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Determination of Gastric Volume by Different Administration Methods before Painless Gastroscopic Anesthesia and Risk assessment of aspiration

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Abstract

Objective: To observe the volume of gastric contents in the dacronin group versus the streptaprotease particles and dacronin group in order to better predict the risk of reflux aspiration under anesthesia. **Method:** A total of 90 patients underwent gastroscopy under general anesthesia at Shenzhen Hospital (Fu Tian) of Guangzhou University of Chinese Medicine from July 2021 to July 2022. Of these, 42 were men and 48 were women, aged from 18 to 65 years old, ASA I-II. The cross-sectional area of the gastric antrum (CSA), gastric volume (GV), and GV/W (gastric volume/body weight) were analyzed using the T-test in the dacronin group (Group A) and the streptaprotease particles and dacronin group (Group B). **Results:**The GV of Group A was 28.59 ± 20.74, and the GV of Group B was 38.79 ± 18.89. The T-test showed P=0.0168, indicating a statistically significant difference between the two groups. The GV/W in Group A was 0.48 ± 0.36, and the GV/W in Group B was 0.65 ± 0.40. According to the two-sample T-test, P=0.0355 showed differences within the same groups in the supine, semi-supine, and right supine positions ($P < 0.001$). **Conclusion:**Oral administration of 60 ml fluid is safe 30 minutes before gastroscopy, and antral ultrasound in the right lateral position can most easily achieve positive results.

Keywords Gastroscopy; Anesthesia; Gastric Volume; Reflux Aspiration; Ultrasound Evaluation

1 Introduction

Painless gastroscopy is an upper gastrointestinal disease detection technique that uses short-term anesthetic drugs for sedation and pain relief, followed by routine gastroscopy testing. To reduce interference in the gastroscopy field of view, clinical practice typically requires patients to fast for 8 hours before testing. Studies have shown that, even for patients who strictly fast, a full stomach state may still be present, leading to an increased risk of vomiting and aspiration during anesthesia [1]. Additionally, patients swallowing too much saliva during painless gastroscopy examination can further increase gastric contents, which increases the risk of gastroscopy visual field occlusion.

To eliminate the interference of gastric mucus and foam in the gastroscope's visual field, patients are often given priority for gastroscopy-assisted detection drugs such as Dacron gel and streptomycin granules. Dacron hydrochloride mucilage is a mixture of local anesthetic Dacron hydrochloride and medical defoamers, which can have a local anesthetic effect on the pharyngeal mucosa and also achieve a good defoaming effect [2]. Chain protease is a protein lyase that can lyse or dissolve mucus on the surface of the gastric mucosa. Since its most suitable pH value for breaking down mucus is between 6 and 8, sodium bicarbonate is often used as a buffer to neutralize the acidic environment of gastric juice. Simultaneously, 2000 units of oral chain enzyme protease and 1g of sodium bicarbonate are taken and diluted with 50ml of warm water. The mucus remover can break down the mucin in the upper digestive tract mucus, converting it into liquid gastric juice [2].

Related studies have shown that ultrasound can objectively and quantitatively monitor gastric volume or gastric intake [3-4]. However, there are few reports on changes in gastric volume and the risk of anesthesia aspiration after consuming 50ml of streptomycin granules and 10ml of Dacron gel 30 minutes before the examination. This study evaluated the volume of gastric contents in the group receiving only Daclonine gel through ultrasound compared to the group receiving streptomycin granules and Daclonine gel. The study explored the differences in gastric volume and the risk of aspiration before painless gastroscopy anesthesia using different administration methods and evaluated the application value of gastric antral ultrasound in gastroscopy examination.

