Original Article

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Anaesthesia Section

Comparison of Gastric Residual Volume using Ultrasound in Diabetic and Non-diabetic Fasting Surgical Patients: A Prospective Observational Study

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ABSTRACT

Introduction: Standard preoperative fasting guidelines may not be applicable to patients with co-morbidities such as diabetes mellitus due to delayed gastric emptying. Point-of-care ultrasonography allows assessment of Gastric Residual Volume (GRV) and may help predict the risk of pulmonary aspiration.

Aim: To compare GRV in fasting diabetic and non-diabetic patients undergoing elective surgery using ultrasonography.

Materials and Methods: The present prospective observational study was conducted over a period of 18 months, from January 2020 to June 2021 at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India, included 30 diabetic patients with a disease duration of ≥10 years (Group D) and 30 non-diabetic patients (Group ND) undergoing elective surgery under General Anaesthesia (GA). Preoperative gastric ultrasonography was performed to assess antral dimensions and gastric contents in the Right Lateral (RL) and Semi-Sitting (SS) positions, and GRV was calculated. Gastric aspirate volume obtained via an orogastric tube was also recorded. Data were analysed using independent t-tests and Chi-square or Fisher's exact tests with Statistical Package for Social Sciences (SPSS) version 21.0.

Results: Groups ND and D were comparable with respect to sex (p=0.426), age (55.6±5.6 vs. 57.8±3.8 years), and Body Mass Index (BMI) (22.2±1.8 vs. 21.6±1.8 kg/m²; p=0.189), but differed significantly in American Society of Anesthesiologists (ASA) physical status (ND: ASA I; D: ASA II; p<0.0001). Qualitative antral grading differed significantly between the groups in both the RL (empty/fluid/solid: 83.3/16.7/0% vs. 26.7/63.3/10%; p<0.0001) and SS positions (96.7/3.3/0% vs. 53.3/46.7/0%; p=0.0002). Diabetic patients had significantly higher antral Cross-Sectional Area (CSA) and calculated GRV in both the RL position (CSA: 10.9±0.9 vs. 6.7±1.9 cm²; GRV: 112.2±12.2 vs. 53.2±30.1 mL) and the SS position (CSA: 8.3±1.8 vs. 4.3±1.4 cm²; GRV: 180.2±5.8 vs. 164.7±10 mL) (all p<0.0001). Gastric aspirate volume was significantly higher in diabetic patients (8.4±4.8 vs. 1.6±2.4 mL; p<0.0001). A significant correlation was observed between aspirated gastric volume and calculated GRV in the RL position in both diabetic (r=0.633) and non-diabetic patients (r=0.874) (p≤0.0002).

Conclusion: Diabetic patients demonstrated significantly higher antral CSA, GRV, and aspirated gastric volume compared to non-diabetic patients, indicating an increased risk of pulmonary aspiration. Bedside gastric ultrasonography is a useful tool for assessing gastric volume and may aid in guiding safer anaesthetic management in this high-risk population.

Keywords: Anaesthesia, Aspiration pneumonia, Gastric antrum, Gastric suction, Gastroparesis, General surgery

INTRODUCTION

Standard preoperative fasting guidelines issued by the American Society of Anesthesiologists (ASA) are designed to minimise the risk of pulmonary aspiration of gastric contents. However, these guidelines may not be applicable to patients with comorbid conditions known to impair gastric emptying [1].

Diabetes mellitus is one such condition in which gastric emptying may be delayed despite adherence to recommended fasting durations. Diabetic patients frequently exhibit delayed gastric emptying and increased gastric residual volume, primarily due to diabetic gastroparesis-an autonomic neuropathy that most commonly develops in individuals with long-standing diabetes of more than 10 years' duration [2]. Importantly, the majority of patients with diabetic gastroparesis are either asymptomatic or present with atypical, non-specific symptoms [3]. Consequently, reliance on clinical symptoms alone to identify patients at risk of increased GRV is unreliable.

Delayed gastric emptying in diabetic patients increases the risk of regurgitation and pulmonary aspiration, particularly under general anaesthesia, where protective airway reflexes are compromised [1]. Even during regional anaesthesia, nausea and vomiting-often exacerbated by increased GRV-may predispose patients to aspiration if airway protection becomes inadequate [4].

