining adequate anesthetic depth is a major concern. Both lighter planes and deep planes of anesthesia can result in unfavorable consequences. Ensuring patient safety, providing adequate analgesia, amnesia and controlled behavior throughout the procedure are pre requisites for successful completion of the procedure. This in turn enables early return of patients' consciousness to pre procedural level.

Aims and objectives

Primary objective of the study was to evaluate prevalence of complications in pediatric upper Gastrointestinal (GI) endoscopies during perioperative period. Secondary objective was to evaluate the complication rates in diagnostic and therapeutic procedures.

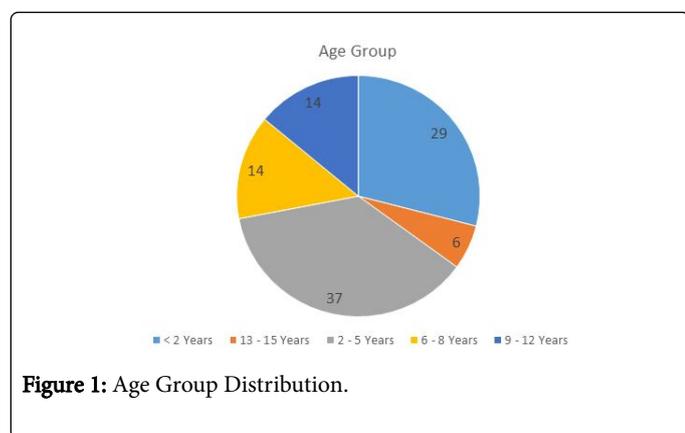
Methods

This prospective observational study was conducted in 100 patients between the age group of 6 months and 15 years of age undergoing elective diagnostic or therapeutic endoscopies at Indira Gandhi Institute of Child Health, Bangalore. All children with ASA grade 1, 2 and 3 were included in the study. A detailed pre-anesthetic checkup was done in all the patients one day prior to the endoscopic procedure. Informed written consent was obtained prior to the procedure and anesthetic exposure. Demographic details, indication for endoscopy and type of anesthesia administered were documented. All children were nebulized with short acting beta agonist (SABA) one hour prior to the procedure and were premedicated with Inj. Midazolam 0.1 mg/kg IV (as per institutional protocol).

All the minimum mandatory monitors, which included Non Invasive Blood Pressure Monitoring (NIBP), Electrocardiography (ECG), SpO₂ probe and axillary temperature probe, were connected prior to induction of anesthesia. Intraoperatively, all patients received Inj. Fentanyl 2 mcg/kg IV, and Inj. Dexamethasone 0.1 mg/kg IV (as per institutional protocol to prevent Post-Operative Nausea and Vomiting). All children were preoxygenated with 100% oxygen and induction was done using IV anesthetic agent i.e. Inj. Propofol 3 mg/kg IV. Intubation was done with appropriate size endotracheal tube as per the age of the patient. Position of the endotracheal tube was confirmed and presence of any leak was checked. All children were maintained using Intermittent Positive Pressure Ventilation (IPPV) and balanced anesthesia technique using oxygen, air and isoflurane in 1:1:1 ratio. Any complications that occurred perioperatively were noted. Post procedure, all patients were extubated and shifted to the postoperative recovery room. Statistical Analysis was done using the software R v3.5.1. Statistical tests applied were Kruskal-Wallis rank sum test, Chi Square test and descriptive statistics such as mean, standard deviation and percentage for qualitative variables.

Results

In our study, with a sample size of 100 patients, 51 of the patients were males and 49 of the patients were female. Among the 100 patients, 29% of the patients were less than 2 years of age, 37% of the patients were between the age of 2 years and 5 years old, 14% were between 6 and 8 years old and another 14% were between the age group of 9 years to 12 years old and the remaining 6% were more than 12 years old (Figure 1). The youngest among the group was 6 months old and the oldest in the group was 15 years old.