2 Materials And Methods

2.1 General Information

This study was approved by the Ethics Committee of Shenzhen Hospital of Guangzhou University of Traditional Chinese Medicine, and all patients signed informed consent forms. Ninety patients who underwent gastroscopy under general anesthesia at Shenzhen Hospital (Futian) of Guangzhou University of Traditional Chinese Medicine from July 2021 to July 2022 were selected for this study, with no gender limitations. The patients were aged 18-65 years old, with ASA grades I-II. Exclusion criteria included: pregnant women; history of organic digestive system diseases (such as gastrointestinal bleeding, pyloric obstruction, history of upper gastrointestinal surgery); history of mental illness or non-authorship; patients with heart failure, renal dysfunction, and active liver disease; BMI > 30 kg/m^2; individuals with a history of drug allergy to the drugs used in this study.

2.2 Grouping And Processing

Using a random number table method, the patients were divided into two groups: Group A, who received 10 ml of Daclonine gel orally 10 minutes before anesthesia, and Group B, who received 50 ml of Streptomyces protease particles orally 30 minutes before anesthesia and 10 ml of Daclonine gel orally 10 minutes before anesthesia. The ultrasound examiners, who had received professional training in ultrasound, were unaware of the grouping of oral medication and required patients to undergo ultrasound examination of the gastric antrum in a right lying position. Both groups underwent ultrasound examination 10 minutes after oral administration of Dacron emulsion, with the examination time controlled within 5 minutes. Patients who exceeded 5 minutes were excluded from this study. General anesthesia was performed by another anesthesiologist based on the patient's condition. The doctor was unaware of the preoperative ultrasound measurement of the gastric antrum and the medication used before anesthesia. The patient was intravenously injected with 0.05 mg/kg of dexamethasone and 1.5-2.5 mg/kg of propofol. After the patient entered a sleep state and the eyelash reflex disappeared, the injection was stopped (if necessary, propofol was injected to maintain anesthesia). After anesthesia, the gastroenterologist could insert an electronic gastroscope to aspirate gastric fluid during the examination process.

C. Outcome Measures

Place the low-frequency ultrasound probe below the xiphoid process to the right, perform sagittal scanning, and evaluate the volume of the stomach by measuring the transverse area of the gastric antrum (CSA). The transverse area of the gastric antrum is measured by measuring the anteroposterior (AP) and craniocaudal (CC) diameters of the gastric antrum. The calculation formula is:

$$\mathrm{CSA} = \pi \times \frac{\mathrm{AP} \times \mathrm{CC}}{4}$$

The craniocaudal diameter and anteroposterior diameter should be taken from the longest and widest part of the gastric antrum image, and the measurement distance should reach the serosal layer. When measuring the two inner diameters, they should be perpendicular to each other. The anteroposterior diameter and craniocaudal diameter of the gastric antrum were measured three times, and the average value was taken. Ultrasound measurement of CSA in the gastric antrum of the patient and calculation of gastric fluid volume in the right supine position [4].

$$\mathrm{GV\ (ml)} = 27.0 + 14.6 \times \text{right-lat CSA} - 1.28 \times \text{age}$$

Closely observe whether there are any adverse events (nausea, vomiting, coughing, aspiration, etc.) occurring in patients during and after surgery. Record the end time of the ultrasound examination and the time for gastric juice suction under gastroscopy to calculate the time interval (T). Use a 20 ml syringe to aspirate the amount of gastric juice from the negative pressure drainage device and record and detect the pH of the gastric juice. Record adverse reactions such as nausea and vomiting in patients 24 hours after surgery.

2.3 Statistical Analysis

SPSS 20.0 statistical software was used for analysis. Quantitative data were expressed as mean ± standard deviation ($x \pm s$). Group t-test was used for intergroup comparisons, repeated measures ANOVA was used for intragroup comparisons, and chi-square test was used for count data comparisons. $P < 0.05$ indicates a statistically significant difference. The difference between the supine position and other supine positions within two groups was analyzed using one-way ANOVA for mean comparison between multiple groups. The measurement data were presented in the form of $x \pm s$, and $P < 0.05$ was considered statistically significant.

3 Result

This study included 90 patients, comprising 42 males and 48 females, aged 18-65 years (average). There were 16 ASA grade I and 74 ASA grade II patients. There was no statistically significant difference in age, height, weight, and gender ratio between the two groups of patients.

