COMPARATIVE STUDY OF FASTING GASTRIC VOLUME IN DIABETIC AND NON-DIABETIC PATIENTS UNDERGOING ELECTIVE SURGERIES USING ULTRASONOGRAPHY- A PROSPECTIVE OBSERVATIONAL STUDY

By

Dr PAIDIMUDDALA YASHWANTH

DISSERTATION SUBMITTED TO SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH, KOLAR, KARNATAKA

In partial fulfilment of the requirements for the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

Under the Guidance of

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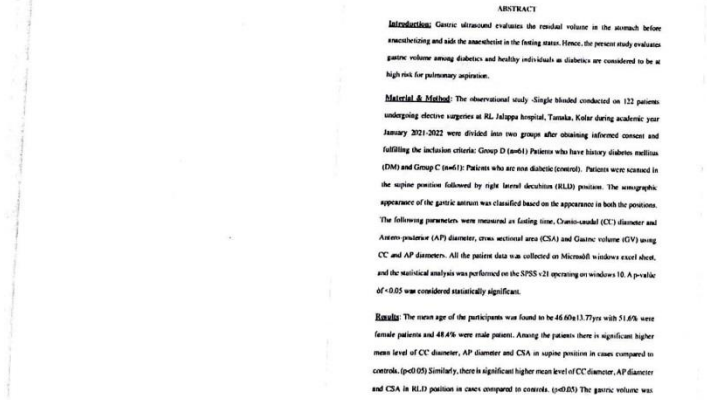

ABSTRACT

Introduction: Gastric ultrasound evaluates the residual volume in the stomach before anaesthetizing and aids the anaesthetist in the fasting status. Hence, the present study evaluates gastric volume among diabetics and healthy individuals as diabetics are considered to be at high risk for pulmonary aspiration.

Material & Method: The observational study -Single blinded conducted on 122 patients undergoing elective surgeries at RL Jalappa hospital, Tamaka, Kolar during academic year January 2021-2022 were divided into two groups after obtaining informed consent and fulfilling the inclusion criteria: Group D (n=61) Patients who have history diabetes mellitus (DM) and Group C (n=61): Patients who are non diabetic (control). Patients were scanned in the supine position followed by right lateral decubitus (RLD) position. The sonographic appearance of the gastric antrum was classified based on the appearance in both the positions. The following parameters were measured as fasting time, Cranio-caudal (CC) diameter and Antero-posterior (AP) diameter, cross sectional area (CSA) and Gastric volume (GV) using CC and AP diameters. All the patient data was collected on Microsoft windows excel sheet, and the statistical analysis was performed on the SPSS v21 operating on windows 10. A p-value of <0.05 was considered statistically significant.

Results: The mean age of the participants was found to be 46.60±13.77yrs with 51.6% were female patients and 48.4% were male patient. Among the patients there is significant higher mean level of CC diameter, AP diameter and CSA in supine position in cases compared to controls. ($p<0.05$) Similarly, there is significant higher mean level of CC diameter, AP diameter and CSA in RLD position in cases compared to controls. ($p<0.05$) The gastric volume was

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Date: **Dr P Yashwanth**

Place: Kolar

ABBREVIATIONS

AP	ANTERO-POSTERIOR
ASA	AMERICAN SOCIETY OF ANESTHESIOLOGISTS
CC	CRANIO-CAUDAL
CSA	CROSS SECTIONAL AREA
DM	DIABETES MELLITUS
ESA	EUROPEAN SOCIETY OF ANAESTHESIOLOGY
GDA	GASTRODUODENAL ARTERY
GDM	GESTATIONAL DIABETES MELLITUS
GV	GASTRIC VOLUME
HCL	HYDROCHLORIC ACID
IFG	IMPAIRED FASTING GLUCOSE
LGA	LEFT GASTRIC ARTERY
LGEA	LEFT GASTROEPIPLOIC (GASTROOMENTAL) ARTERY
OGTT	ORAL GLUCOSE TOLERANCE TEST
RLD	RIGHT LATERAL DECUBITUS
USG	ULTRASONOGRAPHY
NG	NASOGASTRIC

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Conclusion: The fasting gastric volumes measured by point of care ultrasonography is significantly higher in diabetics when compared to healthy individuals.

INTRODUCTION

INTRODUCTION

In the perioperative period a serious complication with a high fatality rate is aspiration of gastrointestinal contents. Diabetics are more likely to get gastropathy due to autonomic dysfunction. Since these patients are prone to have gastroparesis, which results in delayed gastric emptying and makes them vulnerable to have higher risk of aspiration than the healthy individuals.[1,2]

Till date a standard fasting guidelines for people with diabetes is still up for debate. The 2011 Fasting guidelines by European Society of Anaesthesiology (ESA) allow diabetics to adhere to similar requirements as healthy individuals. Whereas the American Society of Anesthesiologists (ASA) in 2017 came up with the conclusion that patients with concomitant diseases has prolonged stomach emptying time, hence it does not necessitate to stick to the standard 8 hour nil per oral (NPO) period or that it has to be changed.[3]

The ability to measure stomach contents at the bedside in real time using ultrasound, which is widely accessible, has been demonstrated to be effective. USG can be done before induction to examine diabetic patients' fasting gastric volume (GV) to see whether it is more than the advised safe limit because these individuals are susceptible to encounter insufficiently empty stomach despite an acceptable fasting period.[4]

Hence, the current research was conducted to analyse fasting gastric volume among diabetic and non-diabetics undergoing elective surgeries using ultrasonography (USG). As there is sparse literature which has stated a considerable difference in quantified fasting gastric volume among diabetics as well as non-diabetic individuals where standardised fasting guidelines were followed in both groups.

AIMS & OBJECTIVES

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To evaluate the fasting gastric volume pre-operatively using USG in diabetics and healthy individuals undergoing elective surgical procedures

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Diabetes has long been viewed as a high-risk illness that poses a variety of difficult situations for anesthesiologists. One of the most terrifying side effects of diabetes is pulmonary aspiration, which happens when a patient has a full stomach because of autonomic gastropathy.[5,6]

In the digestive system the most dilated portion and a crucial organ is the stomach. "It is a large, muscular, hollow organ with the ability to store food, which is divided into four divisions- cardia, fundus, body, and pylorus". The cardia forms a link and is directed towards the oesophagus, where food initially reaches the stomach. The superior, bulbous, dome-shaped fundus follows the cardia in the stomach. The body, comes after fundus. The pylorus transports food towards duodenum, in a conical fashion, following the body. Subsequent steps of digestion commence in the stomach after mastication or chewing. [7,8]

