Original Article

Assessment of the Effect of Granisetron on the Gastric Cross-Sectional Area By Ultrasound on Patients Undergoing Elective Cesarean Section: A Randomized Double-Blind Study

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Abstract

Background: Gastric ultrasound is considered a valuable tool for the assessment of gastric volume preoperatively.

Materials and Methods: The goal of this study was to assess the effect of granisetron on the gastric cross-sectional area by ultrasound estimation of its cross-sectional area for elective Cesarean Section. Sixty patients were assigned randomly into one of 2 groups; Granisetron group (n=30): received 1 mg granisetron diluted in 10 mL normal saline 0.9%. Control (n=30): received 10 mL of normal saline 0.9%. Cross-sectional area and volume of stomach contents were measured using ultrasound immediately before administration of the study drug and one hour later.

Results: No statistical difference was detected in post-treatment antral CSA nor gastric residual volume between the two groups (4.8±1.4 vs 4.6±2.1, P: 0.8) and (50±19 vs 57±27, P: 0.3) for antral CSA and gastric volume comparison between both groups. However, a significant statistical difference was found in antral CSA pre and post-granisetron administration (4.8±1.4 vs 4 ±1.2; P<0.001). The Granesitron group had a statistically significantly lower rate of nausea and vomiting than the control group.

Conclusion: Based on ultrasonographic measurement granesitron could effectively reduce the gastric cross-sectional area when administered preoperatively to parturients undergoing elective CS.

Keywords: Gastric POCUS, Antral cross-sectional area, Granesitron, Pregnancy

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Introduction

Pulmonary aspiration is one of the catastrophic complications of anesthesia that could lead to a deleterious outcome. The risk of aspiration assessment is usually based on fasting hours. Current recommended guidelines by the American society of anaesthesiology (ASA) advocate 2 hours of fasting for clear fluids, 6 hours for light meals, and 8 hours after a full meal. However, these guidelines could be applied only for healthy patients undergoing elective surgeries, but are not reliable for those with coexisting diseases that delay gastric emptying (1). Granisetron is a selective serotonin (5-HT3) receptor antagonist with little or no selectivity for other serotonin receptors, granisetron is a stronger antagonist with a prolonged

onset of action than ondansetron (2). Different approaches for viewing the structure, volume, and time to stomach emptying have been proposed, including acetaminophen absorbing, polyethylene glycol dilution (PEG), and electric impedance tomography (EIT). The gold standard for such detections remains gastric scintigraphy. Due to the danger of radiation exposure, limited cost-effectiveness, and complicated instrumental setups, scintigraphy is not recommended in typical clinical settings or for pregnant women (3). Evaluation of the Gastric content and volume is a new POCUS (point of care ultrasound) application that could help to determine the perioperative aspiration risk (1).

Gastric sonography has previously been used to monitor gastric motility and emptiness. It has also been used to identify the existence of liquids and solids, as well as to report the relationship between CSA and fasting periods. However, the use of stomach sonography at the bedside in real-time is a new application (4). The present study hypothesizes that granisetron can enhance gastric emptying if administered preoperatively. This study aimed to assess the effect of granisetron on gastric antrum by ultrasound estimation of its cross-sectional area in pregnant patients planned for elective CS.

Methods

This is a prospective double-blind randomized controlled trial, that was carried out from April 2020 to November 2021 at Assuit University Hospital. Every research participant gave informed written consent once the local ethical committee approved it (17101141) and clinical trial registration (NCT04290026). Sixty patients undergone cesarean section were included and randomly assigned into one of two groups:

Group G (granisetron): Patients (n=30) who had fasted for 6 hours received 1 mg of granisetron intravenously diluted in 10 mL 0.9 % normal saline one hour before CS.

The control group (Group P): Patients (n=30) who had fasted for 6 hours got 10 mL of normal saline 0.9% intravenously as a placebo one hour before CS. Randomization was done using computer-generated random tables, saline drug mixture was prepared and administered by an anesthetist who was not involved in US evaluation or data collection. Both patients and the data collector (anesthetist who was performing the ultrasound study) were blind to the study.

