

ORIGINAL ARTICLE

Traumatic and non-traumatic Ped surgeries degree of risk and gastric ultrasound as an instrument for assessment of post-Operative nausea and vomiting

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ABSTRACT

Keyword: Famotidine; Placebo; Pediatric Surgery; Nausea.

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Background: The classification of pediatric surgeries as traumatic or non-traumatic depends on factors such as surgery type, age, medical conditions, and procedure complexity. **Methods:** This prospective observational study was performed in the Department of Anesthesiology, Intensive Care, and Pain Management at Aswan University Hospital. The study included 50 pediatric patients who underwent emergency surgeries, categorized into traumatic and non-traumatic procedures. The research was permitted via the institutional review board, and informed consent was attained from the parents or legal guardians of all participants. **Results:** Orthopedic fracture trauma accounted for 46% of emergency pediatric surgeries, followed by soft tissue trauma (24%), abdominal surgery (18%), neuro-ophthalmic (eye-related) trauma (8%), and compartment syndrome (4%). Additionally, we compared preoperative and postoperative gastric ultrasound measurements in 100 patients. In the supine position, there were no significant variances between the pre- and post-surgery values for the anteroposterior diameter (APD), the craniocaudal diameter (CCD), and the cross-sectional area (CSA), with p-values of 0.371, 0.759, and 0.905, correspondingly. Similarly, for the right lateral decubitus (RLD) position, there were no significant variances in anteroposterior diameter, craniocaudal diameter, cross-sectional area, and gastric volume (GV) among the both groups, with p-values of 0.449, 0.527, 0.637, and 0.874, correspondingly. **Conclusion:** The study found no significant differences in postoperative nausea and vomiting risk in trauma surgeries, indicating ultrasound as a valuable bedside tool for anesthesia planning.

INTRODUCTION:

Pediatric surgeries can be broadly categorized into traumatic and non-traumatic procedures, each with distinct risks and postoperative considerations. The degree of risk associated with pediatric surgeries depends on several factors, including the type of surgery, the child's age, underlying medical conditions, and the nature of the surgical procedure itself (1).

Traumatic surgeries, which are usually caused by accidents or injuries, may have a higher risk of complications because of the trauma. Non-traumatic surgeries, on the other hand, tend to be elective procedures, like those for birth defects or long-term illnesses (1).

Ultrasonography can evaluate the elevated volume of gastric content, which could lead to pulmonary aspiration and regurgitation. As suggested by the European Society of Anesthesiology and Intensive Care, bedside point of care ultrasound (POCUS) is a safe and non-invasive way to assess the stomach (2).

This method improves our understanding of gastric emptying in various cases and clinical circumstances, assisting in the identification of potential risk factors related to gastric content. Nil per os (NPO) protocols are currently the standard preventive measures against aspiration (3). Postoperative nausea and vomiting can lead to longer discharge times, which could cause slower turnover in the ambulatory outpatient setting. PONV can also lead to aspiration, unwarranted hospital admissions, and patient dissatisfaction. Patients would rather spend extra money to avoid nausea (4).

As a treatment for PONV prevention, famotidine is often compared to placebo in clinical studies to evaluate its effectiveness in reducing these symptoms after pediatric surgeries. The potential benefits of famotidine in this setting have been studied, but its exact role in preventing PONV in pediatric emergency surgery remains a subject of ongoing research (5).

Although anesthesiologists are aware of postoperative nausea and vomiting (PONV/POV) as a prevalent complication in pediatric anesthesia, its incidence in daily routine is still too great. Anesthesia risk factors are volatile agents, nitrous oxide, opioids, and the length of the anesthetic (6).

Point-of-care ultrasonography (POCUS) has emerged as a valuable instrument to assess critically ill cases, and it has been confirmed to be effective in evaluating gastric contents and volume in various clinical settings. Point-of-care ultrasonography can assist in identifying cases that are at risk for aspiration, consequently guiding the decision to employ an RSI and assisting in determining the most appropriate airway treatment method throughout anesthesia (7).

This research aimed to assess the variance of the gastric volume via quantitative measurements of the gastric antrum before and after surgery.