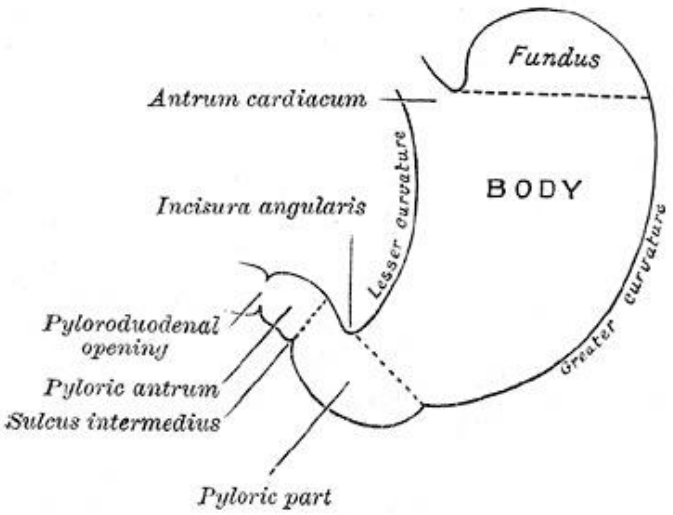

Figure 1: Outline of stomach

Structure and function[9]

The stomach's principal tasks include temporary food storage and partial digestion of food. As food enters, top sections of stomach loosen up, allowing the stomach to detain larger amounts of food. The bottom region contracts rhythmically to help in the breakdown of food particles and blend it with gastric fluids, which helps to disrupt the food particles and produce the combination, known as chyme, for advanced digestion. Mixing waves are created at 20-second intervals, increasing in intensity until it reaches bottom region of the stomach.

With each wave passing through the pyloric sphincter, enough chyme is released into the small intestine for the duodenum to manage and control. The fundus area of the stomach generates gastric juices, which are liquids containing hydrochloric acid (HCL) and pepsin enzyme, for the purpose of chemical digestion. Furthermore, the stomach's parietal cells additionally create intrinsic factor (IF). The IF created helps the small intestine's subsequent absorption of vitamin B12. Due to the necessity of vitamin B12 for both brain and red blood cell development, the intrinsic factor's synthesis is crucial.

Food is broken down in the stomach and sent to the duodenum in 2 to 4 hours on average. However, the type of food ingested significantly affects this pace since proteins and carbohydrates digest relatively quickly in the stomach, but fats like triglycerides take longer. Although the stomach is not the primary site for absorption of nutrients, it may do so with some substances. Water in case of dehydration, drugs like ethanol, aspirin, caffeine, amino acids, and numerous water-soluble vitamins.[10–12]

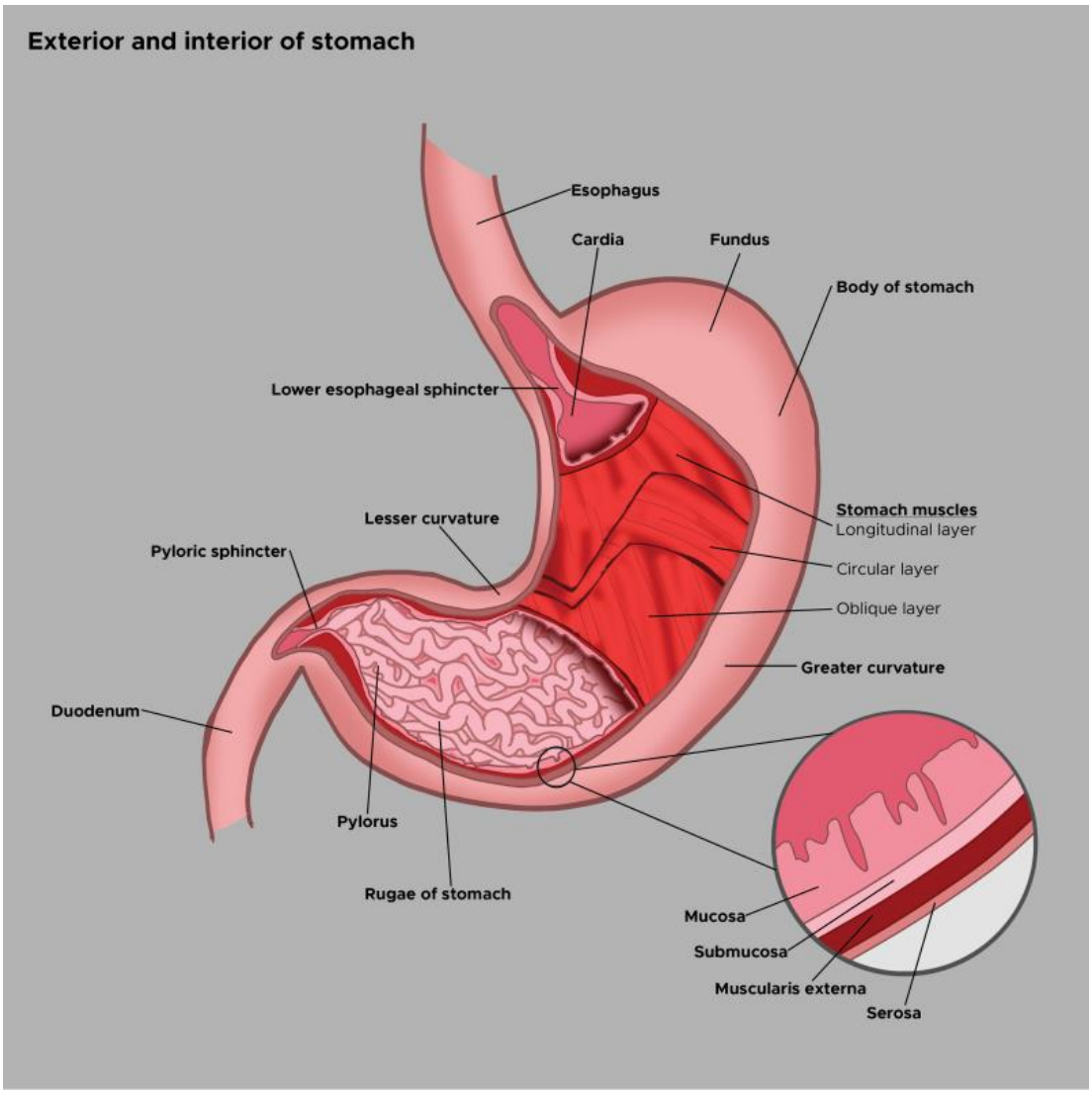

Figure 2: Illustration of the exterior and interior of the stomach

Embryology[9]

At 4th week of development in the foregut region stomach sets to form at the extremely enlarged region. Because of fast oesophageal elongation, by the 12th week, it drops from C2 to T11 vertebral level. By 5th week, the dorsal part of the stomach develops quicker than the ventral part, causing the stomach to protrude more towards one side, allowing it to take its distinctive form. During the 7th week, the stomach revolves 90° dextro-rotation in its vertical axis and again around the AP axis amid the 8th week, bringing the pyloric area higher to its ultimate position.