Gastric ultrasonography has emerged as a valuable, non-invasive, bedside tool for real-time qualitative and quantitative assessment of gastric contents [5-7]. The gastric antrum is particularly well suited for ultrasonographic evaluation because of its superficial location in the epigastric region and its dependent position within the stomach, allowing reliable visualisation and measurement [5,8]. Several studies have validated the use of antral Cross-Sectional Area (CSA) as a surrogate marker for estimating GRV, and predictive mathematical models have been proposed [5,8,9].

Perlas A et al., described a validated model for estimating GRV in the RL position, which is considered the most accurate for quantitative assessment [9]. Bouvet L et al., proposed an alternative model in the SS position, which, although less precise than the RL position, may be advantageous in clinical situations where lateral positioning is inconvenient or impractical, such as in patients with trauma, obesity, or limited mobility [10]. Both the RL and SS positions have been recommended for gastric antral assessment, as they facilitate gravitational pooling of gastric contents into the dependent antral region, thereby improving detection and quantification [6,8].

Despite the expanding literature supporting gastric ultrasonography, several important gaps remain. Many studies have evaluated heterogeneous surgical populations [11,12], whereas studies focusing specifically on diabetic patients are limited. Investigations assessing fasting diabetic surgical patients are few, and reported GRV values show considerable variability [7,13-17]. Some studies have used the supine position for assessment, which is less reliable for GRV estimation due to inadequate gravitational redistribution of gastric contents [13,15,18,19].

Furthermore, the duration of diabetes-a critical determinant of autonomic dysfunction and delayed gastric emptying-has varied widely across studies, with several including patients with short or unspecified disease duration [12,14-16], potentially underestimating the true burden of increased GRV in chronic diabetes [18]. In addition, many studies have relied solely on ultrasonographic estimates without correlating calculated GRV with aspirated gastric volumes, thereby limiting validation of ultrasound-derived measurements [15,16,18,19].

These methodological inconsistencies hinder accurate aspiration-risk stratification in diabetic patients and limit the generalisability of existing evidence. There is a clear need for studies focusing on well-defined diabetic populations with long-standing disease, employing validated ultrasonographic positions, and correlating calculated GRV with actual aspirated gastric volumes. Accordingly, the present study was undertaken to address these gaps by evaluating fasting surgical patients with diabetes of at least 10 years' duration, irrespective of symptoms suggestive of gastroparesis. The primary objective was to compare ultrasonographically assessed GRV between diabetic and non-diabetic patients in the RL position. Secondary objectives included assessment in the SS position and evaluation of the correlation between ultrasonographically calculated GRV and aspirated gastric volume.

MATERIALS AND METHODS

The present prospective observational single-centre study was conducted over a period of 18 months, from January 2020 to June 2021, at Vardhman Mahavir Medical College and Safdarjung Hospital, New Delhi, India, a tertiary care teaching institution. Ethical approval was obtained from the Institutional Ethics Committee (IEC/VMMC/SJH/Thesis2019/10-20), and the study was registered with the Clinical Trials Registry of India (CTRI/2019/12/022575).

Sample size calculation: In a study by Sabry R et al., the observed median {Interquartile Range (IQR)} of GRV determined using ultrasonography in the RL position was 200 mL (111-306 mL) in diabetic patients and 95 mL (63-123 mL) in non-diabetic patients [7]. Based on these values, the minimum required sample size for each study group was calculated to be 27 patients, assuming a study power of 95% and a significance level of 5%.

For sample size estimation, the mean was approximated from the median, and the Standard Deviation (SD) was derived using the formula:

SD=IQR/1.35

For comparing the mean of two groups:

$$N \geq \frac{2\times (\text{Standard deviation})^2 \times (Z\alpha+Z\beta)^2}{(\text{Mean difference})^2}$$

Using the formula for comparing two means with $Z\alpha=1.96$, $Z\beta=1.645$, ($Z\alpha$=Z at the two-sided alpha error of 5% and $Z\beta$=Z at the power of 95%)

Pooled Standard Deviation (SD) $=\mathrm{Sqrt}\ (((S1)^2+(S2)^2)/2)$

Where, S1 SD of 1 group

And S2 is SD of the other group.

Control group: Mean=95, SD=(123-63)/1.35=44.44

Diabetes group: Mean=200, SD=(306-111)/1.35=144.44

Pooled SD=sqrt $(((44.44)^2+(144.44)^2)/2)=106.86$

$$N \geq \frac{2((106.86)^2\times(1.96+1.645)^2)}{(105)^2}$$

$\geq 26.92=27$ (approx.)