PATIENTS AND METHODS:

This prospective observational study has been performed on the Department of Anesthesiology, Intensive Care, and Pain Management at Aswan University Hospital. The study included 50 pediatric patients who underwent emergency surgeries, categorized into traumatic and non-traumatic procedures. The study has been permitted via the institutional review board, and informed consent has been attained from the parents or legal guardians of all participants.

Inclusion Criteria: Patients aged 1 to 18 years, scheduled for emergency pediatric surgeries (both traumatic and non-traumatic), and able to undergo a gastric ultrasound assessment.

Exclusion Criteria: History of gastrointestinal disorders, recent food intake within the last 6 hours, receipt of antiemetic medications within 24 hours before surgery, and inability to undergo gastric ultrasound assessment due to technical or clinical reasons.

Patient Selection

Cases that met the inclusion criteria and didn't meet any of the exclusion criteria have been enrolled in the research. Depending on the type of surgery, we separated the cases into two groups: traumatic (number=41) and non-traumatic (number=9).

Data Collection

Demographic information, involving sex, age, and weight, has been documented for each patient. The type of surgery, duration of surgery, and preoperative risk factors for postoperative nausea and vomiting (PONV) were also documented. Risk factors for PONV included age, duration of surgery, history of motion sickness, and the presence of preoperative vomiting.

Gastric Ultrasound Assessment

Gastric ultrasound assessments were performed preoperatively and postoperatively using a portable ultrasound machine with a high-frequency linear probe. The following measurements were taken in both the supine and right lateral decubitus (RLD) positions:

- Anterior-posterior diameter (APD) of the gastric antrum
- Cross-sectional diameter (CCD) of the gastric antrum
- Cross-sectional area (CSA) of the gastric antrum
- Gastric volume (GV) has been estimated utilizing the formula: $GV = \pi \times (APD/2)^2 \times CCD$

The ultrasound measurements have been conducted through a single experienced operator to diminish interobserver variability.

Postoperative Management

All patients received standard postoperative care, including routine monitoring of vital signs and administration of analgesics as needed. The incidence of postoperative nausea and vomiting was recorded within the first 24 hours postoperatively. Patients who experienced PONV were treated with standard antiemetic protocols.

Statistical Analysis:

Information has been analyzed utilizing statistical software (SPSS version 26). Continuous variables have been represented as mean \pm standard deviation (SD) or median [interquartile range (IQR)], and categorical variables have been represented as percentages and frequencies. Comparisons between groups have been made utilizing the Mann-Whitney U test for continuous variables and the chi-square test for categorical variables. A p-value of below 0.05 has been considered statistically significant.

RESULTS:

Table 1: Risk factor for vomiting and scoring of risk for patients undergo emergency pediatric surgery

	Overall (n = 50)	Traumatic (n = 41)	Non Traumatic (n = 9)	p-value
Age (Years)	8.50 [5.00, 11.00]	8.00 [5.00, 11.00]	11.00 [7.00, 11.00]	0.647
Duration of Surgery (Min)	90.00 [60.00, 97.50]	90.00 [60.00, 90.00]	90.00 [60.00, 120.00]	0.359
Scoring of Risk	21.00 [13.00, 21.00]	21.00 [13.00, 21.00]	36.00 [21.00, 36.00]	0.002
Degree of Risk				<0.00

				1
High risk	6 (12.0)	0 (0.0)	6 (66.7)	
Moderate risk	37 (74.0)	34 (82.9)	3 (33.3)	
Low risk	7 (14.0)	7 (17.1)	0 (0.0)	
Gender = male	41 (82.0)	33 (80.5)	8 (88.9)	0.908
Pre-operative Vomiting	33 (66.0)	26 (63.4)	7 (77.8)	0.663
Data presented, Median [IQR] , n(%)				

Our study included 50 patients with a median age of 8.5 years, of whom 41 (82%) were male. Traumatic surgeries made up 82% of the cases, with orthopedic fracture repair being the most common (46%), followed by soft tissue trauma (24%). Non-traumatic surgeries accounted for 9 cases (18%). There is a significant difference in the risk score and degree of risk between traumatic and non-traumatic surgery ($p = 0.02$ and $p < 0.001$, respectively). There was no significant difference between the traumatic and non-traumatic groups regarding the age or duration of surgery ($p = 0.647$ and $p = 0.359$, respectively). Most patients had a moderate risk score (74%), while 12% had a high-risk score. Although two other risk factors were included, none of the 50 patients had a history of previous PONV or were predisposed to multiple opioid doses (**Table 1**).