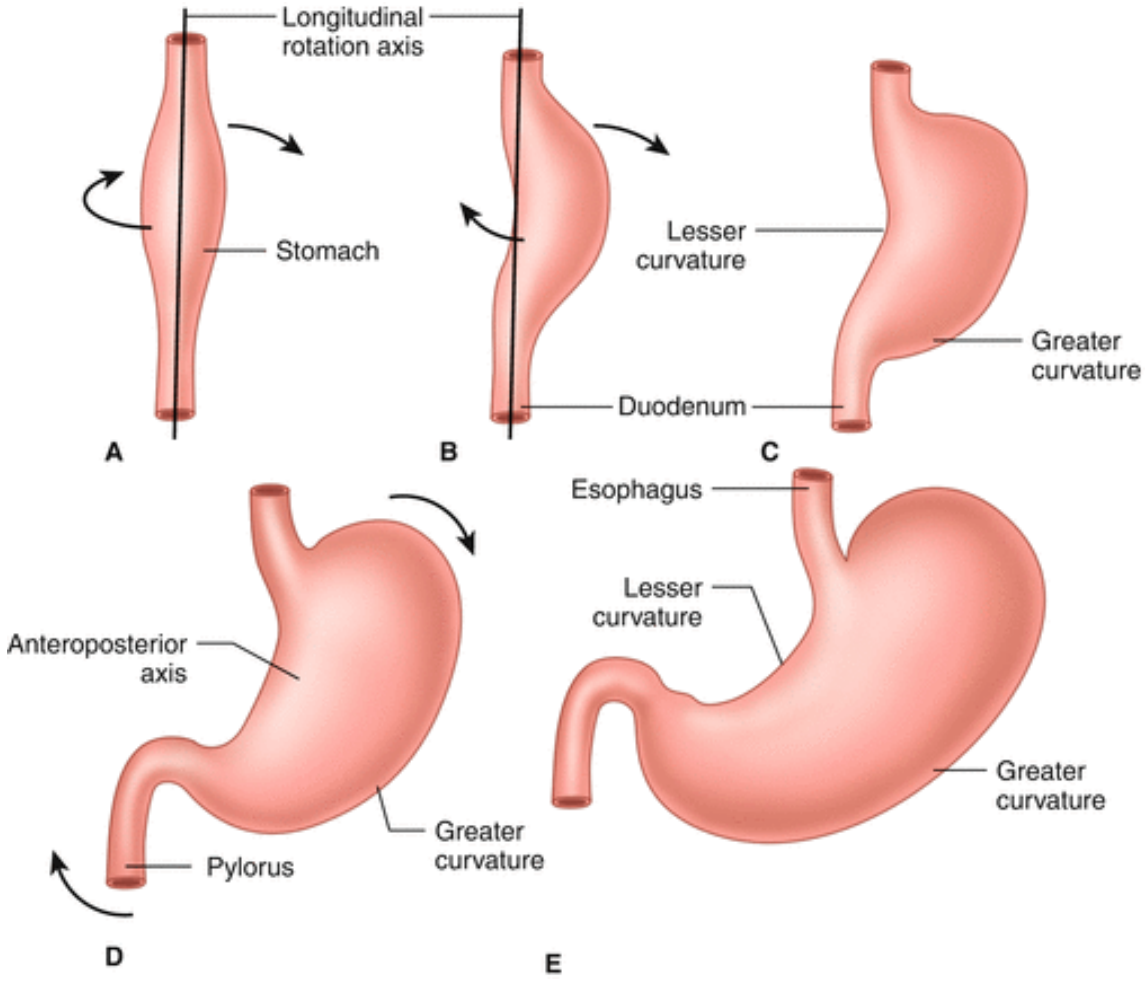

Figure 3: Embryology of the stomach

Blood supply to stomach[9]

The stomach is a highly mobile and distensible organ made up of five different cell types that have high metabolic rates as well as a number of muscle layers that support the stomach's fast peristalsis waves during the second phase of digestion. Most arterial blood flow is provided by the celiac trunk, which divides anteriorly from the aorta. The Left gastric artery (LGA) ascending branch supplies a section of the oesophagus, while its descending branch supplies the stomach's less curved side. The right gastric artery (RGA) is a branch of the hepatic artery, that supplies lesser curvature of the stomach. The gastroduodenal artery (GDA) branches into a right gastroepiploic artery (RGEA) which

supplies larger flexure of stomach. The left gastroepiploic artery (LGEA) branch of the splenic artery serves greater curvature of the stomach.

Left and right gastric vein, right gastro-omental veins drains to portal vein. Splenic vein drains the short stomach veins known as vasa brevia and left gastro-omental vein.

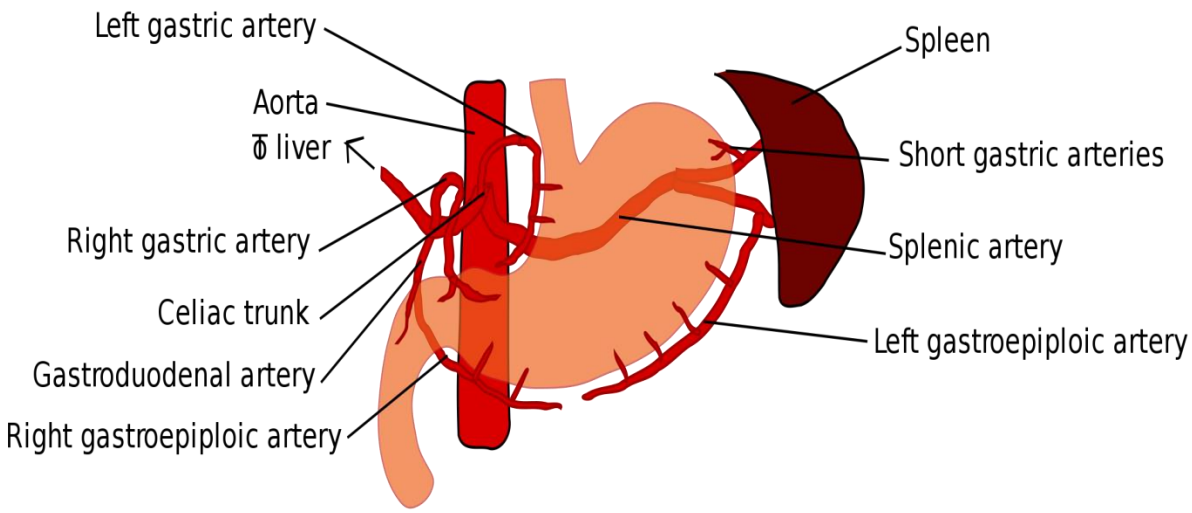

Figure 4: Blood supply

Nerve innervations[9]

Nerve supply of stomach is through parasympathetic and sympathetic fibres. The PNS is innervated by the vagus nerve through the right posterior and left vagal trunks. The criminal nerve of Grassi which innervates the cardia and fundus, receives a branch from the right vagus nerve. The trunks also create the Latarjet posterior and anterior gastric nerves which innervates the body, antrum, and pylorus. Segments T6-T9 of spinal cord contains sympathetic nerves that supply the celiac plexus, including some fibres that convey pain.