Tab.1 Comparison of General Conditions between Two Groups of Patients

Group	Number of cases	Male/Female (Example)	BMI（kg/m^2）	ASAI/II （Example）	Age (years)
A	45	22/23	22.6±2.8	10/35	35±5.5
B	45	20/25	22.0±3.0	6/39	40±6.1

3.1 Statistical Results of the Cross-sectional Area (CSA) of the Right Lying Gastric Antrum Between Two Groups

The cross-sectional area (CSA) of the gastric antrum in the right lateral position was measured by ultrasound in two groups of patients, and the results showed that there was a statistically significant difference (P<0.05) between the right semi-recumbent position in Group A and the right lateral position in Group B.

3.2 Statistical Results of GV and GV/W Between Two Groups

Comparison of gastric capacity in the right supine position between two groups.

Ultrasound was used to measure the gastric volume (GV) of two groups of patients in the right lateral position, and the difference in gastric volume between the two groups was compared. The results showed that the gastric volume of Group B was significantly higher than that of Group A, and the difference was statistically significant (P<0.05).

Comparison of gastric volume/body weight (GV/W) between the two groups.

The gastric volume (GV) of two groups of patients was measured by ultrasound, and the difference in gastric volume/weight (GV/W) between the two groups was compared. The results showed that the gastric volume/weight of Group B was higher than that of Group A, and the difference was statistically significant (P<0.05).

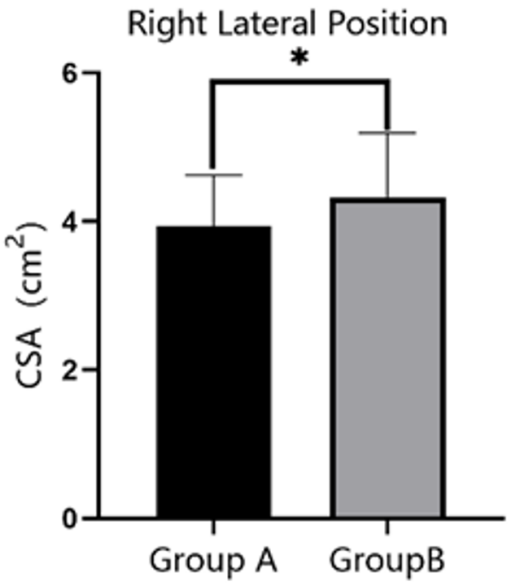

Figure 1: Comparison of cross-sectional area (CSA) of gastric antrum in two groups of right lateral positions

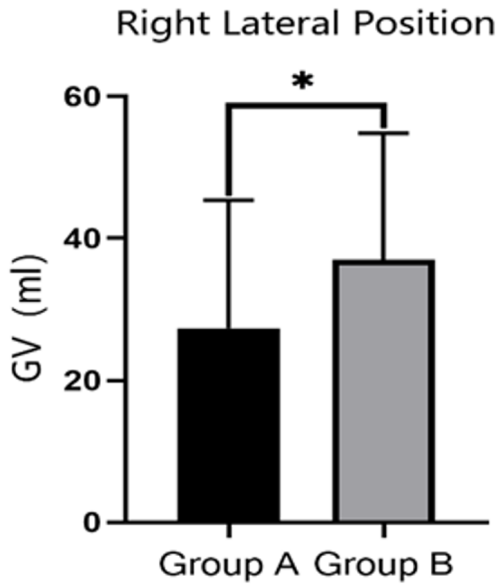

Figure 2: Comparison of gastric volume (GV) between two groups

3.3 Statistical Results of Supine and Other Lying Positions

Group A:

Statistical result description: According to the one-way analysis of variance ($P<0.001$), there is statistical significance in the comparison between the groups, indicating differences between different lying positions in Group A. After pairwise comparison between each group, there was no significant difference between supine and semi-supine positions, while the comparisons between supine and right semi-supine positions, and between supine and right supine positions, were statistically significant ($P<0.001$).

