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RESEARCH ARTICLE

"STUDY TO COMPARE FASTING GASTRIC VOLUME USING ULTRASOUND IN DIABETIC AND NON DIABETIC PATIENTS POSTED FOR ELECTIVE SURGERIES"

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Abstract

Objective: To study the comparison of fasting gastric volume using ultrasound in diabetic and nondiabetic patients in elective surgeries. To compare the incidence of delayed gastric emptying in diabetic and nondiabetic after standard fasting guidelines

Material and Methods: After institutional ethical committee approval, CTRI registration and patient consent, prospective study was conducted in 30 diabetic and 30 non-diabetic patients aged 30-60years of American society of anesthesiologists- physical status I-III having similar fasting intervals. Pre operatively, quantitative assessments of gastric antrum in supine and right lateral decubitus (RLD) positions were performed using curvilinear probe in accordance to standard gastric scanning. USG grade, cross-sectional area (CSA) of the antrum and gastric volume were calculated. The gastric antrum was classified as Grade 0, 1 or 2, signifying empty antrum, fluid in RLD position only and antral fluid in both supine and RLD positions, respectively.

Results: The CSA of 2.35 ± 1.07 cm2 and 3.51 ± 1.4 cm2 in diabetic were significantly higher (P = 0.001) than 1.37 ± 0.32 cm2 and 2.19 ± 1.15 cm2 of control, in supine and RLD positions, respectively. GV was 3.85± 20.06 ml in control group and 6.5±23.51 ml in diabetic group.

Conclusion: Diabetic patients have higher gastric antral cross-sectional area and gastric volumes as observed by gastric ultrasound than the non-diabetic patients.

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Introduction:-

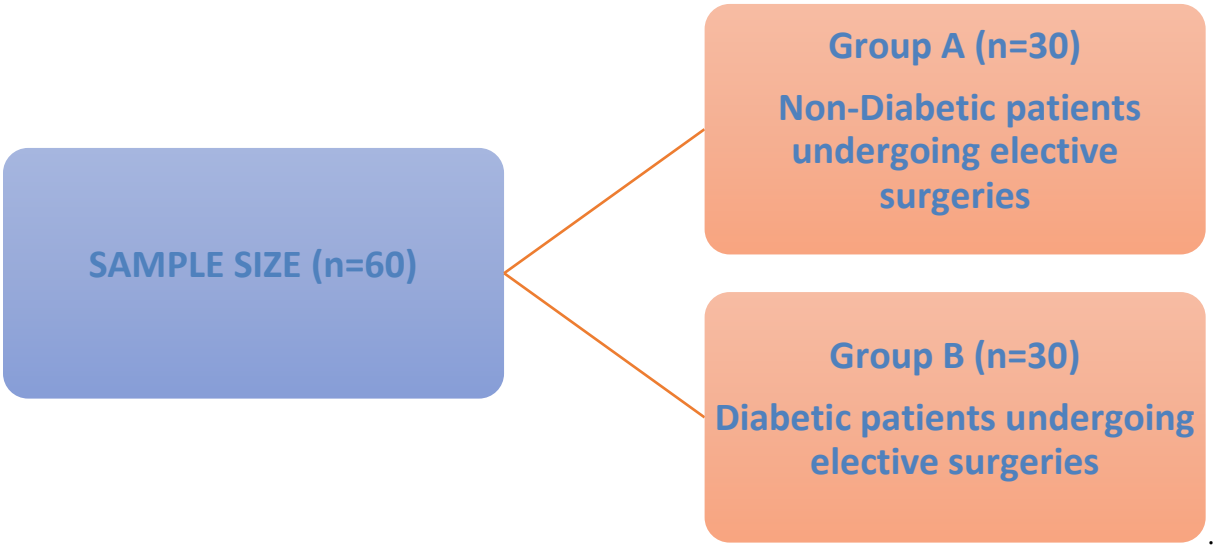
Fasting is a mandatory requirement prior to elective anaesthesia and is intended to reduce gastric fluid volume and the risk of aspiration of gastric contents and subsequent organ injury as it is a grave complication with significant morbidity and mortality. Diabetic patients have a higher incidence of autonomic dysfunction, causing gastropathy. They are known to have gastroparesis and the consequent delayed gastric emptying which predisposes them to an increased risk of aspiration than the general population. However, gastric ultrasound has emerged as an evaluative mechanism of gastric content in the setting of fasting as well as to confirm placement of gastric tubes.[1]