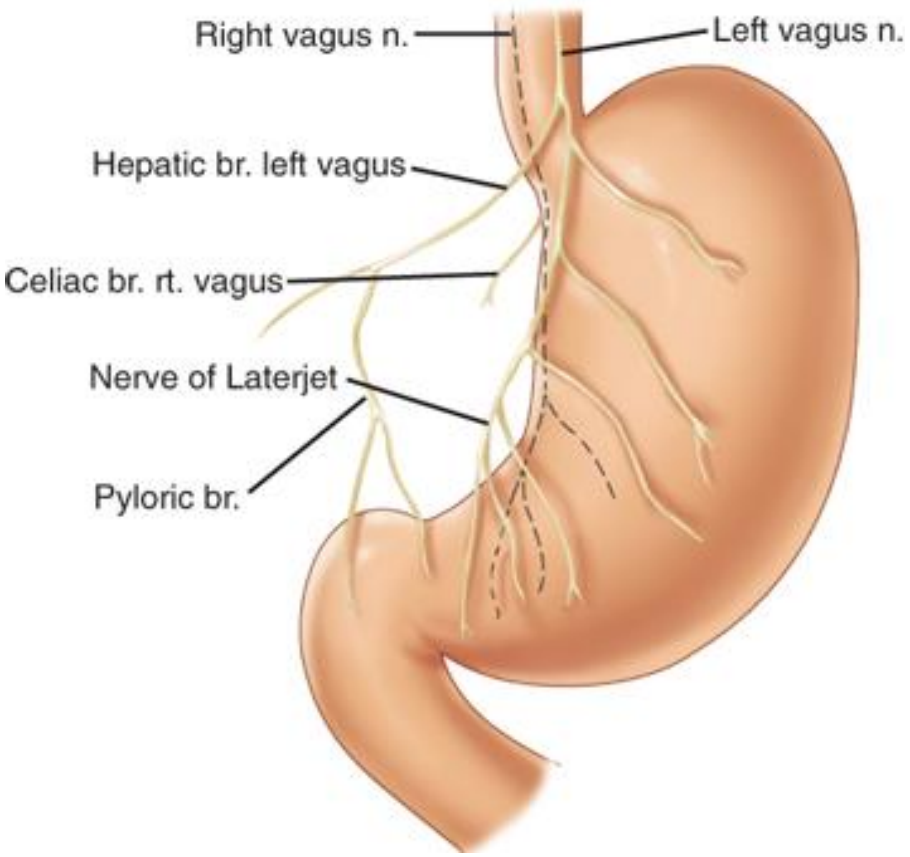

Figure 5: Innervations of stomach

Muscles of stomach[9]

The stomach wall is made up of four major layers:

a) Mucosa- innermost layer, contains gastric glands which secretes enzymes and gastric juices.

b) Submucosa- contains blood vessels, lymphatics, nerves and thick connective tissue forming the rugae, supports the mucosal layer and allows it to expand as food enters the stomach.

c) muscularis externa- it has 3 sub layers

- Outer longitudinal layer

- Middle circular layer

- Inner oblique layer

The Auerbach's (myenteric) plexus, which acts as an area of innervation for the two close-by muscle layers, is in between the circular layer and the longitudinal layer. The outer longitudinal layer promotes food flow into the pylorus by shortening the muscles

d) serosa- The last layer, is made of several layers of connective tissue that are permanently connected to the peritoneum.

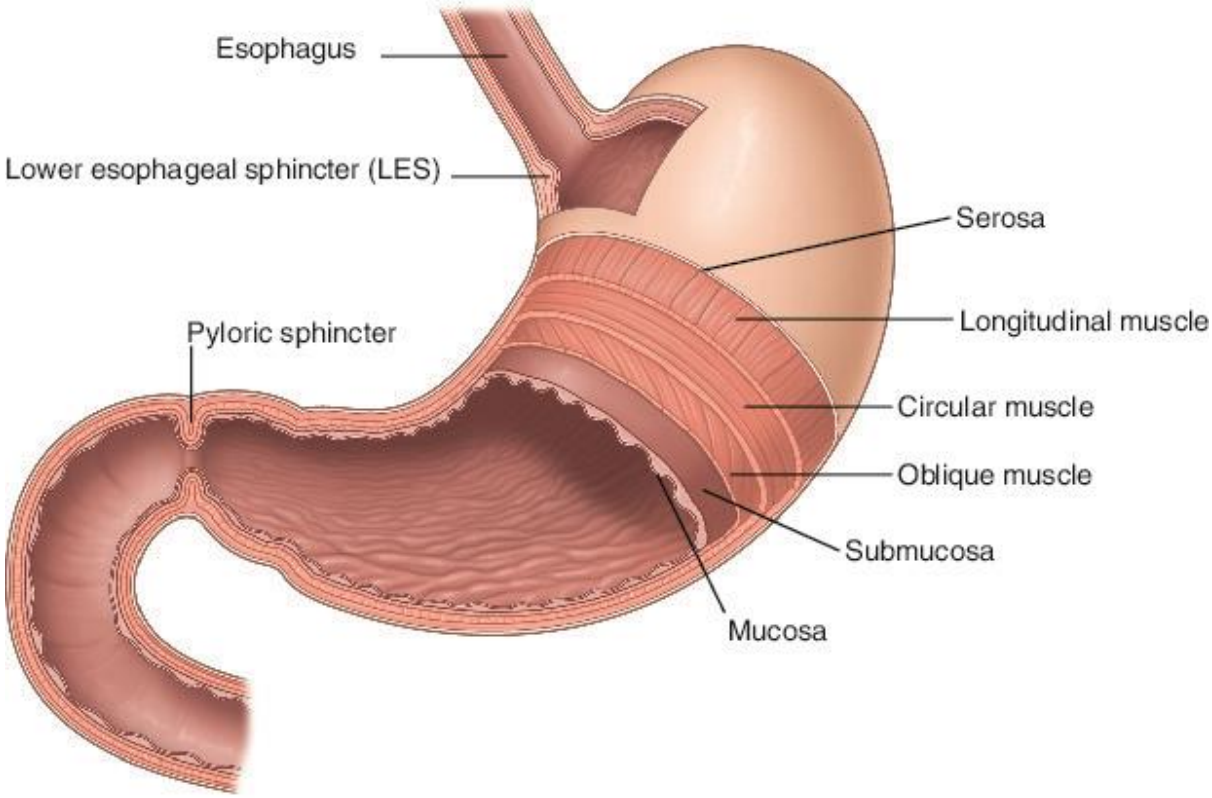

Figure 6: Muscles of stomach structure

Physiological variants[9]

Natural physiological changes in stomachs are limited. The most prevalent variations are linked to its position, size, and form, which is greatly influenced by nutrition. Rugae, for

example, may stay swollen if someone consistently overeats. However, there are a number of congenital oesophageal anomalies, including the following.