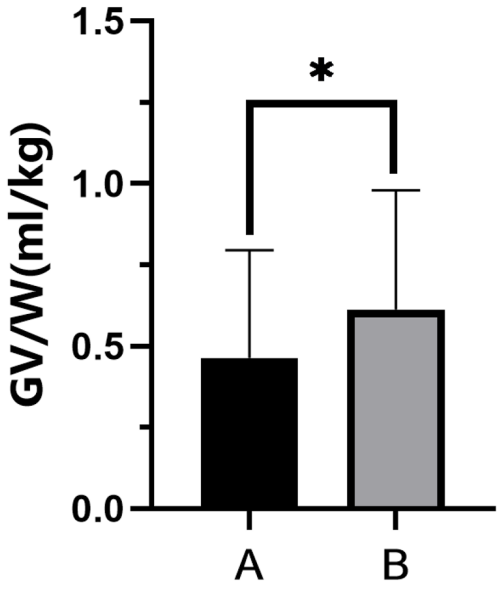

Figure 3: Comparison of gastric volume (GV) between two groups

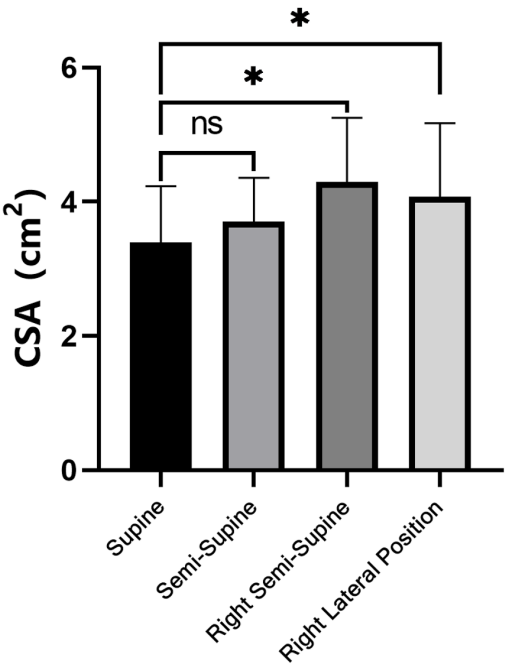

Figure 4: Statistical results of supine and other lying positions within Group A

Group B:

Statistical result description: According to the one-way analysis of variance (P<0.001), the comparison between the groups is statistically significant, indicating differences between different lying positions in Group B. After pairwise comparison between each group, the comparisons between supine and semi-supine positions, supine and right semi-supine positions, and supine and right supine positions were statistically significant (P<0.001).

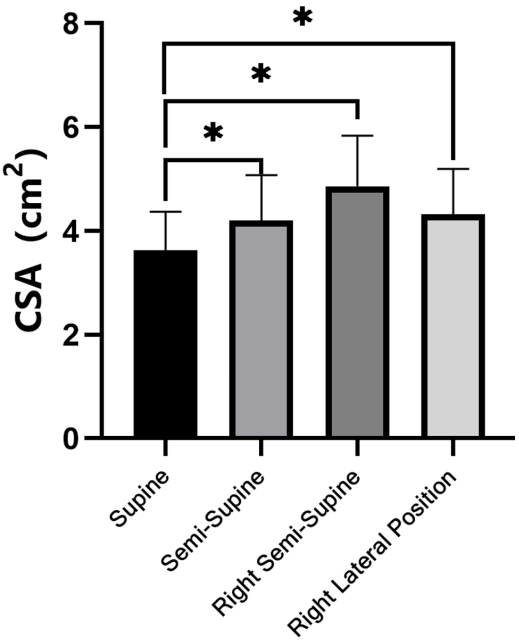

Figure 5: Statistical results of supine and other lying positions within Group B

Tab.2 compares the incidence of vomiting between two groups

Group	n	Vomiting (Example)	Vomiting rate (%)
A	45	1	2.22
B	45	2	4.44

Tab.3 Comparison of pH values, gastric juice attraction, and time interval T between two groups of gastric juice