Inclusion criteria: After screening 84 patients, 60 consenting adults aged 40-80 years, with a BMI <35 kg/m², of either gender, and belonging to ASA physical status I or II were enrolled in the study.

Exclusion criteria: Patients with upper gastrointestinal morbidity, a history of upper abdominal surgery, liver or kidney disease, and pregnancy were excluded from both study groups.

Patients were categorised into two groups: Group D, comprising patients with diabetes of at least 10 years' duration, and Group ND, comprising non-diabetic patients belonging to ASA physical status I or II.

Study Procedure

All patients were kept fasting for eight hours and received tablet alprazolam 0.25 mg as premedication the night before and the morning of surgery with a sip of water. Premedications known to affect gastric Potential of Hydrogen (pH) or gastric volume, including Histamine-2 Receptor Antagonists (H_2) blockers and prokinetic agents, were omitted. In the preoperative holding area, ultrasonography (Sonosite) using a curvilinear low-frequency transducer (2-5 MHz) with standard abdominal settings was utilised to identify the gastric antrum in both the RL and SS positions. To eliminate inter-observer variability, all scans were performed by the primary investigator, who was blinded to the study group.

Based on its shape and contents, the gastric antrum was classified as empty (appearing flat with juxtaposed anterior and posterior walls), fluid-containing (appearing distended with thin walls and hypoechoic content), or solid-containing (appearing distended with contents of mixed echogenicity) [6]. The gastric antrum was measured for two diameters, D1 and D2, representing the Anteroposterior (AP) and Craniocaudal (CC) diameters, respectively. The antral CSA was calculated using the formula: $\varpi\times(D1\times D2)/4$ [6].

The GRV was calculated using equations based on the patient's scanning position. The equation described by Perlas A et al., was used for patients in the RL position:

GRV (mL)=27.0+14.6×RL CSA-1.28×age [9].

The equation described by Bouvet L et al., was used for patients in the SS position:

GRV (mL)=215+57×log CSA (mm²)-0.78×age (years)-0.16×height (cm)-0.25×weight (kg)-0.80×ASA [10].

The Van de Putte P and Perlas A et al., classification was used to assess aspiration risk: low risk was defined as an empty antrum or liquid contents with GRV <1.5 mL/kg, and high risk was defined as solid contents in the antrum or liquid contents with GRV >1.5 mL/kg [8].

Patients with a GRV <1.5 mL/kg or an empty gastric antrum underwent standard induction of General Anaesthesia (GA) with fentanyl 2 μg/kg, propofol 1-1.5 mg/kg, and vecuronium 0.1 mg/kg intravenously. Patients with a GRV >1.5 mL/kg or solid gastric contents received rapid sequence induction using succinylcholine 1.5 mg/kg for muscle relaxation. Following induction of GA and securing the endotracheal tube, the primary investigator, who was blinded to the study group, inserted an 18 French orogastric tube and aspirated gastric contents by applying gentle suction using a 50 mL syringe, along with concomitant epigastric massage and gentle in-and-out movement of the orogastric tube for 10 minutes.

Haemodynamic parameters-Heart Rate (HR), systolic blood pressure, diastolic blood pressure, Mean Arterial Pressure (MAP), oxygen saturation, and End-Tidal Carbon Dioxide ($EtCO_2$)-were recorded at baseline, induction, intubation, and at 1, 3, 5, and 10 minutes postintubation.

STATISTICAL ANALYSIS

Quantitative variables were analysed using the independent t-test. Qualitative variables were analysed using the Chi-square test. Fisher's exact test was applied when the expected cell count was less than 5. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS), IBM Corp., Chicago, USA, version 21.0.

RESULTS

A total of 84 patients aged 40-80 years, belonging to ASA physical status I and II and scheduled for elective surgery under general anaesthesia, were screened. Sixty consenting patients who fulfilled the inclusion criteria were included for assessment of gastric residual volume using gastric ultrasonography.

The two study groups were demographically and anthropometrically comparable, except for ASA physical status [Table/Fig-1]. Ultrasonographic assessment of the gastric antrum in the RL position is shown in [Table/Fig-2]. The majority of patients in Group ND, 25 (83.3%), had an empty antrum, whereas the majority of patients in Group D, 19 (63.3%), had a fluid-containing antrum. An antrum with solid contents was observed in 3 (10%) patients in Group D, while no patient in Group ND demonstrated solid gastric contents.