-Organ duplication

-Diverticula

-Organ transposition

-Bilocular contractions (horse glass)

-Gastric outlet obstruction

Cellular structure to maintain the function[13]

The stomach mucosal layer is composed of the muscularis mucosa, a layer of connective tissue called the lamina propria, and the surface epithelium. When the gastric epithelial layer invades the lamina propria Stomach pits and glands are formed. Surface mucous cells, also known as foveolar cells, chief cells, parietal cells, and neuroendocrine cells, sometimes known as G-cells or ECL-like cells, line the stomach glands.[14,15]

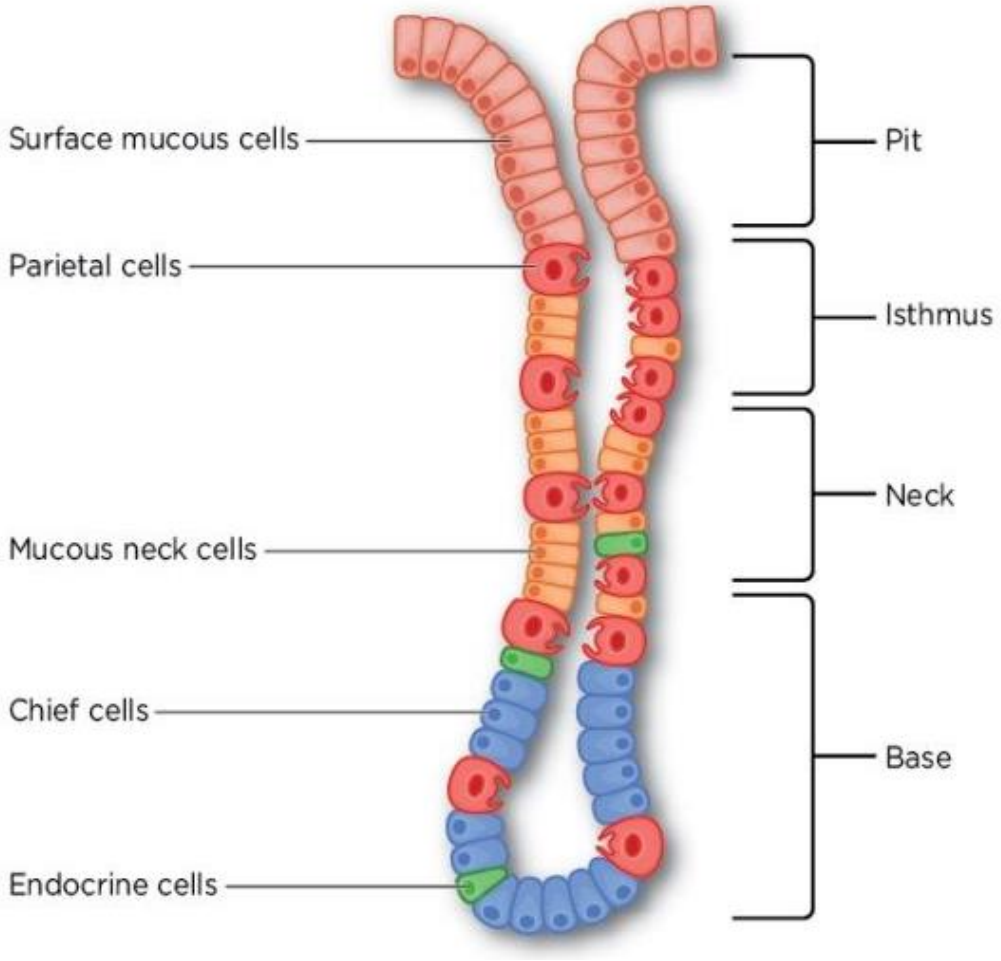

Figure 7: Structure of gastric pit

The surface mucous cells mainly line the stomach mucosa and produce mucus. The mucus produced functions as a barrier against the corrosive character of the stomach acid.

Parietal cells are secretory form of epithelial cells, present in the fundus that allows gastric acid (HCL production) to escape into the stomach lumen. It also exudes a protein known as intrinsic factor (IF). In the terminal ileum, vitamin B12 absorption depends on IF. These cells are controlled by three regulatory molecules: acetylcholine, histamines and gastrin. On the luminal side, H+/K+ ATPase protein channel is controlled by all receptors. This protein absorbs one k+ ion while transferring one proton into the lumen.

Chloride ions follow the proton gradient through the stomach lumen via the K+/Cl- channel, resulting in production of HCl.[13,15]