Group	Example	Gastric Juice PH(average)	Gastric Juice Suction Volume (ml)	Time Interval T(min)
A	45	2.27±1.04	21.76±24.55	11.87±2.84
B	45	2.45±1.27	25.19±27.94	12.18±2.47
t		0.80	1.42	0.55
P		0.4257	0.1602	0.58058

4 Discussion

Bedside ultrasound examination is a non-invasive tool for measuring gastric contents and gastric volume. Despite the recommended fasting regimen, a considerable proportion of surgical patients may not be fasting. Research has found that the amount of gastric juice is very low on an empty stomach, and it can be rapidly secreted and increased after eating. Therefore, the amount of gastric juice, to some extent, reflects the amount of gastric content[3]. Ultrasound measurement helps anesthesiologists better predict the risk of aspiration and make early decisions to choose anesthesia plans and airway management for patients, minimizing complications such as reflux aspiration.

Lung aspiration is a serious complication of anesthesia, and the mortality rate increases with an increase in inhalation volume or when the gastric contents have a pH value <2.5[6]. Lung aspiration is associated with a significant incidence and mortality rate of complications; therefore,

prevention is a key component of anesthesia practice, which is most prominently reflected in preoperative fasting guidelines[7-8]. After the use of drugs in this study, the mean pH of Group A was 2.27 ± 1.04, and the mean pH of Group B was 2.45 ± 1.27. Both groups had pH values less than 2.5. Once aspiration occurs, the risk level increases. Therefore, it is necessary to strengthen monitoring of gastric volume and fasting management for prevention.

The guidelines of the American Society of Anesthesiologists (ASA) suggest that patients undergoing gastroscopy should abstain from fried, high-fat, and meat foods for 8 hours, formula milk, milk, and easily digestible meals for 6 hours, and water for 2 hours before anesthesia, to ensure a high-definition gastroscopy view and reduce the risk of gastric contents reflux during the procedure. There are few reports on the risk assessment of anesthesia aspiration by consuming 50 ml of streptomycin granules and 10 ml of dacron gel 30 minutes before examination.

A study has reported the use of ultrasound to evaluate residual gastric fluid during anesthesia in patients undergoing elective surgery, indicating that a semi-seated or right lateral position is the optimal position for evaluating the gastric antrum and body (distal end of the stomach) for gastric fluid and low gastric volume[7-8]. Especially, the right lateral position has a stronger correlation between CSA and gastric volume[9]. This study measured the cross-sectional area (CSA) of the gastric antrum in the right lateral position of two groups of patients using ultrasound. The results showed that there was a statistically significant difference ($P<0.05$) between Group A's right lateral position CSA of 3.94 ± 0.69 cm^2 and Group B's right lateral position CSA of 4.32 ± 0.87 cm^2.

Ultrasound measurement was used to calculate the gastric volume (GV right) in the right supine position of two groups of patients. The results showed that the GV of Group A was 27.36 ± 18.01 ml, and the GV of Group B was 36.98 ± 17.86 ml. The T-test showed P=0.0127, and the comparison between the two groups was statistically significant. The GV/W of Group A is 0.46 ± 0.33 ml/kg, while that of Group B is 0.61 ± 0.37 ml/kg. According to the T-test results of two samples, P=0.0469, indicating statistical significance between the two groups. Individuals with a GV/W greater than 1.5 ml/kg are classified as having a "dangerous stomach" that may cause reflux aspiration (adult, non-pregnant, right lateral position, BMI □ 40 kg/m^2, GV □ 100 ml)[10-11]. The results of this study showed that both GV/W were less than 1.5 ml/kg. Therefore, although there were differences in CSA and GV (right) between the two groups, they were within the safe range.