Parameters	Group ND (n=30)	Group D (n=30)	p-value
Age (years)	55.6±5.5	57.8±3.8	0.079*
Gender: Male/Female	17/13	20/10	0.426***
ASA physical status class I/II	30/0	0/30	<0.0001**
Height (cm)	162.5±6.7	162.0±5.3	0.782*
Weight (kg)	58.7±7.5	56.5±4.4	0.181*
Body mass index (kg/m²)	22.2±1.8	21.6±1.8	0.189*

[Table/Fig-1]: Demographic and anthropometric parameters.
Values are (Mean±SD), Numbers; Significance threshold, p<0.05; *Independent t-test, **Fisher's-exact test, ***Chi-square test

Parameter	Group ND (n=30)	Group D (n=30)	p-value
Gastric antrum appears: Empty/ Fluid/ Solid	25(83.3)/5(16.7)/0 (0)	8(26.7)/19 (63.3)/3(10)	<0.0001**
Antero-posterior diameter (cm)	3.6±0.6	4.6±0.2	<0.0001*
Cranio-caudal diameter (cm)	2.3±0.4	3.0±0.2	<0.0001*
Antral Cross-Sectional Area (CSA) (cm²)	6.7±1.9	10.9±0.9	<0.0001*
Gastric Residual Volume (GRV) (mL)	53.2±30.1	112.2±12.2	<0.0001*

[Table/Fig-2]: Ultrasonographic assessment of gastric antrum in the RL position.
Values are Mean±SD, Numbers (percent); Significance threshold, p<0.05; *Independent t-test, **Fisher's-exact test

The mean AP and CC diameters were significantly greater in Group D compared to Group ND (p<0.0001 and p<0.0001, respectively). The calculated mean antral CSA and GRV were also significantly higher in Group D than in Group ND (p<0.0001 and p<0.0001, respectively).

In the supine (SS) position, ultrasonographic assessment of the gastric antrum is shown in [Table/Fig-3]. In Group ND, 29 (96.7%) patients had an empty antrum compared to 16 (53.3%) patients in Group D. The mean AP and CC diameters were significantly higher in Group D than in Group ND (p<0.0001 and p<0.0001, respectively). The calculated mean antral CSA and GRV were also greater in Group D compared to Group ND (p<0.0001 and p<0.0001, respectively). The mean aspirated gastric volume was significantly higher in Group D compared to Group ND (8.4±4.8 mL vs. 1.6±2.4 mL, respectively; p<0.0001). A significant correlation was observed between aspirated and calculated GRV in the RL position in both Group ND (r=0.874, p<0.0001) and Group D (r=0.633, p=0.0002) [Table/Fig-4,5]. A similar correlation was noted in the SS position in Group ND (r=0.749, p<0.0001); however, no such correlation was observed in Group D (r=0.076, p=0.688) [Table/Fig-4,5].

Parameters	Group ND (n=30)	Group D (n=30)	p-value
Gastric antrum appears Empty/ Fluid/ Solid	29(96.7)/1 (3.3)/0(0)	16 (53.3)/14 (46.7)/0(0)	0.0002**
Antero-posterior diameter (cm)	2.9±0.5	4.0±0.4	<0.0001*
Cranio-caudal diameter (cm)	1.9±0.4	2.6±0.4	<0.0001*
Antral Cross-Sectional Area (CSA) (cm²)	4.3±1.4	8.3±1.8	<0.0001*
Gastric Residual Volume (GRV) (mL)	164.7±10	180.2±5.8	<0.0001*

[Table/Fig-3]: Ultrasonographic assessment of gastric antrum in the SS position.
Values are (Mean±SD), Numbers (percent); Significance threshold, p<0.05; *Independent t-test, **Fisher's-exact test

Variables	GRV (mL) in SS position	GRV (mL) in RL position
Aspirated gastric volume (mL)		
Correlation coefficient	0.749	0.874
p-value	<0.0001	<0.0001

[Table/Fig-4]: Correlation of GRV (mL) in semi -sitting and RL position with aspirated gastric volume (mL) in Group ND.
Spearman rank correlation coefficient

Variables	GRV (mL) in SS position	GRV (mL) in RL position
Aspirated gastric volume(mL)		
Correlation coefficient	0.076	0.633
p-value	0.688	0.0002