Currently, there is no consensus on what constitutes an adequate fasting interval in diabetic patients. European Society of Anaesthesiology (ESA) 2011 fasting guidelines state that diabetic patients can follow the same guidelines as healthy adults,[2] While American Society of Anesthesiologists (ASA) in 2017 fasting guidelines mentioned that the standard eight hours fasting may not apply or may need to be modified for patients with coexisting diseases or conditions that can affect gastric emptying or fluid volume.[3]

Ultrasound is widely available and has been proven to be a reliable, bedside assessment tool for real-time evaluation of gastric contents.[4,5,6,7] As diabetic patients are prone to have an inadequately empty stomach even after an adequate fasting, USG can be used in the preoperative room for screening the fasting gastric volume (GV) of diabetic patients and see if it is more than the recommended safe limit. There is no published literature evidence documenting a significant difference in real-time fasting gastric volume between the healthy and diabetic patients after following the same fasting guidelines. In the present study, ultrasonography (USG) was used to compare the fasting GV in diabetic and non-diabetic patients scheduled for elective surgery.

Methods:-

Study was conducted at Basaveshwar Teaching and General Hospital attached to Mahadevappa Rampure Medical college, Kalaburagi. The study was approved by the Institutional Ethics Committee. The study was conducted as per the principles of the Declaration of Helsinki. After receiving written informed consent, patients of both sexes, aged 30-60 years of ASA grade I to II and posted for elective surgery were enrolled for the study. Patient with history of drug/alcohol abuse, Patient with acute abdomen, Patient with other known gastric motility disorders, Patient on opioid/other sedative medication prior to surgery were excluded from the study.



The fasting status was assessed, and the duration of fasting interval noted. USG was done in the preoperative room. A curved array, low-frequency (2-5 MHz, 60 mm) transducer providing a scan depth up to 30 cm and a Micromaxx (C60e, US)™ sonosite machine was used. Patients were scanned in the supine position followed by right lateral decubitus (RLD) position. The sonographic appearance of the gastric antrum was classified as Grade 0,1 or 2, signifying empty antrum, fluid detected in RLD position only and antral fluid in both supine and RLD positions, respectively, based on the appearance in both the positions as defined by Perlas et al.[8] Cross-sectional area (CSA)

was calculated by using two perpendicular diameters—anteroposterior (AP) and craniocaudal (CC) and the formula for area of an ellipse:
CSA = (AP × CC × π)/4.[9]

The gastric volume was calculated using the previously validated formula:
GV (ml) = 27.0 + 14.6 × right-lat CSA − 1.28 × age.[10]

The sample size was calculated based on the model for case-control studies using methods of Kelsey, Fleiss, and Fleiss with a continuity correction, assuming a 25% incidence of gastroparesis in diabetics.[11,12,13] With a prediction of 90% power and an alpha error 0.05, 30 diabetic and 30 non-diabetic subjects were enrolled in the study. Age, height, weight, BMI, fasting interval, CSA of antrum and gastric volumes are presented as mean ± SD and analysed using unpaired Student t-test. Normality of the continuous data was checked applying the Kolmogorov-Smirnov test. Ultrasound grades were analysed with Chi-square test. Data analysis was done using SPSS Version 22.0 (IBM, USA) and Microsoft Excel 2010 (Microsoft, USA). All tests were two-tailed with 95% confidence interval and level of significance at 5% ($P < 0.05$).

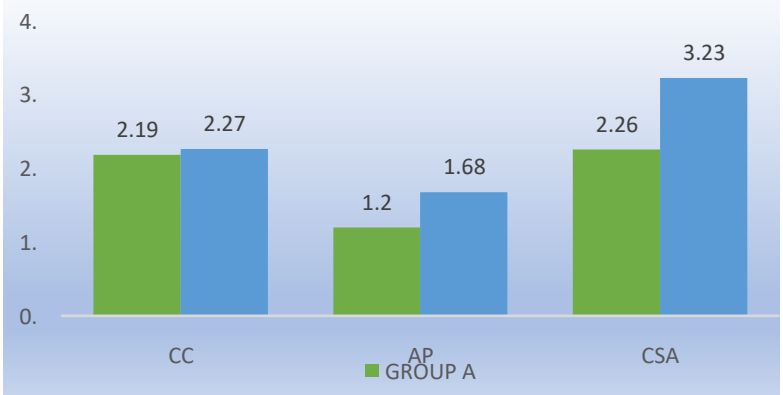
Results:-

A total of 30 patients were included in group A and 30 patients were in group B. The demographic data like age, gender, height, weight, BMI, ASA physical status in both the groups were comparable and not statistically significant Table 1

