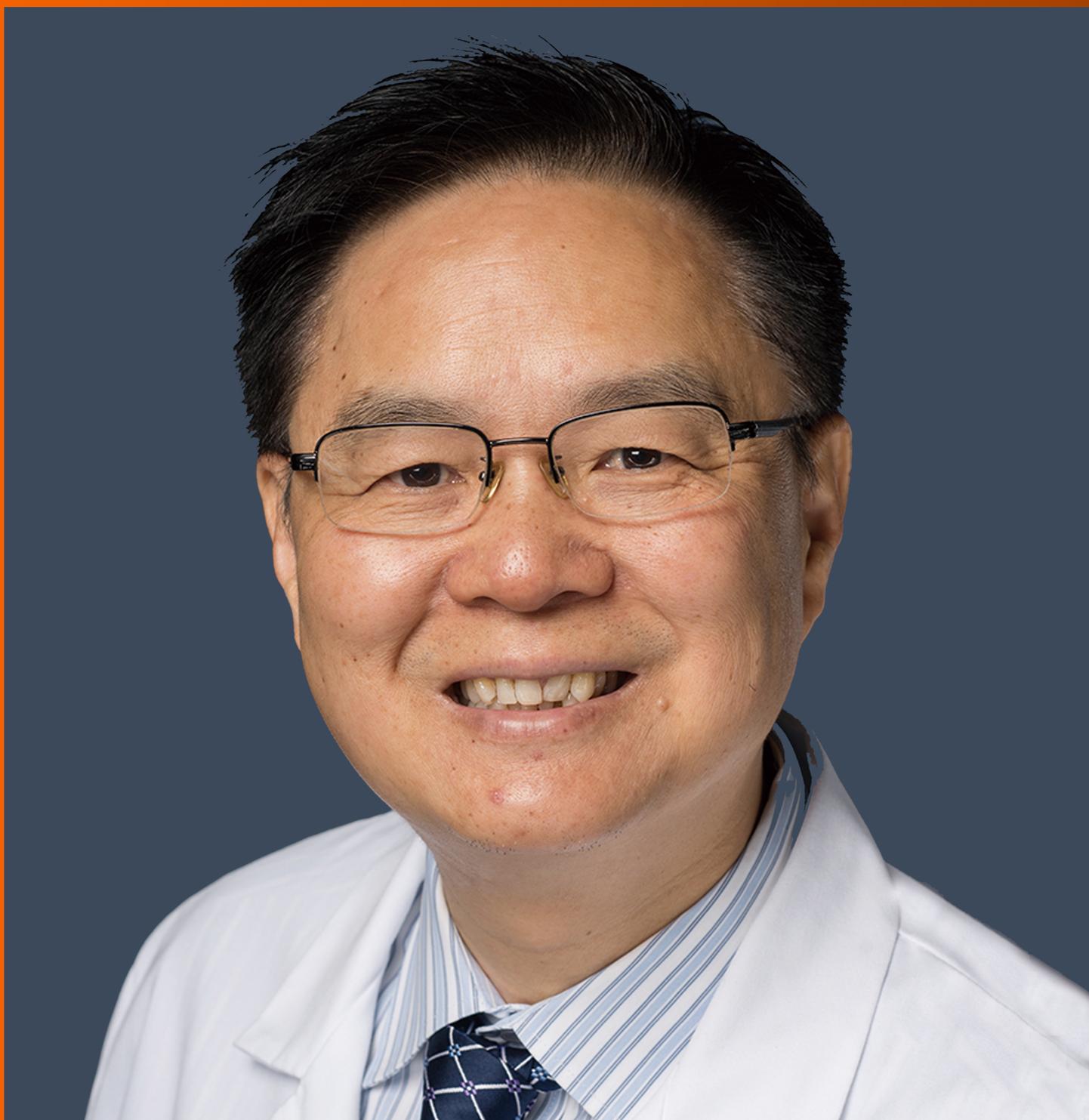


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The primary aim of *World Journal of Gastrointestinal Endoscopy* (WJGE, *World J Gastrointest Endosc*) is to provide scholars and readers from various fields of gastrointestinal endoscopy with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