[Table/Fig-5]: Correlation of GRV (mL) in SS and RL position with aspirated gastric volume(mL) in Group D.
Spearman rank correlation coefficient

Aspiration risk estimated using ultrasonography in the RL position [Table/Fig-6] was significantly higher in diabetic patients compared to non-diabetic patients (p<0.00001). Haemodynamic parameters, including HR (all p>0.05) [Table/Fig-7], MAP (all p>0.05) [Table/Fig-8], Oxygen Saturation (SpO_2; all p>0.05) [Table/Fig-9], and $EtCO_2$ (all p>0.05) [Table/Fig-10], remained within normal physiological limits at all measured time points and were comparable between the two groups. The $EtCO_2$ values recorded at baseline and during induction were relatively low, likely due to inadequate airway carbon dioxide sampling caused by an imperfect mask seal during these phases.

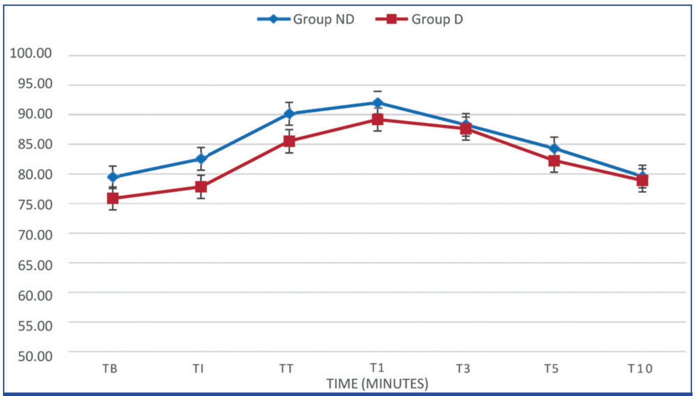
Study group	Low-risk	High-risk	p-value
Group ND (n=30)	26 (86.7)	4 (13.3)	p<0.00001**
Group D (n=30)	8 (26.7)	22 (73.3)	

[Table/Fig-6]: Aspiration risk as estimated by ultrasonography in RL position.
Values are Numbers (percent); Significance threshold, p<0.05; **Fisher's-exact test

DISCUSSION

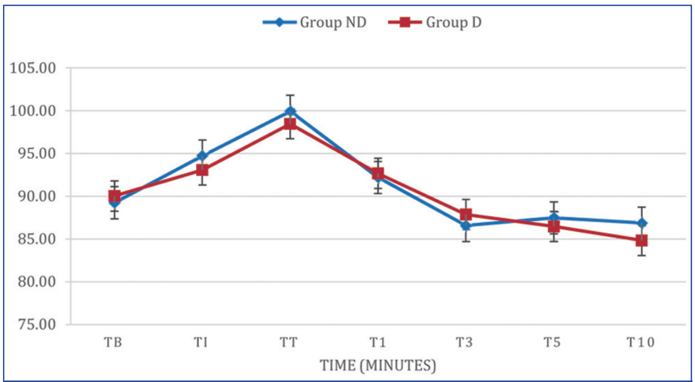
The present study demonstrated a significant difference in the appearance of antral contents between diabetic and non-diabetic patients in both the RL (p<0.0001) and supine (SS) (p=0.0002) positions. Following an eight-hour fasting period, diabetic patients exhibited significantly higher gastric residual volumes than non-diabetic patients in both positions (all p<0.0001), along with a greater volume of aspirated gastric contents (p<0.0001). The aspirated gastric volume showed a strong correlation with the calculated GRV in the RL position in both diabetic (r=0.633, p=0.0002) and non-diabetic patients (r=0.874, p<0.0001).

Qualitative ultrasonographic assessment revealed that most non-diabetic patients had an empty antrum in both the RL {25 (83.3%)} and SS {29 (96.7%)} positions. In contrast, the majority of diabetic patients demonstrated fluid-filled antra {19 (63.3%)



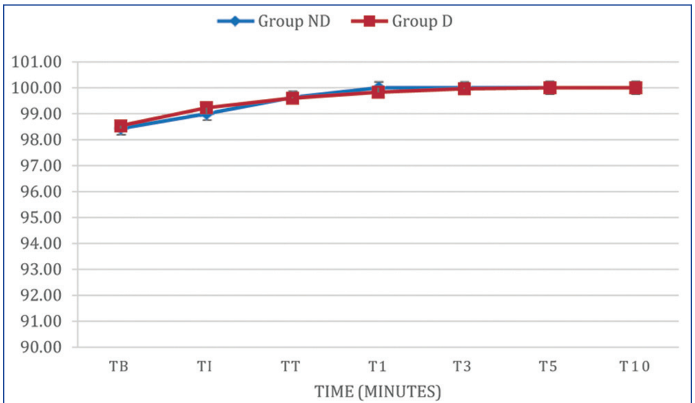
[Table/Fig-7]: Comparison of HR (bpm) at different time points between groups ND and D.