Table 2: Type of emergency pediatric surgery		
Type of surgery	surgery Category	N (%)
Orthopedic fracture trauma	Traumatic	23 (46%)
Soft Tissue trauma	Traumatic	12 (24%)
Abdominal Surgery	Non Traumatic	9 (18%)
Neuro-eye Trauma	Traumatic	4 (8%)
Compartmental Syndrome	Traumatic	2 (4%)

According to the type of emergency pediatric surgery, the current study revealed that orthopedic fracture trauma was represented 46%, soft tissue trauma was represented 24%, abdominal surgery was represented 18%, neuro-eye trauma was represented 8%, and compartmental syndrome was represented 4%. (**Table 2**).

Table3: Gastric Ultrasound Measurement in Pediatric Patients by before and after surgery					
		Overall	Pre-operative	Post-operative	p-value
Supine	APD	1.10 [0.85, 1.40]	1.10 [0.90, 1.40]	1.00 [0.81, 1.40]	0.371
	CCD	2.83 (0.62)	2.85 (0.54)	2.81 (0.69)	0.759

	CSA	2.66 (1.24)	2.64 (0.97)	2.67 (1.47)	0.905
RLD	APD	1.16 (0.30)	1.18 (0.25)	1.14 (0.35)	0.449
	CCD	2.80 [2.30, 3.30]	2.95 [2.40, 3.30]	2.70 [2.20, 3.30]	0.527
	CSA	2.57 (1.01)	2.62 (0.76)	2.53 (1.21)	0.637
	GV	104.10 (47.26)	104.85 (36.43)	103.34 (56.43)	0.874
Data presented Mean \pm SD, Median] IQR] , n(%)					

The study compared before and after surgery measurements in 100 patients. For supine measurements, an insignificant variance has been observed among values before and after surgery for APD, CCD, and CSA (p-values: 0.371, 0.759, and 0.905, respectively). Similarly, for RLD measurements, APD, CCD, CSA, and GV showed insignificant variances among the 2 groups (p-values: 0.449, 0.527, 0.637, and 0.874, respectively) (**Table 3**).

DISCUSSION:

Regarding risk factors for vomiting and scoring of risk for patients undergoing emergency pediatric surgery, the current study showed that cases had a median age of 8.5 years, of which 41 (82%) were male. Traumatic surgeries made up 82% of the cases, with orthopedic fracture repair being the most common (46%), followed by soft tissue trauma (24%). Non-traumatic surgeries accounted for 9 cases (18%); there was a significant difference in the risk score and degree of risk between traumatic and non-traumatic surgery (p-value equal to 0.02 and p-value below 0.001, correspondingly). An insignificant variance has been observed among the traumatic and non-traumatic groups regarding the age or duration of surgery (p-value equal to 0.647 and p-value equal to 0.359, respectively). Most patients had a moderate risk score (74%), while 12% had a high-risk score. Although two other risk factors were included, none of the 50 patients had a history of previous PONV or were predisposed to multiple opioid doses.

Traumatic surgeries, especially those involving orthopedic fractures and soft tissue trauma, often lead to more severe and complex cases requiring a higher level of intervention and postoperative care. These cases are typically associated with greater pain, inflammation, and potential for complications, which may increase the risk of postoperative nausea and vomiting (PONV). Additionally, traumatic injuries might involve more extensive surgical procedures, which could further increase the risk of PONV due to factors like longer anesthesia times, higher levels of pain management required (often with opioids), and the physical stress associated with trauma (8).