	Group	N	Mean	Std. Deviation	Std. Error Mean	T	P
AGE	GROUP A	30	48.045	10.376	2.212	-0.1386	0.890
	GROUP B	30	48.500	11.363	2.423		
WEIGHT (in Kg)	GROUP A	**30**	53.43	6.792	1.448	1.2021	0.236
	GROUP B	30	50.86	7.368	1.571		
HEIGHT (m)	GROUP A	30	1.48	0.082	0.017	0.7789	0.440
	GROUP B	30	1.47	0.060	0.013		
BMI	GROUP A	30	24.34	2.835	0.604	0.8073	0.424
	GROUP B	30	23.65	2.894	0.617		

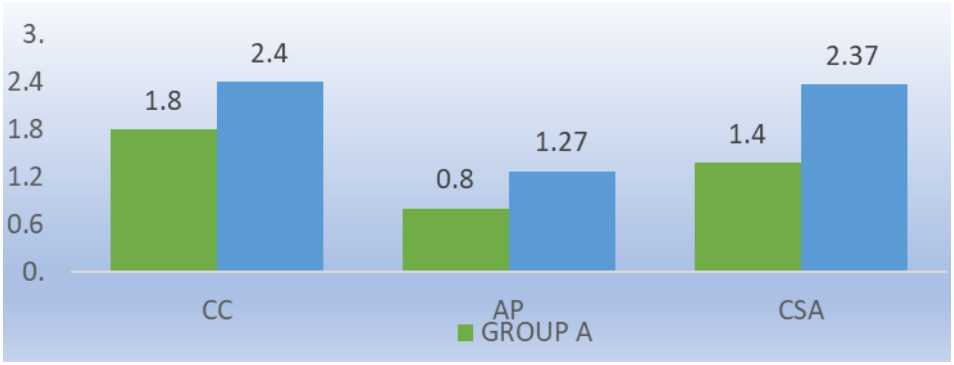
The diameters measured in the RLD position were as follows: group A illustrates the CC diameter of 2.19 +/- 0.48, AP diameter of 1.2 + 0.44, and CSA of 2.26 +/- 1.14, and in group B, the CC diameter was 2.47 +/- 0.51, AP diameter was 1.68 +/- 0.45 and CSA was 3.23 +/- 0.12. Among the groups, there was a significantly higher mean level of CC diameter, AP diameter, and CSA in group B when compared to group A ($p < 0.05$).

RLD	GROUP A	GROUPB
CC	2.19±0.48	2.47 ±0.51
AP	1.2±0.44	1.68 ±0.45
CSA	2.26±1.14	3.23 ±0.82



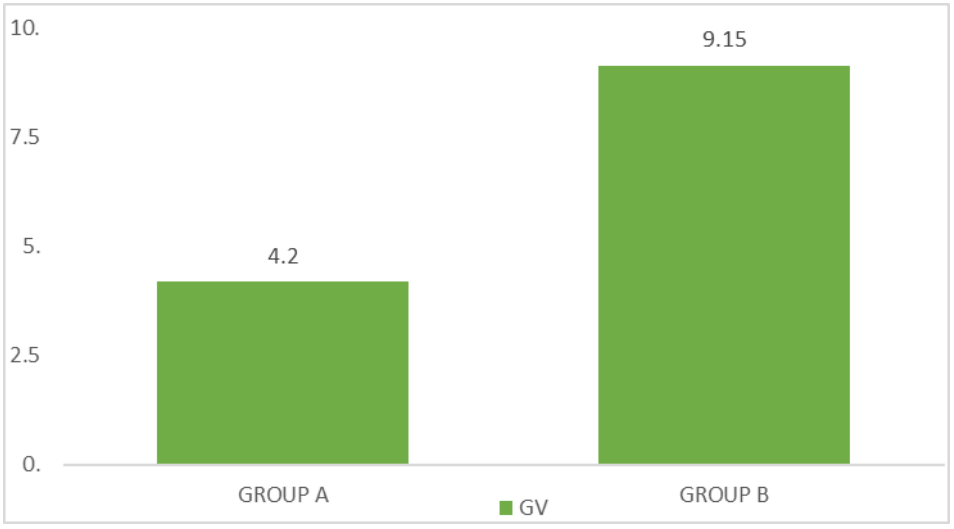
The diameters measured in the supine position were as follows: group A illustrates the CC diameter of 1.80 +/- 0.38 , AP diameter of 0.8 +/- 0.52, and CSA of 1.38 +/- 0.45, and in group B, the CC diameter was 2.4 +/- 0.39 , AP diameter was 1.27 +/- 0.51, and CSA was 2.37 +/- 0.82. Among the groups, there was a significantly higher mean level of CC diameter, AP diameter, and CSA in group B when compared to group A.

