

Original Research Article

Bon Appetite To Enterally Fed Diabetics! Novel Use Of Gastric Pocus in the ICU to Guide Enteral Nutrition**Sowmya M Jois^{1*}, Bhaskar Murthy², Rangalakshmi S³**¹*Assistant professor, Department of Anesthesiology, Rajarajeswari medical college, Bangalore, Karnataka, India*²*Junior Resident, Department of Anesthesiology, Rajarajeswari Medical College, Bangalore, Karnataka, India*³*Professor and HOD, Department of Anesthesiology, Rajarajeswari Medical College, Bangalore, Karnataka, India***Received: 09-03-2021 / Revised: 17-04-2021 / Accepted: 15-05-2021****Abstract**

Background: Feed intolerance is common in critically ill patients. Diabetic patients have decreased gastric motility, and therefore they are at high risk of feed intolerance. The traditional measurement of gastric residual volume by aspiration of the nasogastric tube can be inaccurate and requires interventions with its risk of infection in a patient who already has multiple comorbidities. In our study, we have compared ultrasound-guided calculation of gastric residual volume and the gastric residual volume by nasogastric tube aspiration in critically ill diabetic patients. **Materials and Methods:** This prospective study included 40 critically ill diabetic patients aged between 18 to 60 years who were on enteral feeding. Before giving the enteral feed, antral cross-sectional area (ACA) of the patient was assessed by ultrasound using 2 to 8MHz curvilinear probe in the right lateral position and also by the nasogastric tube aspiration method. **Results:** Gastric residual volume calculated by the ultrasound method was found to be greater than the traditional nasogastric tube aspiration method. **Conclusion:** Gastric residual volume calculated by ultrasound is greater than the gastric residual volume calculated by nasogastric tube aspiration. The use of ultrasound in critically ill diabetics helps to guide enteral feeding and to prevent the complications such as aspiration due to overfeeding and infection, thereby decreasing ICU stay.

Keywords: gastric, volume, point of care, diabetic

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Introduction

Enteral feeding in the critically ill maintains the structure and function of the gastrointestinal tract.[1,2,3] As per recent guidelines, enteral feeding has to be started early for all ICU patients.[4] Feeding intolerance is the most commonly recognized problem in enterally fed critically ill patients due to delayed gastric emptying.[2] The various causes of feeding intolerance include sepsis, head injury, drugs such as narcotics and catecholamines, polytrauma, hyperglycaemia, shock, and recent abdominal surgery.[2] Feed intolerance is more common in diabetic patients because of delayed gastric emptying.[5] Measurement of gastric residual volume by nasogastric tube aspiration method is considered as a useful surrogate for gastric emptying, but measurement can be inaccurate. Ultrasound guided measurement of antral cross-sectional area is non-invasive, reliable bedside evaluation, and is found to correlate well with gastric residual volume.[6,7] It is also easy to perform and requires very few measurements. In our study, we compared the ultrasound-guided gastric residual volume and gastric residual volume by nasogastric tube aspiration method in critically ill diabetic patients on enteral feeding.

The primary aim of our study was to compare gastric residual volume calculated using point of care ultrasound (POCUS) and by nasogastric tube aspiration method prior to nasogastric feeding. The secondary objective was to record complications such as

regurgitation, vomiting, bloating, and abdominal distension.

Methods

Our study was a prospective, comparative study that was done between July 2019 and September 2019. Institutional ethical committee approval was taken, and informed consent was obtained from patients enrolled in the study. Forty critically ill diabetic patients aged between 18 to 60 years requiring enteral feeds through nasogastric tubes and orogastric tubes in the intensive care unit were included in the study. Patients who had undergone gastric resection, gastric banding, patients with nasojejunal tubes, obese patients, patients with surgical emergencies, patients on sedatives, and pregnant women were excluded from the study. The prescription of energy to the patients was according to the standard weight-based formula of 30 kcal/kg. Protein requirement was fixed at 0.8-1.5g/kg based on the type and severity of the disease. Formula-based feeds were not given due to the low socioeconomic status of the patients coming to our hospital. In consultation with the nutritionist, served formula was ensured to meet the calorie requirement in the form of milk with protein formulation, egg, chicken broth, vegetable and dal soup which were provided by the hospital canteen. Before giving the first enteral feed in the morning, gastric residual volume was calculated by Point of care ultrasound (POCUS) done by an anesthesiologist trained in ultrasound not involved in the study. 2-5 MHz curvilinear probe was used in abdominal scan mode settings for performing gastric ultrasound. The patient was placed in the supine position. Scanning was done to identify gastric antrum in the sagittal plane over epigastrium using abdominal aorta as a landmark with probe depth of 17cm. When the antrum was identified, patients were turned into the right lateral position. As in the figure, still images of the antrum were taken. The gastric cross-sectional area was measured