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Retrospective Study

Complication rates in emergent endoscopy for foreign bodies under different sedation modalities: A large single-center retrospective review

Ming-Han Cha, Rashi Sandooja, Saher Khalid, Nicole Lao, Joseph Lim, Roshan Razik

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Abstract

BACKGROUND

Foreign object ingestion (FOI) and food bolus impaction (FBI) are common causes of emergent endoscopic intervention. The choice of sedation used is often dictated by physician experience. Many endoscopists frequently prefer to use monitored anesthesia care (MAC) and general anesthesia (GA) as opposed to conscious sedation (CS) due to the concern for inadequate airway protection. However, there is insufficient data examining the safety of different sedation modalities in emergent endoscopic management of FOI and FBI.

AIM

To investigate the complication rates of emergent endoscopic extraction performed under different sedation modalities.

METHODS

We conducted a retrospective chart review of patients presenting with acute FBI and FOI between 2010 and 2018 in two hospitals. A standardized questionnaire was utilized to collect data on demographics, endoscopic details, sedation practices, hospital stay and adverse events. Complications recognized during and within 24 h of the procedure were considered early, whereas patients presenting with a procedure-related adverse event within two weeks of the index event were considered delayed complications. Complication rates of patients who underwent emergent endoscopic retrieval were compared based on sedation types, namely CS, MAC and GA. Chi-square analysis and multiple logistic regression were used to compare complication rate based on sedation type.

up and/or expired since the procedure. Please refer to IRB approval letter for further details.

Conflict-of-interest statement:

There are no conflict of interest pertaining to this manuscript.

Data sharing statement: Technical appendix, statistical code, and dataset available from the corresponding author at razikr@ccf.org. Consent was not obtained but the presented data are anonymized and risk of identification is low. No additional data are available.

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RESULTS

Among the 929 procedures analyzed, 353 procedures (38.0%) were performed under CS, 278 procedures (29.9%) under MAC and the rest (32.1%) under GA. The median age of the subjects was 52 years old, with 57.4% being male. The majority of the procedures (64.3%) were FBI with the rest being FOI (35.7%). A total of 132 subjects (14.2%) had chronic comorbidities while 29.0% had psychiatric disorders. The most commonly observed early complications were mucosal laceration (3.8%) and bleeding (2.6%). The most common delayed complication was aspiration pneumonia (1.8%). A total of 20 patients (5.6%) could not adequately be sedated with CS and had to be converted to MAC or GA. Patient sedated with MAC and GA were more likely to require hospitalization, $P < 0.0001$. Analysis revealed no statistically significant difference in the complication rate between patients sedated under CS (14.7%), MAC (14.7%) and GA (19.5%), $P = 0.19$.

CONCLUSION

For patients who present with FOI or FBI and undergo emergent endoscopic treatment, there is no significant difference in adverse event rates between CS, MAC and GA.

Key Words: Foreign body; Food bolus impaction; Endoscopy; Sedation; Anesthesia; Complications

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Core Tip: There is insufficient data examining the safety of different sedation modalities in emergent endoscopic management of food bolus impaction or foreign object ingestion. Many endoscopists frequently perform emergent endoscopy under monitored anesthesia care or general anesthesia instead of conscious sedation. This retrospective study aims to investigate the complication rate of emergent endoscopic extraction performed under different sedation modalities. Analysis revealed no significant difference in the complication rate among patients sedated under different sedation modalities. These findings can potentially lead to sedation practices that allow more timely access to emergent endoscopy and further cost savings to the health care system.

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INTRODUCTION

Foreign object ingestion (FOI) and food bolus impaction (FBI) represent the second most common endoscopic emergency after gastrointestinal bleeding^[1]. FOI occurs more commonly in the pediatric population but can also affect the adult population^[2,3]. Adults presenting with FOI frequently have underlying psychiatric disorders and may occasionally be found to be trafficking illegal drugs^[4-7]. Meanwhile, pathologies in esophageal structure or motility predispose adult patients to FBI^[8-10]. Flexible endoscopy is preferred compared to rigid endoscopy while performing endoscopic retrieval of foreign objects or food bolus due to lower adverse event rates along with other advantages like avoidance of surgery, reduced cost, ease of access, improved visualization, reduced morbidity, and high removal success rate^[11-13]. In general, all FOI and FBI require urgent or emergent endoscopic intervention. Foreign bodies and FBIs in the esophagus have the highest incidence of adverse events with the adverse event rate directly proportional to the dwell time in the esophagus^[14-16]. Perforation is most common with sharp objects^[17,18]. Thus, they should be removed within 24 h, preferably within 6 to 12 h after presentation^[19-21].