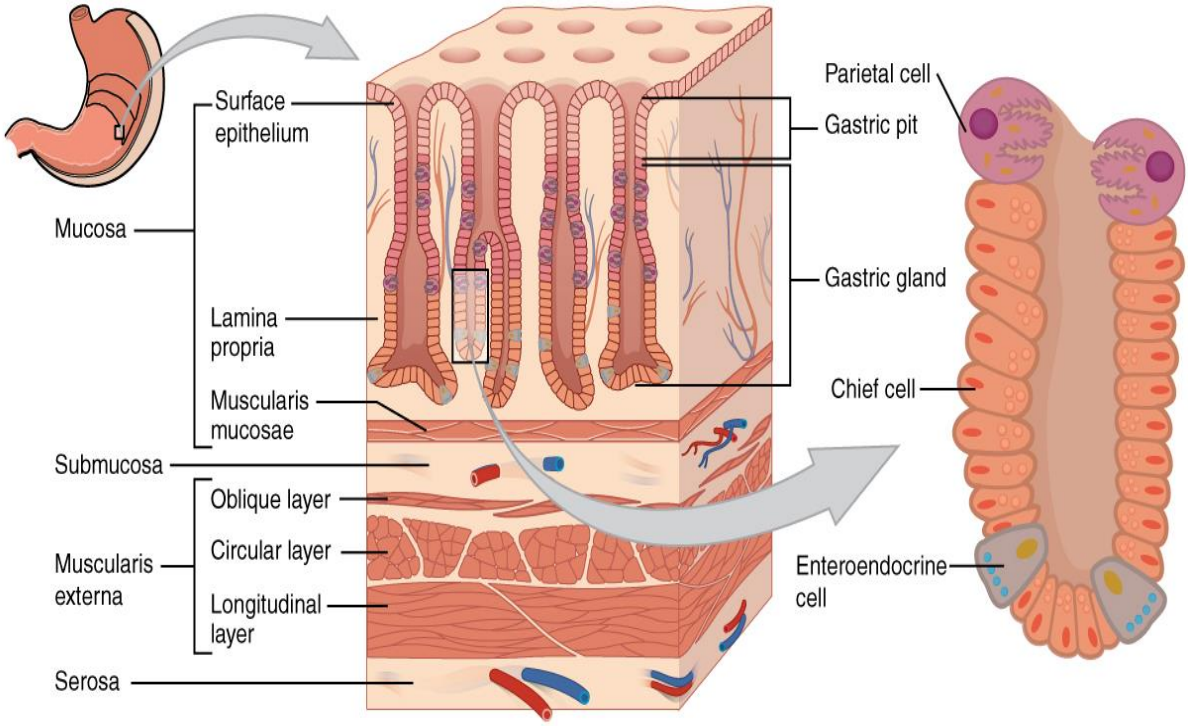

Figure 8: Stomach and gastric epithelial structure

Chief cells are type of secretory cells, which secretes pepsinogen and are located in the fundus of the stomach. The proteolytic enzyme Pepsin which is necessary for breaking down proteins into minute pieces known as polypeptides, exists in an inactive state called pepsinogen. It is activated only by the gastric acid produced by the parietal cells. This avoids improper digestion of proteins found outside the stomach lumen.

Neuroendocrine cells (referred to as enterochromaffin-like cells or G-cells) secretes gastric acid.

When triggered by the hormone gastrin, **ECL-like cells** release histamine, which indirectly boosts HCL synthesis via parietal cells. ECL-like cells are mostly seen in the stomach fundus.

G-cells are found in the stomach's pylorus area and create the neuroendocrine hormone gastrin. Gastrin can increase HCL production by 2 methods. The first method involves stimulating ECL-like cells to release Histamine, which subsequently activates Parietal cells. The second method is to stimulate the Parietal cells directly. Both processes boost the activity of the H+/K+ ATPase.

D-cells are found in the stomach's pylorus and release an inhibitory substance known as Somatostatin. When the stomach lumen reaches a specific amount of acidity, D cells are activated. Somatostatin then suppresses gastrin release, lowering total stomach acid output.[16]

GASTRIC MOTOR FUNCTION

The gut motor function is controlled by 3 main levels

-Parasympathetic and sympathetic nervous system

-Smooth muscle cells

-Enteric neurons and interstitial cell of cajal

Autonomic nervous system: The vagus nerves carry extrinsic neuronal control from parasympathetic circuits to the stomach and upper intestine. Vagal efferent originate in the vagus nerve's dorsal motor nucleus. They don’t directly innervate muscle, but they generate distinctive terminals that resembles bead chains in the myenteric plexus of the stomach.[17] from T5-T10, the sympathetic supply of stomach travels through the celiac ganglia from the intermediolateral columns of the spinal cord. The cell bodies of splanchnic efferents to stomach are present in celiac ganglia; it provides the myenteric ganglia, and a dense supply to the pyloric sphincter.[18–20]

Enteric nervous system: It is a huge network of ganglionated plexi that acts as an integrative circuitry between extrinsic gastrointestinal motility regulation and sensory afferents in the stomach wall. These neural networks are divided into five layers that are distributed throughout the gut wall; the most well known are the myenteric, deep muscular, and submucosal plexi. The ICC, which operate as a pacemakers for the muscle sheets within the gut wall, comprise the deep muscular plexus.

Smooth muscles: At 3rd level, the excitable membrane of smooth muscle cells regulates gastrointestinal motility. Peptides, Amines, and other transmitters that go by endocrine, neurocrine, or paracrine routes to the smooth muscle membrane bind to certain receptors in the cell membrane. Pacemaker cells produce action potentials that force the cell to contract and are identified by spontaneous depolarization of the resting membrane potential.

Areas with motor function: Three layers make up the stomach muscle, and its fibres are arranged along three axes: circular, oblique, and longitudinal. The fundus and antrum were once believed to be the two functional portions of the stomach. At the centre of the stomach's larger curvature, the gastric electrical pacemaker is active. The stomach serves as a "housekeeper," directing indigestible solid matter toward the colon as part of the cyclical activity front that spreads throughout the digestive system when fasting. In dogs hormone motilin, which is produced from the duodenum, appears to trigger this stomach component of the migrating motor complex.[22]

Pathogenesis of delayed gastric emptying:

Various disorders exists which might cause stomach motor dysfunction, as a result, delayed gastric emptying. Different pathologic conditions may affect each of the stomach regions.

Fundus abnormalities: A number of illnesses are related with impaired proximal gastric motor function. The accommodation response has been shown to considerably alter the pace of gastric emptying, including the proximal stomach.[23]

Post-vagotomy dysfunction: Accommodation response as well as phasic contractility of stomach in response to distention are eliminated following vagotomy and minimal gastric resection.[24] which describes the reason for solid part of food takes longer time to be emptied than compared to liquids which transmits faster.[25] Fundoplication, is the most common reason for decreased fundal accommodation; also reduced relaxation is exacerbated by concurrent vagal damage.[26]

Functional dyspepsia: is a condition where patients presents with symptoms like nausea, early satiety, postprandial fullness, bloating, and discomfort without any organic pathology. A research illustrated the interchangeable symptoms and baseline features of gastroparesis and functional dyspepsia, as well as modification in stomach emptying with time, resulting in criteria that "alter" the diagnosis.[27]

GASTRIC ULTRASOUND

Point of care gastric ultrasound has gained popularity in recent times and has been adapted in the field of Anesthesiology gradually to make the clinical decision before anaesthetizing patients helpful where the fasting status is uncertain and in emergency patients where surgery is indicated.

In Gastric USG, in pediatric patients <40kgs linear transducer is recommended and for adults curvilinear transducer (low frequency2-5Mhz) is employed.

The probe was placed between the xiphoid process and umbilicus in sagittal axis because the gastric antrum is superficial and can be visualized through the hepatic lobe window.