TB - Baseline; TI - Induction; TT - Tracheal intubation; T1, T3, T5, T10 are post intubation times at 1, 3, 5 and 10 minutes, respectively; Independent t-test showed no statistically significant difference between groups ND and D at time points TB (p=0.825), TI (p=0.639), TT (p=0.314), T1 (p=0.627), T3 (p=0.955), T5 (p=0.144) and T10 (p=0.589)



[Table/Fig-8]: Comparison of MAP at different time points between groups ND and D.

Independent t-test showed that there was no statistically significant difference between Groups ND and D at time points TB (p=0.696), TI (p=0.333), TT (p=0.386), T1 (p=0.788), T3 (p=0.443), T5 (p=0.471) and T10 (p=0.091)

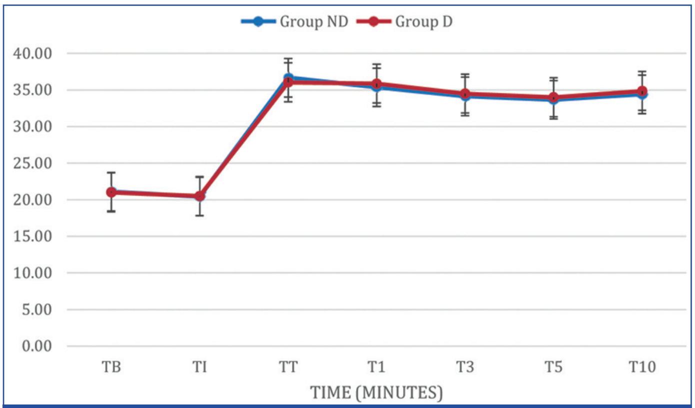


[Table/Fig-9]: Comparison of SpO_2 at different time points between Groups ND and D.

SpO_2 values were comparable between the ND and D groups at all time points, with no episodes of desaturation observed. Mann-Whitney U test showed no statistically significant intergroup differences at any time point (TB p=0.784; TI p=0.367; TT p=0.842; T1 p=0.057; T3 p=0.326; T5 p=1.000; T10 p=1.000).

in the RL position and 14 (46.7%) in the SS position}. Solid gastric contents were identified in 10% of diabetic patients in the RL position, classifying them as high aspiration risk, whereas none of the non-diabetic patients demonstrated solid gastric contents. These findings are consistent with previous reports describing a higher prevalence of solid gastric contents in diabetic patients [7,20].

Diabetic patients also exhibited significantly larger antral CSA in both scanning positions, reflecting greater gastric volumes, in agreement with earlier studies [7,11]. In the present study, calculated GRV was significantly higher in diabetic patients than in non-diabetic patients in both the RL position (112.2±12.2 mL vs. 53.2±30.1 mL) and the SS position (180.2±5.8 mL vs.



[Table/Fig-10]: Comparison of End-Tidal Carbon Dioxide ($EtCO_2$) at different timepoints between groups ND and D.

Mann-Whitney test showed that there was no statistically significant difference between Groups-ND and D at time points TB (p=0.84), TI (p=0.887), TT (p=0.225), T1 (p=0.316), T3 (p=0.143), T5 (p=0.164) and T10 (p=0.068)

164.7±10 mL; all p<0.0001). Similar trends have been reported by Sabry R et al., and several Indian studies, although absolute GRV values varied considerably [7,13-16]. This variability likely reflects differences in patient populations, fasting durations, ultrasonographic techniques, and GRV prediction equations.