Traditionally, low risk flexible endoscopy among adults is performed under

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conscious sedation (CS), which is more time and cost effective compared to general anesthesia (GA)^[22]. Meanwhile, GA is recommended in patients who are unable to protect their airway, uncooperative or have a long estimated duration of procedure^[21,23]. However, GA is associated with various adverse events including cardiovascular adverse events such as hypotension, cardiac arrhythmias and myocardial infarction, and respiratory adverse events such as respiratory depression, hypoxia and aspiration pneumonia^[24].

Currently, there are no standard guidelines in the United States recommending the modality of anesthesia to use for emergent or urgent endoscopy^[23]. Often times, the clinician's preference to use monitored anesthesia care (MAC) and GA for emergent endoscopic procedures is due to the concern for airway protection. Some institutions have also enforced policies to mandate the use of GA for endoscopic intervention of FOI and FBI for similar reasons. Despite no substantial evidence that supports the practice, many physicians frequently perform emergent endoscopic retrieval of foreign object/food bolus under MAC and GA. Recognizing the gap in knowledge, our study aims to compare the adverse event rates among patients who underwent flexible endoscopy for FOI or FBI when performed under CS, MAC and GA.

MATERIALS AND METHODS

Subjects recruitment

A retrospective chart review was performed examining all subjects presenting with FBI or FOI who subsequently underwent emergent endoscopy, between January 1st, 2011 to December 31st, 2018 in Cleveland Clinic Main Campus and Cleveland Clinic Akron General. This study was approved by the local institutional review boards of all participating centers with a waiver of informed consent because of the minimal risk to participants. A total of 2664 subjects with the relevant current procedural terminology codes and International Classification of Diseases codes were reviewed. Endoscopic procedures were excluded if subjects presented with a rectal foreign body, were less than 18 years of age or were pregnant. Subjects undergoing removal of stents, pH probes, PEG (percutaneous endoscopic gastrostomy) tubes, sutures and food bezoars were similarly excluded. After excluding subjects mentioned above, a total of 929 endoscopic procedures were included for analysis.

Materials

For this study, a standardized questionnaire was utilized by investigators to collect demographic, clinical and endoscopic data. This included age, sex, comorbidities, use of anticoagulation, type of impaction, location of impaction, sedation modality, instruments (*e.g.*, Roth net, forceps, snare, talon grasper) used for foreign object or food bolus removal and adverse events related to the endoscopic procedure. CS is defined as a "light" sedation modality which does not typically compromise patient's respiratory function. The common medications used are midazolam, fentanyl and diphenhydramine. It is administered by the endoscopist, and the endoscopist typically assumes the dual role of performing the procedure and supervising the sedation. Meanwhile, MAC is a "deeper" sedation modality that is commonly administered by a qualified anesthesia provider, such as an anesthesiologist or certified registered nurse anesthetist, who also monitors the patient's airway and hemodynamics continuously. Although MAC includes sedatives that are frequently used in CS, propofol is exclusively used in MAC. Lastly, GA is solely administered by a qualified anesthesia provider and involves using a variety of medications to induce loss of consciousness and often impairs patient's respiratory function. Patients who undergo GA are almost always placed on mechanical ventilation.

Outcomes

The primary outcome of this study is the adverse event rate for endoscopic removal of foreign object or food bolus under different sedation modalities. Adverse events within 24 h post-procedure were recorded as early adverse events whereas delayed adverse events included those occurring between 1 and 14 d after the procedure. The secondary outcomes include hospitalization rate and success rate among endoscopic procedures using different sedation modalities. Additionally, we also compared the demographic data and outcomes between patients with FOI and FBI.