In adults the thickness of the gastric wall is about 4-6 millimetres, among all the five layers Muscularis Propria is distinctive and specific to locating antrum in USG.Any content seen in the antrum.[30]

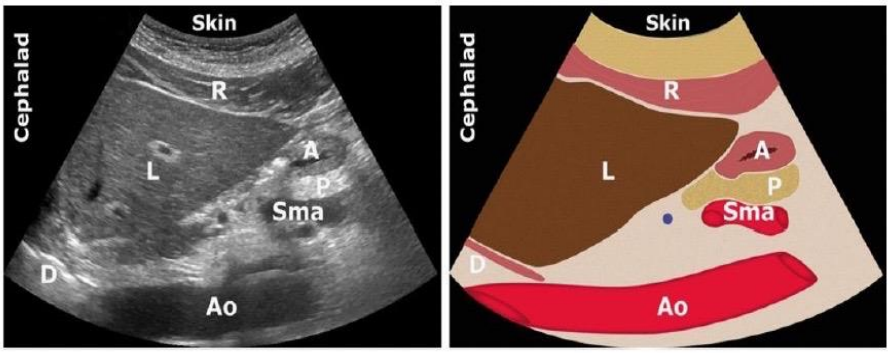

Fig.9 Ultrasound image showing empty antrum. A – Antrum, P – Pancreas, Sma – Superior mesenteric artery, Ao – Aorta, D – Duodenum, L – Liver, R – Rectus abdominis muscle

Figure 9:Ultrasonography image showing empty antrum

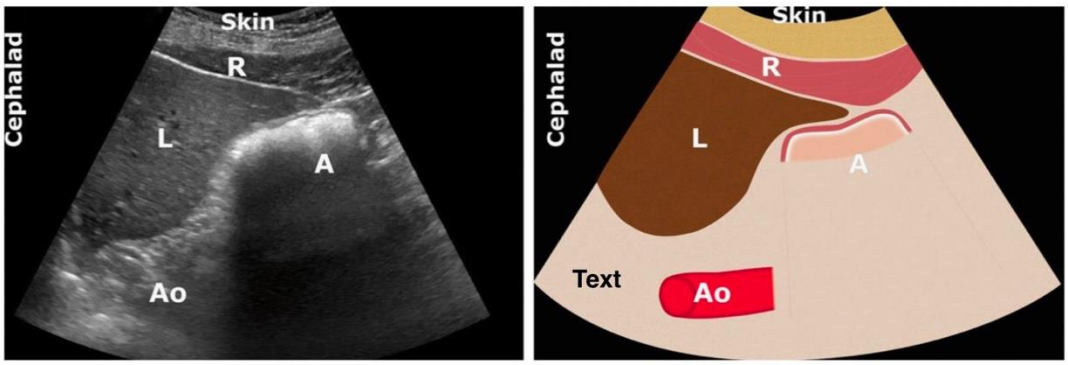

Fig. 10 Ultrasound image showing solid gastric contents with a "frosted glass" appearance. R – Rectus abdominis muscle, A – Antrum, Ao- Aorta, L - Liver

Figure 10:Ultrasonography image showing solid gastric contents

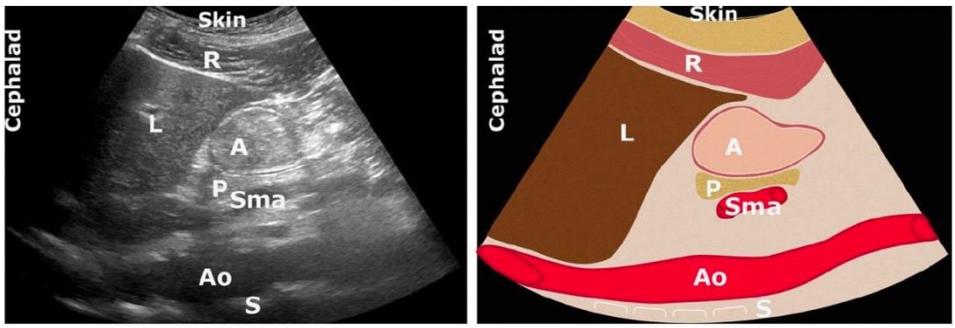

Fig 11 Ultrasound image showing late stage solid gastric contents. R – Rectus abdominis muscle, A – antrum, Ao- Aorta, L – Liver, P – pancreas, Sma – superior mesenteric artery, L – liver, S - spine

Figure 11:Ultrasonography image showing late stage solid gastric contents

Text

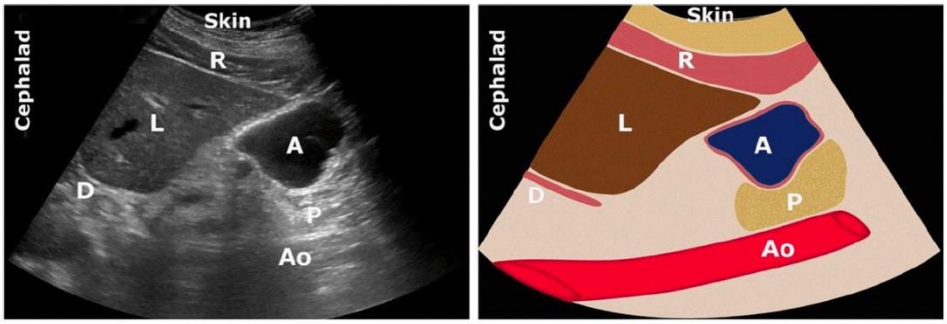

Fig 12 Ultrasound image showing clear fluid gastric contents. R – Rectus abdominis muscle, A – antrum, Ao- Aorta, L – Liver, P – pancreas, L – liver

Figure 12:Ultrasonography image clear fluid gastric contents

DIABETES MELLITUS

According to International Diabetes Federation around 463 million elderly are living with diabetes already.[28] DM is a global epidemic burden in both developing and developed countries. Antrum is hallow organ which is multilayered with five various layers lies anterior to pancreas Inferior Vena Cava and aorta. Curvilinear probe the muscularis propria with

"Diabetes Mellitus is defined as a group f metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The American Diabetes Association Expert Panel recommends a diagnosis of diabetes mellitus when one of the three criteria is met".[29]

CLASSIFICATION

DM is classified into 4 types:

1. Type 1/Insulin dependent DM /Juvenile onset DM
2. Type 2/Non-insulin dependent DM / Adult onset
3. MODY or Maturity onset Diabetes Mellitus
4. Gestational diabetes mellitus (GDM)

SECONDARY CAUSES include:

- Pancreatic disease
- Hormonal abnormalities

- Genetic diseases
- Intake of certain drugs or chemical compounds.