Sharma G et al., reported that patients with conditions impairing gastric emptying, such as diabetes mellitus, are more likely to retain unsafe gastric contents [11]. They also demonstrated higher GRVs in patients fasted for 10-15 hours compared with those fasted for 6-10 hours, suggesting that prolonged fasting may paradoxically increase gastric volume and acidity despite adherence to fasting guidelines [11,21]. However, conflicting evidence exists; Perlas A et al., observed comparable baseline gastric volumes in fasting diabetic and non-diabetic patients [17]. These discrepancies underscore the value of point-of-care gastric ultrasonography for directly assessing gastric residual volume in patients at risk of delayed gastric emptying, rather than relying solely on prolonged fasting.

Although antral CSA was consistently greater in the RL position, calculated GRV was higher in the SS position. This difference is likely attributable to the use of distinct GRV prediction models. The Bouvet equation, applied in the SS position, incorporates multiple covariates, including age, height, weight, and ASA physical status, whereas the Perlas equation, used in the RL position, includes age alone [9,10].

The aspirated gastric volume was significantly higher in diabetic patients than in non-diabetic patients and correlated with the calculated GRV in the RL position. Sabry R et al., similarly demonstrated a strong correlation between nasogastric aspirate volume and antral CSA in both the supine and RL positions (Spearman's r=0.933 and 0.951, respectively) [7]. In the SS position, a correlation between aspirated volume and GRV was observed in non-diabetic patients but not in diabetic patients.

Aspirated volumes were consistently lower than calculated GRV, likely due to continued gastric emptying between ultrasonographic assessment and aspiration, as previously reported by Mohammad Khalil A et al., [22]. In addition, aspirated volumes are influenced by suction technique, tube size and positioning, and the consistency of gastric contents, making gastric suctioning an unreliable surrogate for true GRV estimation [23-25].

Using established ultrasound-based criteria-an empty antrum and GRV <1.5 mL/kg indicating low aspiration risk, and solid contents or GRV >1.5 mL/kg indicating high aspiration risk [7]-73.3% of diabetic patients were classified as high risk compared with 13.3% of non-diabetic patients (p<0.00001). Comparable findings have been reported by Sabry R et al., and other Indian studies using Perlas grading [7,13,19]. In contrast, Haramgatti A et al., reported a low aspiration risk in all patients [14]. Van de Putte P et al., demonstrated that a small proportion of fasted elective surgical patients may still present with a full stomach despite adherence to fasting guidelines, often in the absence of identifiable risk factors [26].

Although gastric volume and pH are commonly used surrogate markers of aspiration risk, their direct correlation with anaesthesia-related aspiration in humans remains unproven [27]. Furthermore, the optimal GRV threshold for defining high risk remains debated, with some evidence suggesting that volumes up to 20 mL/kg may be physiologically tolerated [28].

No intraoperative haemodynamic or respiratory instability-such as desaturation, tachycardia, hypo or hypertension, or an increase in $EtCO_2$ suggestive of aspiration-was observed in any patient. This may be attributed to the use of rapid sequence induction in patients identified as high risk for aspiration on antral ultrasonography, ensuring prompt and secure airway control. In contrast, several previous studies did not specify the induction technique or systematically evaluate intraoperative parameters, although no aspiration events were reported [6,13,22,26]. Additionally, some authors did not clearly report whether general anaesthesia was administered to patients identified as high risk for aspiration [11-13,15,16,20].

Overall, the present study reinforces the value of point-of-care gastric ultrasonography for individualised aspiration risk assessment, particularly in diabetic patients. The RL position appears optimal for both qualitative and quantitative evaluation of the gastric antrum, while the SS position remains a practical alternative when RL positioning is not feasible.

Limitation(s)

The present study has several limitations. First, the actual fasting duration may have exceeded eight hours in some patients due to unavoidable changes in surgical scheduling, which could have influenced the results. Second, pregnant women and patients with other conditions known to delay gastric emptying were not included, limiting the generalisability of the findings. Third, gastric emptying time was not assessed in patients with increased GRV; future studies evaluating gastric emptying in this subgroup may help refine fasting protocols for diabetic patients.

CONCLUSION(S)

The current study indicates that diabetic patients have consistently higher antral CSA, GRV, and aspirated gastric volumes than non-diabetic patients, irrespective of scanning position, suggesting a higher aspiration risk under current fasting guidelines. Bedside gastric ultrasonography is a simple and useful tool for assessing gastric volume and guiding safe anaesthetic management in these patients. However, the present study did not evaluate whether an increased aspiration risk identified on gastric ultrasonography translates into a higher incidence of clinically significant aspiration during anaesthesia.

Declaration: The abstract of the current study has been published previously.

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