Statistical analysis

Descriptive statistics as well as inferential statistics were performed. Categorical variables were described using frequencies and percentages, whereas continuous variables were described using medians and interquartile range. Pearson's chi-square test was used to assess the association between type of anesthesia and whether a patient developed an adverse event during or after the procedure. Subsequently, multiple logistic regression analysis was used to estimate the effect of different variables on adverse event rates and hospitalization rates. Analyses were performed using SAS® Software (version 9.4; Cary, NC, United States). A significance level of 0.05 was assumed. The statistical analysis of this study is performed by Mangira C, biostatistician from department of research, Cleveland Clinic.

RESULTS

Baseline patient characteristics

A total of 929 procedures were included for analysis, with demographic and clinical characteristics shown in [Table 1](#). Among these cases, male patients (57.37%) were slightly more common compared to female patients. The median age was 52, with range between 18 and 103 years. Chronic co-morbidities were recorded in 14.21% of patients, while mental health disorders were present in 28.96% of the patients. Only 13 cases (1.40%) presented with airway compromise.

Endoscopy and anesthesia management

All the patients that were recruited underwent endoscopy for food bolus or foreign object extraction performed by gastroenterology, otolaryngology and/or the general surgery service. A total of 597 patients presented with FBI (64.26%) and the rest with FOI ($n = 332$, 35.74%). The most common site of FBI and FOI was the esophagus ($n = 699$, 75.24%), followed by the stomach ($n = 186$, 20.02%). Food bolus or foreign objects were seen in the oropharynx in only 11 cases (1.18%). Endoscopic instruments were commonly used, with 646 procedures (69.54%) requiring use of one or more instruments. Instruments that were frequently utilized include Roth net ($n = 299$, 32.18%), snare ($n = 233$, 25.08%) and forceps ($n = 188$, 20.24%). As some procedures required multiple endoscopic devices, the aggregate data presented may exceed 100%. Meanwhile, a total of 283 (30.46%) endoscopy procedures required only push method without the use of any instruments.

To investigate the association between sedation modality and adverse event rate, patients in the present study were divided into three groups following the sedation modalities used during endoscopy. The most commonly used sedation modality was CS ($n = 353$, 38.0%), followed by GA ($n = 298$, 32.08%) and MAC ($n = 278$, 29.92%). Of the 353 patients who underwent CS, midazolam ($n = 322$, 91.22%) and fentanyl ($n = 241$, 68.27%) were the most commonly used sedatives. Patients with FBI more frequently underwent CS ($n = 292$, 82.72%) compared to MAC ($n = 138$, 49.64%) and GA ($n = 167$, 56.04%), $P < 0.001$. Conversely, mental health disorders were more commonly seen in patients undergoing MAC ($n = 131$, 47.12%) and GA ($n = 108$, 36.24%), compared to CS ($n = 30$, 8.50%), $P < 0.001$. The majority of patients that presented with airway compromise due to their FBI/FOI, underwent endoscopy with either MAC ($n = 5$, 1.80%) or GA ($n = 6$, 2.01%).

Comparison between FOI and FBI

Patients with FOI were found to be younger (median age 33) compared to FBI patients (median age 61), $P < 0.001$. They also had less co-morbidities ($n = 32$, 9.64%) compared to patients with FBI ($n = 100$, 16.75%), $P = 0.0029$. However, prevalence of psychiatric disorder was higher among FOI patients ($n = 235$, 70.78%) compared to FBI patients ($n = 34$, 5.70%), $P < 0.0001$. When comparing between the two groups, the FOI group ($n = 67$, 20.18%) was found to have a higher total adverse event rate compared to the FBI group ($n = 84$, 14.07%), $P = 0.0156$.