This study used surface ultrasound to detect the cross-sectional area of the gastric antrum, combined with a formula method to calculate the gastric volume, and measured the amount of fluid attracted through gastroscopy, providing an accurate reference for clinical anesthesia. In this study, the gastric juice suction time and the time interval T for gastric antral ultrasound examination were 11.87 ± 2.84 minutes and 12.18 ± 2.47 minutes, respectively. The gastric juice suction volume was 21.76 ± 24.55 ml and 25.19 ± 27.94 ml, respectively. Both had a low risk of aspiration, but had poor correlation with CSA, GV, and GV/W. Considering their correlation with the time interval between gastroscopy and ultrasound examination in clinical studies, further research can be conducted on the correlation between gastric juice extraction immediately after gastric antral ultrasound examination is completed.

The aim of this study is to evaluate the effect of oral administration of Dacron emulsion and Streptomycin granules on the volume of gastric contents in painless gastroscopy anesthesia patients, to speculate on the risk of anesthesia reflux aspiration. Through clinical observation and data analysis, we have discovered some noteworthy results that have certain implications for clin-

ical practice and future research.

4.1 The Effect Of Oral Administration of Daclonine Syrup And Streptomycin Granules on The Volume of Gastric Contents

The results of this study indicate that oral administration of Dacron emulsion and Streptomycin granules did not significantly increase the volume of gastric contents in patients undergoing painless gastroscopy anesthesia. Although there were differences in gastric volume and antral cross-sectional area between the two groups of patients, the risk of aspiration was low. This result is consistent with our initial hypothesis, indicating that oral administration of Dacron emulsion and streptomycin granules has a relatively small impact on gastric contents volume 30 minutes before anesthesia.

4.2 Clinical Significance And Application Value

The findings of this study are of great significance for clinical practice. Gastroscopy is a common clinical examination method, but the risk of reflux aspiration during anesthesia has always been a focus of concern for doctors and patients. The clarity and success rate of gastroscopy can be effectively improved by selecting oral administration of Dacron emulsion and Streptomycin granules. This discovery provides clinical doctors with a safe and effective drug treatment option, which helps improve the patient's treatment experience and medical quality.

4.3 Potential Biological Mechanisms

Although this study did not delve into the biological mechanisms of oral Daclonine mucilage and Streptomycin granules, we can gain some insights from existing studies. Dacron gel may reduce the accumulation of gastric contents by increasing the viscosity of the gastric mucus layer and promoting gastric motility, while streptomycin particles may achieve similar effects by promoting protein digestion and increasing gastrointestinal peristalsis. These biological mechanisms may help explain the impact of oral administration of these two drugs on gastric contents volume, but further research is needed to confirm.

4.4 Research Limitations And Future Prospects

There are some limitations in this study that need to be overcome in future research. Firstly, the sample size used in this study is relatively small, which may affect the stability and reliability of the results. Future research can expand the sample size and improve the reliability of research results. Secondly, this study adopted a single-center prospective design, targeting ASA grade I-II patients, excluding special patients with a history of organic digestive system diseases; therefore, this study still has limitations for special patients, and there are still many questions to be answered in the future. It is still necessary to strengthen the monitoring and management of special patients. There may be regional and population-specific differences that limit the generalizability of the research results. Future research can adopt a multicenter design to further validate the stability and reliability of research results. In addition, this study only observed the effect of oral administration of Dacron emulsion and Streptomycin granules on gastric contents volume and

did not observe other clinical outcomes. Future research can take a broader perspective to observe the impact of oral administration of these two drugs on other clinical outcomes, in order to comprehensively evaluate their application value in clinical practice.

In summary, it is feasible to use ultrasound to measure the cross-sectional area of the gastric antrum (CSA) and calculate the amount of gastric fluid to predict the risk of vomiting, reflux, and aspiration. Oral administration of 60 ml and 10 ml of liquid 30 minutes before gastroscopy has a different effect on gastric volume, but the risk of aspiration is lower and both are safe.

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