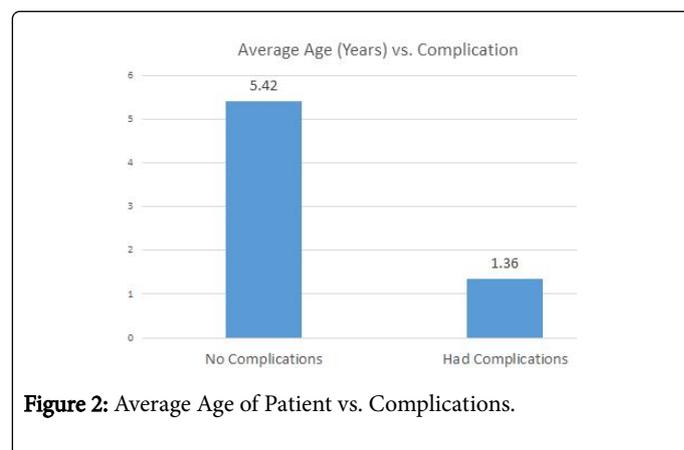
Within the sample group, it was found that 20% of the patients were diagnosed with TEF, 18% of the group with EHPVO, and 17% of the group with Gastric Outlet Obstruction. Other diagnoses for the group included Corrosive Ingestion (10%), Portal Hypertension (8%), Achalasia Cardia (5%) (Table 1).

Diagnosis	Count	Percentage
Achalasia Cardia	5	5%
Corrosive Ingestion	10	10%
EHPVO	18	18%
Portal Hypertension	8	8%
TEF	20	20%
Gastric Outlet Obstruction	17	17%
Others	22	22%

Table 1: Diagnosis of Patients.

The average duration of the procedure among the 100 patients was 35.38 minutes, with a standard deviation of 4.74 minutes, and the average time of recovery for the patients was found to be 15.05 minutes, with a standard deviation of 1.42 minutes.

In our study, 85 children undergoing upper GI endoscopies had an uneventful recovery. However, 15 patients had respiratory complications. Hence, prevalence of respiratory complications was found to be 15%. Of the 15 children who experienced complications, 14 children had bronchospasm immediately after extubation and none of them required reintubation. 1 child had aspiration following which tube exchange was done. Amongst 100 children, 37 children underwent endoscopies for diagnostic purposes and 63 children underwent endoscopy for therapeutic indications. 63 patients out of 100 had a surgical etiology and 37 had medical etiology. It was also found that the average age of those who had complications was 1.36 years while those who did not was 5.42 years of age (p value<0.01) (Figure 2).



It was found that a higher proportion of patients who underwent endoscopy for therapeutic purposes had complications (26%) than patients who underwent endoscopy for diagnostic purposes (5.7%) (Figure 3), and this difference in proportions was found to be statistically significant using the Chi Square test of independence with a p value of 0.039473.

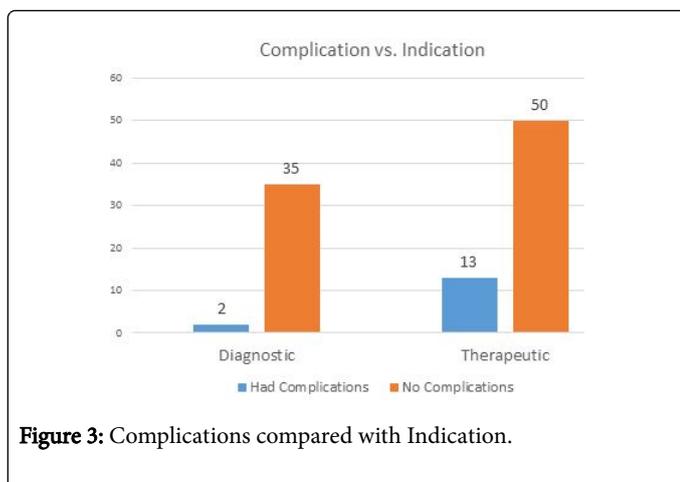


Figure 3: Complications compared with Indication.

Hyper reactive airway was found to be prevalent in 60% of the sample group. We also found that out of all children who had complications, 12 children had preexisting hyper reactive airway disease. In our study we also noted that bronchospasm occurred immediately after extubation and was treated with 100% oxygen with IPPV, Inj. Hydrocortisone 2 mg/kg IV, and nebulization with 0.5 mg Budesonide inhalation suspension (as per institutional protocol). None of the children who experienced bronchospasm required reintubation. Aspiration in one child occurred midway during esophagoduodenoscopy and was promptly treated with thorough suctioning, tube exchange and Inj. Hydrocortisone 2 mg/kg IV. The child was shifted to PICU with endotracheal tube in situ.