Outcomes and adverse events of endoscopy

In total, 151 adverse events (16.3%) were recorded, with the majority of adverse events reported within 24 h of endoscopy ($n = 110$). Types of adverse events are shown in [Table 2](#). The most common early adverse events included mucosal laceration ($n = 35$, 3.77%), bleeding ($n = 24$, 2.58%), and hypoxia ($n = 12$, 1.29%). A total of 53 cases of delayed adverse events were recorded, which primarily included aspiration

Table 1 Comparison of baseline characteristics among different sedation modalities (n = 929)

	Conscious sedation (n = 353), n (%)	Monitored anesthesia care (n = 278), n (%)	General anesthesia (n = 298), n (%)	Total (n = 929), n (%)	P value
Gender					
Male	226 (64.02)	131 (47.12)	176 (59.06)	533 (57.37)	< 0.0001
Median age	58 (45-74)	39 (33-64)	46 (33-67)	52 (33-69)	< 0.0001
Type of impaction					
Food bolus	292 (82.72)	138 (49.64)	167 (56.04)	597 (64.26)	< 0.0001
Foreign object	61 (17.28)	140 (50.36)	131 (43.96)	332 (35.74)	
Presence of chronic co-morbidities	58 (16.43)	45 (16.19)	29 (9.73)	132 (14.21)	0.0270
Patient with mental health disorder	30 (8.50)	131 (47.12)	108 (36.24)	269 (28.96)	< 0.0001
Periprocedural airway compromise	2 (0.57)	5 (1.80)	6 (2.01)	13 (1.40)	0.2449
Overtube used	16 (4.53)	41 (14.75)	45 (15.10)	102 (10.98)	< 0.001

Table 2 Types of adverse events encountered during/after emergent endoscopy

Endoscopic adverse events	n (%)
Early adverse events (n = 110)	
Local adverse events	
Bleeding	24 (2.58)
Mucosal Lacerations	35 (3.77)
Perforation	4 (0.43)
Respiratory associated adverse events	
Failure to extubate	3 (0.32)
Hypoxia	12 (1.29)
Aspiration	10 (1.08)
Pain	
Chest pain	4 (0.43)
Abdominal pain	10 (1.08)
Delayed Adverse events (n = 53)	
Aspiration pneumonia/hypoxia	17 (1.83)
Abdominal pain	15 (1.61)
Bleeding	4 (0.43)
Fever	7 (0.75)
Perforation	3 (0.32)
Chest pain	6 (0.65)

pneumonia (n = 17, 1.83%) and abdominal pain (n = 15, 1.61%). Some endoscopy procedures were complicated by both early and delayed adverse events (n = 12, 1.29%). Most of the adverse events were monitored and managed with supportive care with less than half of the cases requiring directed treatments (n = 62, 41.05%), including antibiotics (n = 34) and pain medications (n = 17). The vast majority of endoscopic extraction procedures were successful, with only 45 procedures (4.84%)

resulting in inability to remove some or any of the food bolus or foreign object. Only one endoscopic procedure (0.11%) needed conversion to surgical intervention for foreign body removal.

When comparing among the sedation modalities, there was no significant difference in the overall adverse event rate observed among CS ($n = 52$, 14.73%), MAC ($n = 41$, 14.75%) and GA ($n = 58$, 19.46%), $P = 0.1902$. Comparison of adverse event rates and hospitalization rates among different sedation modalities and other patient characteristics are shown in Table 3. Patients presenting with FOI and procedures requiring the use of instruments were found to have higher rates of adverse events. Conversely, the presence of chronic comorbidities was not associated with a significant difference in adverse event rates. Although adverse event rates did not differ significantly among different sedation modalities, patients who required hospitalization were significantly more common among patients who underwent MAC (51.45%) and GA (50.35%) when compared to CS (25.44%), $P < 0.001$. Similarly, a significantly higher number of patients who needed hospitalization were seen among patients that presented with FOI and endoscopic procedures that required instrumentation for extraction ($P < 0.001$).

Among 353 patients who underwent CS, 20 patients (5.67%) needed escalation of sedation modalities to either MAC or GA. However, only 6 patients (2.16%) who underwent MAC needed conversion to GA during endoscopic removal of foreign object or food bolus.

After controlling for potential confounding factors including type of impaction, presence of chronic comorbidities and use of instruments, there was no difference in complication rates between the three sedation modalities. However, subjects who underwent GA were 2.43 times more likely to be admitted to the hospital as compared to those who underwent CS. Similarly, subjects who underwent MAC were 2.22 times more likely to be hospitalized as compared to those who underwent CS after controlling for potential confounding variables. Lastly, success rate of endoscopic removal of foreign object and food bolus was significantly higher in patients who underwent CS ($n = 344$, 97.45%) compared to MAC ($n = 259$, 93.17%) and GA ($n = 281$, 94.30%), $P = 0.0317$.