Corresponding to our result, (9) assessed postoperative nausea and vomiting and incidence in kids. They reported that the incidence of postoperative nausea and vomiting in kids was still too great in outpatients and inpatients, and there were simple strategies to decrease baseline risk.

Famotidine is an antihistamine that has an impact on improving duodenal and gastric ulcers. Numerous researches have demonstrated that famotidine has the potential to be effective in the management of gastric inflammation, gastroesophageal reflux, stress ulcers, upper gastrointestinal bleeding, and prevention of acid aspiration into the lungs. Despite this, there is restricted research available concerning the effects of famotidine on pain control after surgery (10).

According to the type of emergency pediatric surgery, the current study revealed that orthopedic fracture trauma was represented 46%, soft tissue trauma was represented 24%, abdominal

surgery was represented 18%, neuro-eye trauma was represented 8%, and compartmental syndrome was represented 4%.

Orthopedic fracture trauma represented 46% of the cases in this study, likely because fractures are among the most common injuries in pediatric emergency surgery. Children are more prone to accidents, falls, and sports-related injuries, which often result in fractures, particularly in the context of trauma (11).

This study compared before and after surgery measurements in 100 patients. For supine measurements, an insignificant variance among values before and after surgery for APD, CCD, and CSA (p-values: 0.371, 0.759, and 0.905, respectively). Similarly, for RLD measurements, APD, CCD, CSA, and GV showed insignificant variances among the 2 groups (p-values: 0.449, 0.527, 0.637, and 0.874, respectively), (12) used US to diagnose gastric distension. They reported that fluid-filled stomachs observed on ultrasound may also be useful to expect cases who may suffer emesis; ultrasonography (US) is frequently utilized in medicine as a means of diagnosis. This method is noninvasive, accessible, inexpensive, and doesn't need to be subjected to radiation or contrast. Ultrasonography is a rapid and practical tool for bedside assessment. Ultrasonography is user dependent, but it is routinely utilized by surgeons for venous access and focused assessment with sonography for trauma exams.

Inconsistent with , (13) used ultrasonographic assessment of gastric content and volume in pediatric cases having elective operations. They found that ultrasound results of solid content in the antrum and/or a calculated volume of the stomach above 1.25 milliliters per kilogram. Before surgery, they conducted both supine and right lateral decubitus ultrasound examinations on the antrum. We assessed the gastric fluid content using a qualitative grading scale ranging from zero to two. The cross-sectional area of the antrum has been determined in the right lateral decubitus position, assisting the calculation of the gastric fluid volume regarding an established formula by Perlas. Ultrasound measurements of kids have been assessed. The median fasting period was four hours for liquids and nine hours for thick liquids and solids. Solid content was absent in all the kids. Five kids (5.2%) exhibited a grade two antrum, implying that fluid content was visible in both the supine and right lateral decubitus positions. The proportion of kids with a gastric fluid volume above 1.25 milliliters per kilogram, ranging from 0.1 to 4.7 percent, was lower than those above 0.8 and 1 milliliters per kilogram. These results reinforce the idea that surpassing 1.25 milliliters per kilogram of gastric fluid volume is rare in kids who have fasted before elective operation and may serve as a significant threshold to distinguish normal from elevated gastric fluid volume, consistent with earlier research , (14). Even in the absence of apparent risk factors, her gastric volume has been categorized as "high-risk." The literature points to incremental growth in overall gastric volume with a constant right lateral decubitus and cross-sectional area as age develops. For example, a four-year-old child weighing seventeen kilograms with a right lateral decubitus and a cross-sectional area of four cm² would have an estimated total gastric volume of twelve milliliters (0.7 mL/kg⁻¹), while a ten-year-old child weighing twenty-nine kilograms would have an estimated twenty-one milliliters (14).

Conclusion

This research found no significant differences in gastric volume or antrum measurements preoperatively and postoperatively in pediatric emergency surgeries, regardless of surgery type or medication. While traumatic surgeries had a higher PONV risk, no correlation was observed with gastric volume changes, suggesting famotidine and surgical factors had minimal impact. Ultrasound is a simple, non-invasive bedside tool that should be integrated into best practice guidelines to aid anesthesia planning and decision-making.

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