Inclusion criteria were parturient ASA I and II undergoing elective CS, and Exclusion criteria were patients with a history of diabetes mellitus, high blood pressure, pre-eclampsia, arrhythmia, neurological and psychiatric problems, kidney or liver illnesses, and chronic GERD are also risk factors. Failure to provide written consent.

Preparation for ultrasound examination: Parturients were instructed to fast for 8 hours, one hour before C.S. ultrasound evaluation was done using a curvilinear transducer of 2-5 MHz (DP-10Mindray ultrasound machine). Parturients were positioned at 45◦ elevated head in right lateral decubitus (RLD), this position facilitates deposition of the liquid or semi-liquid content in the antrum. The gastric antrum is identified at the sagittal plane in the epigastric region medial to the left lobe of the liver, at the aorta level, where the liver is anterior and the pancreas is posterior.

Primary outcome measure: Effect of granisetron on the antral CSA calculated by the two-diameter technique described by Bolondi et al (5). The baseline cross-sectional area is measured followed by re-measurement one hour after administration of the study medication. The ACSA was calculated using the formula; CSA= π (D1*D2)/4. D1= anteroposterior diameter, D2= craniocaudal diameter, π=3.14. Four measurements of gastric antral CSA were obtained for each woman, one in the semi-recumbent supine and three in the semi-recumbent RLP from serosa to serosa. Then the mean of the three consecutive measurements was used to measure antral CSA in RLP.

Secondary outcome measures: Granisetron effect on gastric volume:
Volume = 27.0 + (14.6 * right-lateral CSA) - (1.28 *age) (1,6)

Sample Size Calculation: The software G*Power 3.1.9.4 (developed by Franz Faul, Universität Kiel,

Germany, Copyright 1992-2019) was utilized. The sample size was calculated using G*Power analysis depending on the results of the previous study; where the mean antral CSA in pregnant groups was 4.2 and we supposed the SD to be 1.4 (7). This sample size was estimated to be able to detect a 25% difference in the antral CSA between both groups with α=0.05, 28 patients in each group are required to yield 80% power. We raised it to 30 patients in each group to compensate for attrition.

Statistical analysis: Statistical analyses were done by IBM SPSS version 20 (SPSS Inc., Chicago, IL, USA. Shapiro-Wilk test assessed the normality of data. Categorical data were presented as percentages and analyzed by Chi-square test. Parametric data were analyzed by t-test and non-parametric data was analyzed by Mann-Whitney test. A P-value of < 0.05 was considered statistically significant.

Results

No statistical substantial variation was detected in demographic data between the two groups (table 1). No statistical difference was found in the baseline antral cross-sectional area dimensions nor gastric volume between the study groups (4.8±1.4 vs 4.6±2.1, P: 0.8) for Granisetron and saline respectively (table 2). No statistical difference was detected in post-treatment CSA nor gastric volume between the two groups (4.8±1.4 vs 4.6±2.1, P: 0.8) and (50±19 vs 57±27, P: 0.3) for CSA and volume comparison between both groups (Table 2 and 3). However, a high statistically significant difference was found between the baseline measurement of CSA and the gastric volume and the post-treatment measurements in the granesitron group (4.8±1.4 vs. 4±1.2; P <0.001) and (70±24 vs. 50±19; P<0.001) (Table 2 and Table 3).

Discussion

This randomized controlled trial included 60 patients who completed the study, 30 patients in each group. Despite no statistical difference was detected in post-treatment antral CSA nor gastric residual volume between the two groups (4.8±1.4 vs 4.6±2.1, P: 0.8) and (50±19 vs 57±27, P: 0.3) for antral CSA and gastric volume respectively for comparison between both groups. However, significant statistical difference was found in antral CSA pre and post-granisetron administration (4.8±1.4 vs 4 ±1.2; P<0.001 and 70±24

Table 1: Baseline Data Difference between the studied Groups

	Granisetron N=30	**Control N=30**	**P value**
Age (yrs)	28.6±6	28±6.1	0.8
Weight (kg)	78±6.2	73±6.3	0.06
Height (cm)	161±3.4	160±4	0.7
PONV	1 case	8 cases	0.037

* Independent t-test.