DISCUSSION

FOI and FBI remain a common clinical problem faced by gastroenterologists worldwide. The most frequently ingested foreign bodies in the pediatric population include coins, toys, jewelry and batteries^[25]. In adults, most impactions occur during eating, leading to impaction of either bone and/or meat. Adult patients who intentionally swallow a true foreign body are typically younger, and more likely to have a history of psychiatric illness or possibly drug trafficking^[7,26,27]. Unintentional FOI, however, is more commonly seen in the elderly^[28]. It has been estimated that the annual incidence of FBI is 13 per 100000 in the United States^[9].

FBI and FOI can be associated with serious complications including, but not limited to, mucosal ulceration, esophageal perforation, mediastinitis, vascular trauma, pneumothorax, pericarditis and aorto-esophageal or tracheo-esophageal fistula^[15,16,29]. In an early review of cases, an algorithm for management of these patients was developed depending upon the location of the ingested body. Per this algorithm, patients either underwent spontaneous passage, endoscopic removal or operative management based on the location of the obstruction^[30]. Ultimately, the choice of treatment modality is largely dependent on several factors including the patient's age, clinical condition, comorbidities, type of ingested body, location of the ingested body, anatomical considerations, physician/institutional experience/preference and availability of resources. For example, sharper objects like toothpicks or chicken bones had the highest risk of perforation and favored early endoscopic removal. Furthermore, Zhang *et al.*^[15] also observed lower rates of complications in patients presenting with esophageal FBI or FOI within the first 24 h of ingestion. This emphasizes the importance of early endoscopic removal of retained objects, preferably within the first 24 h.

Present guidelines, however, make no recommendations on the modality of anesthesia for emergent endoscopic management of FOI and FBI. Endoscopic removal, like all other endoscopic procedures, needs pre-procedural patient evaluation to assess the risk of sedation on a case-by-case basis. This includes a good medical history to determine relevant risk factors like history of obstructive sleep apnea, specific allergies or potential drug interactions, history of adverse reaction to various sedatives, history of drug or alcohol abuse and time of last oral intake^[23]. Although endoscopic removal

Table 3 Comparison of adverse event rates and hospitalization rates

Variable	Adverse event (n = 151), n (%)	P value	Hospitalization (n = 374), n (%)	P value
Type of anesthesia				
Conscious sedation	52 (14.73)	0.1902	87 (25.44)	< 0.0001
MAC	41 (14.75)		142 (51.45)	
General anesthesia	58 (19.46)		145 (50.35)	
Type of Impaction				
Foreign object	67 (20.18)	0.0156	199 (60.86)	< 0.0001
Food bolus	84 (14.07)		175 (30.22)	
Severe comorbidity				
Yes	29 (21.97)	0.0547	63 (49.61)	0.0399
No	122 (15.31)		311 (39.92)	
Use of instrument				
Yes	117 (18.11)	0.0204	288 (45.93)	< 0.0001
No (push method only)	34 (12.01)		86 (30.82)	

of foreign bodies or food boluses under CS may prove to be similarly effective and less time consuming, many clinicians may prefer performing these procedures under MAC or GA. However, no study has shown conclusive benefit of using GA or MAC as compared to CS. In fact, the frequent use of GA, can potentially prolong the duration of foreign object or FBI especially in resource-limited hospitals or due to the absence of in-house anesthesia service during night shifts in smaller community hospitals. This is clinically important as previous studies have shown that early endoscopic intervention increases the rate of successful esophageal foreign object/food bolus removal^[14-16,31].

Another factor to be considered in choosing the sedation modality for such patients is the cost. Currently the cost of MAC, which necessitates formal anesthesia assistance can range from an additional \$150-\$1500 per endoscopic case. This increased cost, however, is not associated with significant increase in safety profile of most procedures as compared to endoscopist-directed sedation or CS^[23].