*Correspondence

Dr. Sowmya M Jois

Assistant Professor, Department of Anesthesiology, Rajarajeswari medical college, Bangalore, Karnataka, India

E-mail: drsowmyasharma@gmail.com

using the tracing tool of the ultrasound machine. Gastric residual volume (GRV) was calculated using the following mathematical model. [8]

$$\text{GRV} = 27 + 14.6 \times \text{Right lateral CSA (Cross sectional area) (cm}^2\text{)} - 1.28 \times \text{Age (years)}$$

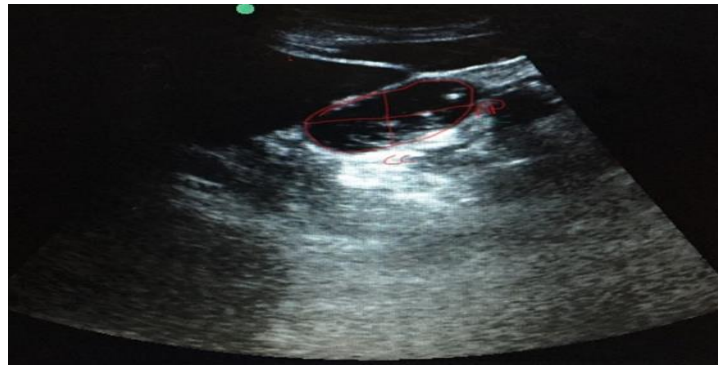


Fig 1: Still image of gastric antrum in the sagittal plane.

After performing gastric ultrasound, gastric residual volume was also measured by the nasogastric tube aspiration method using a 50ml syringe. The position of the nasogastric tube was confirmed before giving feeds. Feeds were withheld if GRV was more than 500ml. Complications and number of days in ICU were noted. Patients were scanned daily up to 4 times a day for 5 days or till the feeding tube was removed or oral feeding resumed. The study was terminated in the event of the death of the patient. The sample size was calculated based on the hospitalization time in the previous study Ying Liu et al [6] i.e. 13.35 ± 2.92 days in ultrasound-guided GRV group, and 16.58 ± 5.95 days in gastric tube aspiration method, with the power

of 90% and significance of 0.05%, the sample size needed for our study was 40 patients. Statistical analyses were performed using SPSS 20.0 software. Normally distributed variables are expressed as mean $\pm$ SD, and non-normally distributed data are expressed as median (interquartile range). Data were analyzed using paired t-test and Fischer exact test. $P < 0.05$ was considered statistically significant. MS Excel was used for data collection and for graphs.

Results

The mean age of patients in our study was (SD, range) years 49.55 years, in which 22(45%) were males and 18(55%) were females (figure 2).

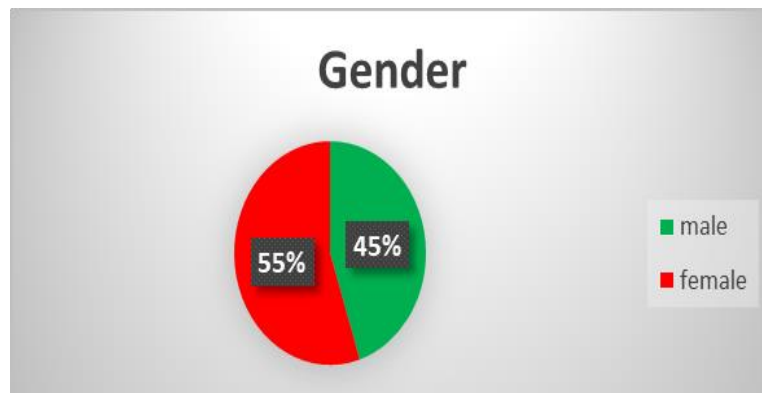


Fig 2: Gender distribution among patients

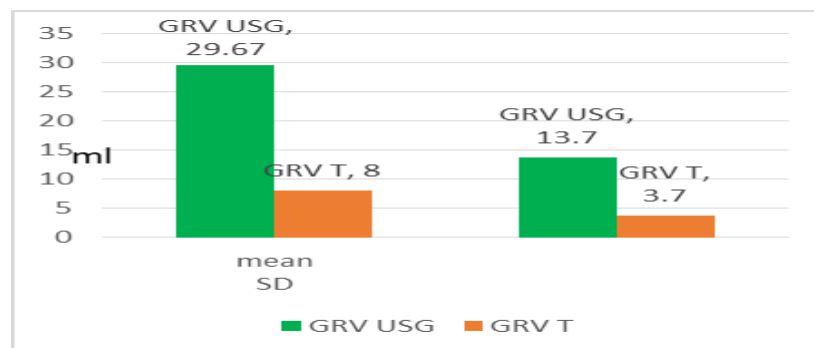


Fig 3: Mean gastric residual volume by ultrasound method (USG) and by tube aspiration method (T)