SUPINE	GROUP A	GROUPB
CC	1.80±0.38	2.4 ±0.39
AP	0.8±0.52	1.27 ±0.51
CSA	1.38±0.45	2.37 ±0.82



The calculated mean GV in RLD was 4.20 + 22.26 in group A whereas it was 9.15 + 25.70 in group B

	GROUP A	GROUP B
GV	4.20	9.15



Discussion:-

1. Diabetes mellitus is complex disease with metabolic syndrome with various microvascular and macrovascular complications. One of the silent, dreaded complication is Autonomic Neuropathy. Autonomic neuropathy causes gastroparesis, silent myocardial infarction, orthostatic hypertension.
2. Patient posted for surgery can have delayed gastric emptying because of autonomic neuropathy and also because of stress and pain.
3. **Camilleri et al**[18]. observed that delayed gastric emptying was the major highlight of DM
4. USG-guided quantification of gastric volume can alter the anesthetist to take that extra precaution to prevent it.
5. This study was conducted to show the volume of stomach before surgeries in diabetes mellitus and non-diabetes mellitus patients. Liberal fasting guidelines and enhanced recovery of surgery protocols aspiration was followed to minimise the aspiration risk.

6. Our study showed no statistical significance in terms of age, gender, height, weight, BMI, and ASA physical status in both the groups. Increased BMI can be an extra risk factor.
7. Perlas et al17. in a prospective study using GUS found that 86 of the 200 patients had no or minimal residual gastric volume. 7 patients had high GV of 180±83ml.
8. In a study by **Sharma et al**[19], There was a significantly higher mean level of measuring parameter in the supine position and RLD in diabetic patients compared to healthy controls ($p < 0.05$). The GV was significantly higher in cases (76.16 ± 4.18) compared to the controls (49.23 ± 2.95) in the study ($p < 0.05$).
9. This also discovered that fasting for 10 hours did not ensure an empty stomach in diabetics.
10. In our study, we considered fasting for 8 hours around 30 samples in diabetic patients of whom 10-12 of them had 15-20 ml more gastric volume as compared to the control group i.e., non-diabetic patients..
11. **Haramgatti et al**[20] documented that despite the disparity in CSA and GV among diabetic and non-diabetic groups, both revealed a minimal residual GV (<1.5 ml/kg). The NG tube aspirate in non-diabetic and diabetics was 0.3 ± 0.78 ml and 1.24 ± 1.46 ml, respectively, and the difference was significant
12. Assessing gastric volume by the USG even in emergency cases, especially in diabetics, can reduce the morbidity because of the risk of aspiration. Measures can be taken to empty stomach by using prokinetics or even passing a Rails tube to empty the gastric contents.
13. Patients with hiatus hernia, pain, trauma, and stress also can have increased gastric volume and thereby increase the risk of aspiration. Measures can be taken to empty the stomach by giving prokinetics or even by passing a Reyle's tube to empty the gastric contents.
14. Thus, our study intended to see that gastric ultrasound can be included in pre-anesthetic protocol to prevent the risk of aspiration and reduce mortality and morbidity, and hospital stay

Limitations of our study

1. The present study was conducted on ASA I and II and thus the results may not be extrapolated to patients with chronic disorders or who are on medications that alter the digestive system motility.
2. As with all ultrasound techniques, which are dependent on the equipment quality and also the operator, the antrum was not identifiable in all patients and multiple attempts needed to be performed to obtain reliable results in some of them.
3. Surgery itself is a stress factor and its influence on gastric motility has not been evaluated by studies so far.
4. The effect of obesity on fasting GV was not evaluated, as obesity coexists in diabetics and can be a confounding factor.

Conclusion:-

This prospective study of 60 patients suggests that diabetic patients have higher gastric antral cross-sectional area and gastric volumes as observed by gastric ultrasound than the non-diabetic patients, signifying delayed gastric emptying. While the qualitative grading may be used for screening, quantitative assessment provides a more reliable estimate of gastric volume.

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