In the current study, a total of 929 emergent endoscopy procedures for FOI and FBI were reviewed and analyzed. The choice of sedation modality was clinician-directed, based on individual preference and clinical judgements. Most of the emergent endoscopies reviewed were performed under CS administered by the endoscopist (38.0%), while the remaining procedures were performed under MAC or GA, with the assistance of a dedicated anesthesia provider. This study found fewer patients underwent GA compared to a previous case series conducted in a Chinese university hospital by Geng *et al*^[14], where approximately 50% of patients who underwent foreign object or food bolus retrieval had GA. In the case series, endoscopic foreign object removal under GA was associated with neither higher success rate nor lower adverse event rate as compared to topical pharyngeal anesthesia only. However, unlike the study by Geng *et al*^[14], where 10.6% of the patients were children less than 14 years old, our study excluded patients less than 18 years of age. This could potentially explain the lower percentage of patients undergoing GA in our study. Interestingly, the aforementioned study observed almost 65.3% of impacted cases being bony foreign body, indicating a potential cultural and geographical variation in these cases.

Meanwhile, two published case series in Italy reported only 0% to 13.2% of the food bolus and foreign object removals were performed with GA^[1,22]. These studies also reported low rates of adverse events ranging between none to 7%. Conversely, in our current study, more than double that number of patients with FOI and FBI, underwent GA. When including only patients with FOI, a case series in a US-based university hospital found that GA and MAC were used in 86% of patients^[32]. This finding is similar to our study as more than 80% of examined patients with FOI also underwent GA or MAC. The vast difference in the sedation practices for emergent endoscopic removal of foreign object and food bolus seen in various studies reflected the lack of research and guidelines in this area. This further highlights the need for more studies in order to understand the benefits and risks of different sedation modalities in these settings.

In the present study, the majority of emergent endoscopic interventions were performed for FBI. FBI in adults are most common at sites of narrowing or angulation due to an underlying esophageal pathology. This disrupts the normal anatomy and may cause impaction of food. These pathologies may include but are not limited to benign and malignant strictures, eosinophilic esophagitis, lymphocytic esophagitis, hiatal hernias, Schatzki's rings and esophageal webs^[33]. In patients without structural abnormalities, seasonal variation has been reported in patients with FBI in previous studies. This may be attributed to seasonal variation of eosinophilic esophagitis especially in patients with concomitant atopic diathesis^[34].

In the present study, patients who presented with FBI were older and had more medical co-morbidities compared to patients with FOI. This could be attributed to poorly chewed food, esophageal narrowing or dysmotility, which are more commonly seen in the older population. Interestingly, patients with FBI who underwent emergent endoscopy were found to have lower adverse event rates compared to patients with FOI despite being in an older age group and having multiple co-morbidities. In contrast, patients who presented with FOI were younger and frequently had underlying psychiatric disorders. The higher adverse event rate among FOI patients may be explained by the sharp nature of many ingested foreign bodies. In addition, they also contributed to frequent re-admission, with one of the patients undergoing a total of 93 endoscopies for foreign object extraction between 2011 and 2018. Unlike FBI, many patients with FOI have underlying psychiatric conditions that are frequently irreversible^[26]. Patients with pica do not have effective treatment and frequently have the urge to swallow foreign objects despite support from multidisciplinary teams. As psychiatric patients frequently also have underlying anxiety and can be uncooperative during endoscopy, GA is frequently used in this population.

The most common early adverse events observed in this study were mucosal laceration and bleeding. Theoretically, patients undergoing endoscopy under CS may be at higher risk of laceration due to patient movements due to use of "lighter" anesthesia. However, this study did not show higher complication rates in this patient population, possibly due to proper use of rubber hoods and overtubes. Also, the majority of sedation-related complications can be minimized through a detailed pre-operative assessment, preparation, intraoperative monitoring and support, and post-sedation management^[35]. In a similar vein, patients who underwent GA and MAC were more likely to be hospitalized. This is in part due to longer inpatient psychiatric monitoring as many patients who underwent emergent endoscopy under GA frequently presented with FOI with underlying psychiatric disorder. Interestingly, incidence of failure or incomplete removal of foreign object or food bolus is significantly lower in patients who underwent CS compared to other sedation modalities. The higher success rate observed in the CS group may be attributed to the higher proportion of patients with FBI in that group, which may present with lesser technical challenges compared to FOI removal. Although patients who underwent CS had higher success rates and no significant difference in adverse event rates compared to other sedation modalities, up to 5.67% of patients who underwent CS needed escalation of sedation modality to MAC or GA. This is often caused by inadequate sedation or prolonged procedure time due to difficult extraction. This is an important factor that may influence clinicians' decision to perform emergent endoscopy under CS or wait for support from anesthesia service.