Table 2: Comparison of Mean CSA Dimension between Groups

(Mean ± SD)	**Granisetron (n= 30)**	**Control (n=30)**	**P-value***
✓ Baseline	4.8±1.4	4.6±2.1	0.6
✓ Post-treatment	4 ±1.2	4.4±2	0.2
P-value**	<0.001	0.9	

* Mean changes across groups Comparison (independent t-test)

**Mean variations within Group Comparison (paired sample t-test).

Table 3: Comparison of Mean gastric volume between Groups

(Mean ± SD)	Granisetron (n= 30)	Control (n=30)	P-value*
✓ Baseline	70±24	67±31	0.7
✓ Post-treatment	50±19	57±19	0.3
P-value**	<0.001	0.88	

* Mean changes across groups Comparison (independent t-test)

**Mean variations within Group Comparison (paired sample t-test).

vs 50±19; P <0.001). The Granesitron group had a statistically significantly lower rate of nausea and vomiting than the control group; P<0.037. The current study evaluated the impacts of granisetron as prokinetic drugs on the gastric volume guided by ultrasound measurement of the gastric antrum dimensions. The results showed that granisetron could enhance gastric emptying as it appeared in gastric CSA post-treatment measurements and gastric volume measurements. However, this study failed to detect a difference between the granesitron and the control group in the post-treatment measurements.

Gastric POCUS is valuable in the perioperative, it could determine the risk of aspiration when the fasting hours are uncertain or comorbidities are causing delayed gastric emptying (8). Pregnancy could cause aspiration during anesthesia induction due to elevated intra-abdominal pressure from the gravid uterus, and progesterone-induced relaxation of the lower esophageal sphincter. Stomach ultrasonography is a noninvasive bedside tool that could effectively be used to identify the volume of the gastric content, as well as if these volumes carry a risk of aspiration, and therefore could guide the anesthetic management of pregnant females (9).

Technical difficulties arise while applying gastric POCUS on pregnant women. The gravid uterus shifts the stomach to right and cephalad direction, making antral visualization more difficult. Pregnancy restricts the space between the xiphisternum and the gravid uterus, which make the positioning of the transducer more challenging (10).

Despite these obstacles, gastric POCUS in parturients has proved to be consistent, with high feasibility and repeatability for the identification of stomach contents. To the best of our research, we could not identify previous trials that used ultrasound to study the prokinetic effect of granisetron on the antral cross-sectional area or gastric volume. However, many studies approved that granisetron could clinically improve gastrointestinal tract (GIT) symptoms secondary to gastroparesis. Jung found that the granisetron transdermal patch could effectively alleviate GIT symptoms in patients suffering from refractory gastroparesis (11).

Another study compared the preventive effect of ondansetron and granisetron on GIT symptoms after laparoscopic cholecystectomy, they declared that both drugs can alleviate postoperative nausea and vomiting (PONV), with granisetron having better results than ondansetron (12). In a recent review article by Ngo et al. on the perioperative benefits of extended-release granisetron, they reported that granisetron has a relatively good safety profile and is a potentially valuable perioperative anti-emetic agent (13). Granisetron is an FDA-approved antiemetic agent for chemotherapy-induced nausea and vomiting. However, it is worth mentioning that granisetron is class B in pregnancy. Limitations of the current study are the small sample size and the exclusion of diabetic and preeclamptic patients.

Conclusion

Based on ultrasonographic measurement granesitron had a prokinetic effect on parturients undergoing elective CS.

Acknowledgment

None.

Conflicts of Interest

The authors declare that they have no conflict of interest.

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