Discussion

Pediatric patients are subjected to gastrointestinal endoscopy as a routine part of the evaluation for many gastrointestinal symptoms and diseases. These procedures involve fair amount of discomfort and anxiety for the patient. As a result, pharmacologic intervention either in the form of general anesthesia or procedural sedation has conventionally been used. Ensuring effective and safe sedation for pediatric endoscopic procedures is non-negotiable and plays an important factor in lowering patients' distress. Unfortunately, it is often difficult to compare complication rates because of differences in the definition of complication between investigators. Incidence and prevalence of complications are often seen in patients less than 6 months of age. This may be as a result of combination of many factors. One such factor is the relatively large size of the endoscope as compared to small airways in the infants. As a result, the endoscope may take up more space or fold the epiglottis down over the glottis opening, producing partial obstruction of the airway [2]. Distension of abdomen due to introduction of air into the stomach may hamper diaphragmatic movement, reduce the functional residual capacity, and lead to hypoventilation. This may in turn result in retention of carbon-dioxide and hypoxia. Another important factor especially in children subjected to endoscopy with surgical etiology (e.g. post tracheoesophageal atresia) and those undergoing therapeutic dilatations (e.g. post corrosive ingestion), invariably have hyper reactive airway. These children with hyper reactive airways when subjected to airway instrumentations can witness sudden bronchospasm or laryngospasm, thus leading to increased morbidity. When these derangements occur in a child with relatively high oxygen consumption, such as a young infant, hypoxemia may result. In our

study we noticed a strong correlation with age and incidence of respiratory complications. Even though an otherwise healthy child with upper respiratory infections (URIs) may be managed safely during that period, risk of bronchospasm is high in children with hyper reactive airways (HRAD). Results of our study is consistent with study done by Koh et al. [2], who described 23 patients out of 150 patients experienced intraoperative complications. 96% of those who encountered complications had primarily respirator complications. Most complications occurred during gastrointestinal endoscopies, with the highest incidence of complications in children younger than 6 months of age [3]. Another study undertaken by Squires et al. [4], reported "no serious complications" in their study of 226 patients undergoing endoscopy with general anesthesia or intravenous sedation. Anesthesiologist's role in management of airway and sedation in endoscopies is paramount [5]. An additional benefit of the involvement of the pediatric anesthesia service is the implementation of a screening mechanism to identify patients at higher risk (patients with asthma, recent pneumonia, and others) for complications. Orel et al. [6], conducted a systematic review and concluded that propofol-based sedation was a safe option with low rates of major respiratory complications compared to other sedative regimens [5,6]. Results of our study are comparable with another prospective study undertaken by Bedirli et al. [7-10], who reported minor, self-limiting complications comprising of bradycardia and desaturation intraoperatively in children between the age group of 0-2 years of age [7,11]. Thus, Sedation for pediatric gastro-intestinal endoscopy is preferably performed by pediatric anesthesiologists, as part of a multidisciplinary team [12-16]. Instead of using multiple sedation regimes, we employed a balanced anesthetic technique using benzodiazepines, opioid, IV anesthetic agent and maintenance using inhalational anesthesia. With this technique, dose related complications of individual drugs were avoided and effective anesthetic depth was achieved to avoid any discomfort for the patient [11,14]. Post procedure recovery was uneventful and no drug related complications were observed.

Conclusion

Anesthetic technique and management of complications in pediatric endoscopies pose a great challenge to the anesthesiologist. The prevalence of complications was higher in infants and those with surgical etiology and preexisting hyper reactive airway. Safe and effective administration of anesthesia for these children involves a thorough preoperative work up and optimization of underlying respiratory conditions prior to the procedure. A multidisciplinary team led by a pediatric anesthesiologist ensures in minimizing the incidence of complications and timely treatment of complications, if it were to occur during the perioperative period.

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