Our study has several limitations. First, the retrospective nature of the study limits the control over selection bias. Retrospective chart review also lacks the ability to detect adverse events that were not appropriately documented. Second, patients who presented with FOI often have high readmission rates for the same chief complaint due to an underlying psychiatric condition. This may have led to over-representation of FOI procedures in this study. Third, patients that presented with FBI and FOI were analyzed together. The nature of the impaction may contribute as a confounding factor which affects the measured outcome. Fourth, patients presenting with FBI or FOI may be hospitalized for various reasons, including psychiatric assessments and behavioral monitoring which are unrelated to the endoscopy. Thus, the high hospitalization rate observed in patient undergoing GA may not have a direct causal relationship with the sedation modalities. Finally, the decision to use a specific sedation modality was usually attributed to endoscopist judgement. However, institutional policy change may affect outcomes. Within the Cleveland Clinic Health System where this study was based, there has been a slow paradigm shift towards favoring GA for all patients with FBI/FOI. This may lead to confounding of the results as the decision on sedation modality may not be entirely at the discretion of the endoscopist.

CONCLUSION

In the setting of increasingly common use of GA for emergent endoscopy, this study has shed some light on the outcomes of emergent endoscopic removal of food bolus or foreign objects in the upper gastrointestinal tract under different sedation modalities. In conclusion, patients who underwent emergent endoscopic foreign object or food bolus retrieval under CS were not associated with higher adverse event rates when compared to MAC or GA. Patients presenting with FOI and those who underwent endoscopic removal with the use of instruments were associated with high adverse events rate. However, the hospitalization rate was higher among patients who underwent endoscopy with MAC and GA, patients with FOI, patients with chronic comorbidities, and endoscopies requiring instrumentation. These findings can potentially lead to sedation practices that allow more timely access to emergent endoscopy and further cost savings to the health care system.

ARTICLE HIGHLIGHTS

Research background

Foreign object ingestion (FOI) and food bolus impaction (FBI) are common causes of emergent endoscopic intervention. However, the choice of sedation used during emergent endoscopy for foreign bodies is often dictated by physician experience.

Research motivation

Currently, there is insufficient data examining the safety of different sedation modalities in emergent endoscopy for removal of ingested foreign objects or FBI.

Research objectives

To investigate the complication rates of emergent endoscopic extraction performed under different sedation modalities, namely conscious sedation (CS), monitored anesthesia care (MAC) and general anesthesia (GA).

Research methods

A standardized questionnaire was utilized to collect data on demographics, endoscopic details, sedation practices, hospital stay and adverse events of endoscopic procedures for foreign body removal. Subsequently, complication rates of patients who underwent emergent endoscopic retrieval were compared based on sedation modalities.

Research results

Among the 929 procedures analyzed, 353 procedures (38.0%) were performed under CS, 278 procedures (29.9%) under MAC and the rest (32.1%) under GA. Analysis revealed no statistically significant difference in the complication rate between patients sedated under CS (14.7%), MAC (14.7%) and GA (19.5%), $P = 0.19$. However, patients that underwent MAC and GA were found to be more likely to require hospitalization. This may be due to longer inpatient psychiatric monitoring as many patients who underwent MAC and GA presented with FOI due to underlying psychiatric disorder.

Research conclusions

Emergent endoscopy for foreign body removal under CS is not associated with significantly higher complication rates compared to MAC and GA.

Research perspectives

Future prospective studies are needed to identify various clinical factors that contributes to higher risk for endoscopy-related adverse events.

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