Mean gastric residual volume calculated by ultrasound method was 29.6 $\pm$ 13.79 ml when compared to gastric residual volume by tube

aspiration method 8 $\pm$ 3.7 ml, which was statistically significant (P-value $P < 0.0001$) (figure3)

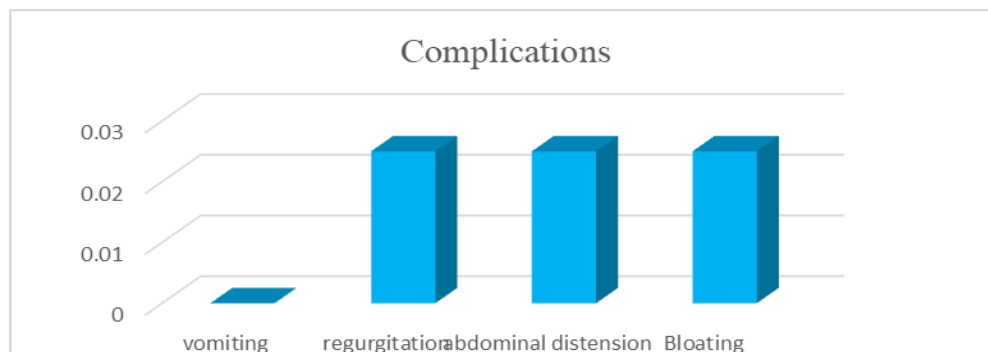


Fig 4: Complications

Fig 5: Table of complications

Vomiting	Regurgitation	Bloating	Abdominal distension
0	1	1	1

One patient in the group had regurgitation. One patient has bloating, and one patient has abdominal distension as in figure 4 and 5. The mean duration of ICU stay was 5.8 $\pm$ 1.6 days.

Discussion

Malnutrition in critically ill patients is associated with adverse clinical outcomes. Early enteral nutrition is recommended in critically ill patients in order to maintain the structural and functional integrity of the gastrointestinal tract. [8,9] At times, patients on enteral nutrition are at risk of feed intolerance which can result in gastric distension, regurgitation, aspiration, and consequently ventilator-associated pneumonia.[10] Feed intolerance is one of most common problems seen in critically ill diabetic patients and can result in failure to achieve nutritional targets and subsequently associated with increased mortality. Although there are no uniformly defined criteria for feed intolerance, a combination of vomiting, regurgitation, abdominal distension, and large GRVs >500 ml suggest intolerance to enteral feeds.[11] There are many techniques for measuring gastric residual volume. Paracetamol absorption test, scintigraphy, refractometry, breath test, gastric impedance monitoring, and several other techniques have been used to measure gastric emptying.[12] Most of these techniques require advanced infrastructure and not feasible on a daily basis. Measuring gastric residual volume by aspirating the nasogastric tube has been traditionally used, but it can be inaccurate, unreliable, and non-standardized. Measurement of the gastric antral cross-sectional area by gastric ultrasound is reliable, feasible and non-invasively predict gastric volume in critically ill patients.[13] We conducted the study to compare the gastric residual volume calculated by point of care ultrasound and by aspiration method in critically ill diabetic patients. A prospective cohort study conducted by Sharma et al. [6] was done on critically ill patients using gastric ultrasound, and they found that gastric cross-sectional area correlated well with aspirated volume. In our study, the Gastric residual volume calculated by ultrasound method was greater (29.6 $\pm$ 13.79 ml) compared to gastric residual volume by tube aspiration method (8 $\pm$ 3.7 ml), which was statistically significant (P-value $P < 0.0001$). Various factors might have contributed to the low volume measured by the aspiration method, position of the patient, position of the tube, number of the distal orifices, abutted orifice influence the measurement. Also, if the tip of the orogastric or nasogastric tube is not positioned in the pool of gastric content, the aspirated volume will be erroneous. Complications like regurgitation, bloating, abdominal distension was found in one patient each. The Mean duration of ICU stay was 5.8

$\pm$ 1.6 days. There were no other studies comparing the gastric residual volume by gastric POCUS and nasogastric tube aspiration method in diabetic critically ill patients on enteral feeds. We found that gastric residual volume calculated by POCUS was greater than nasogastric tube aspiration method in diabetic critically ill patients.

Limitations of our study

Gastric emptying is also affected by age and pain medications given in the ICU. We did not use standard enteral feed formula. Further studies can be done with a larger sample size and by using formula feeds.

Conclusion

Our study showed that gastric residual volume calculated by gastric ultrasound was higher than the nasogastric tube aspiration method. POCUS in critically ill diabetics guides enteral feeding better than the traditional gastric juice withdrawal method. This simple, non-invasive method helps to prevent the complications associated with high residual volume, thereby decreases ICU stay. Further studies are required to determine whether this difference in the gastric volume could lead to overfeeding and subsequently intolerance.

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