PATHOPHYSIOLOGY

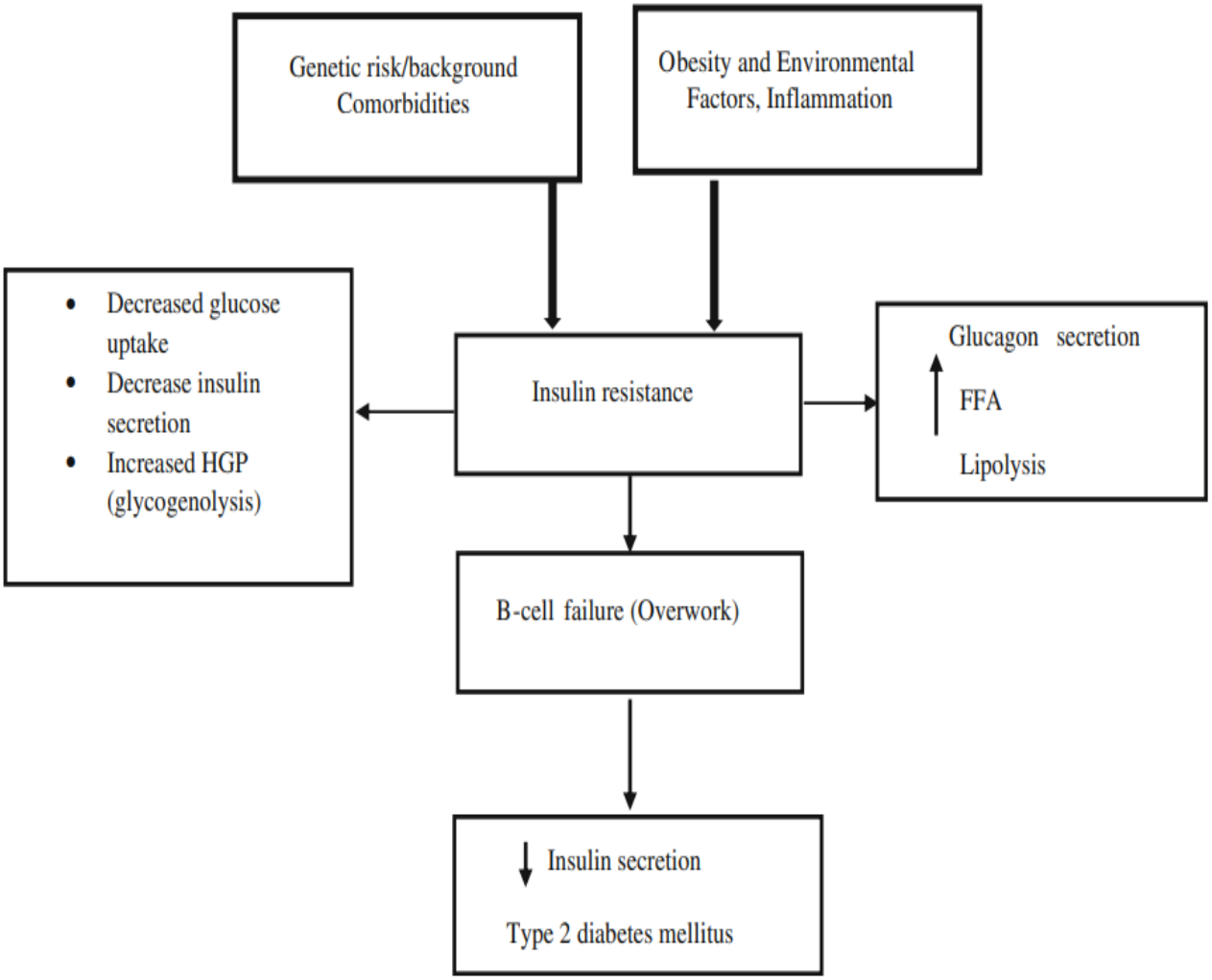

Figure 13: Mechanism of genetic predisposition and obesity induced insulin resistance and T2DM

Risk factors

- Obesity

- Sedentary lifestyle
- Family history
- Ethnicity and race
- Comorbid conditions
- Dyslipidemia
- Old age
- Pre-diabetes
- History of GDM
- Resistance to inulin, Leptin.

DM causes a distinctive complication which is delayed stomach emptying. A cohort study analysis of 538 patients stated that the normal fasting time did not enable proper stomach emptying, resulting in a change in anaesthetic induction.[5,32]

In a research, investigators used ultrasonography to examine gastric emptying rates (GER) in 33 study participants which included both diabetics and non-diabetics after feeding semi-solid meal. Gastric antrum dimensions were collected. Diabetes patients showed significantly higher postprandial antral median readings after about 90 minutes. The median GER of diabetics was 29percent, while it was 63percent for the healthy controls. Their analysis revealed a distinctive difference in GER among people who were healthy and those who had diabetes mellitus.[33]

Patients with longer duration of diabetes had larger residual stomach capacity in comparison to healthy individuals after fasting for eight hours before elective surgery, according to an ultrasonography study of 25 Diabetes Mellitus patients with a history of six years and 25 normal healthy controls.[34]

Sabry R et al. used gastric ultrasonography to determine the stomach residual volume in fasting diabetes individuals. The diabetic group exhibited a larger median (quartiles) antral CSA and a higher measured stomach residual volume in comparison to control group. Additionally, in diabetic group the NG tube aspirate is more compared to control group. Estimated residual stomach capacity and volume of NG tube aspirate exhibited an incredibly strong correlation. After an 8-hour fast before elective surgery, patients with long-term diabetes had greater stomach capacity left than healthy controls.[34]

Ohashi Y et al. conducted a research to measure the preoperative stomach residual volume in fasting subjects. It illustrated no statistically distinct association between "at risk" GRV and obesity, DM, GERD illness and opiate use, even though research was unable to completely rule out the effect of one or more of these variables. The results show that a small proportion of persons, despite following the fasting requirements, have GRVs that enhance the risk of pulmonary aspiration. Anaesthetists should consider this background incidence when deciding which anaesthetic technique to perform on their patients. Preoperative bedside stomach ultrasonography may be useful for detecting GRV patients who are "at risk," however further research is required to determine its effectiveness.[35]

Sharma G et al. conducted an observational research in adult patients to investigate the preoperative evaluation of stomach content and volume using bedside ultrasonography. Six out of 100 participants had solid contents,16 had clear liquids >1.5 millilitres per kilogram despite fasting for 10 to 15 hours. Diabetes and chronic renal diseases were associated with statistically significant increases in CSA in both the supine as well as RLD postures in patients. The patients estimated stomach capacity grew along with their BMI. According to a research, NPO for >6 to 10 hours doesn’t ensure that stomach is

empty. Those who have diabetes, obesity, or CKD are at higher risk to have dangerous stomach contents.[36]

Zhou L et al. conducted a prospective cohort research to evaluate the utility of point-of-care ultrasonography in assessing stomach content in patients with type 2 diabetes undergoing elective surgeries. Approximately half of type-2 diabetics had a full stomach according to current preoperative fasting standards. It is suggested that type 2 diabetes patients have preoperative ultrasonography to assess stomach content.[37]

In order to estimate the fasting stomach capacity in both groups of diabetics as well as non-diabetics undergoing elective surgical procedure, Garg H et al. undertook an observational study. The CC and AP diameters were smaller in the control group than in the diabetic group when lying flat. Diabetes patients had a higher antral CSA and volume compared to non-diabetic individuals, according to gastric ultrasonography.[38]

In order to compare the USG aided residual GV calculation in diabetic and non-diabetic participants undergoing elective surgical procedure, Harmagatti A et al. Both the groups exhibited a small stomach residual capacity, despite differences in CSA and GV. Before particular advice for diabetics can be provided, additional study is required to determine the therapeutic implications of these findings.[39]

Sharma S et al. conducted a research to evaluate the efficiency of conventional fasting recommendations as measured by stomach ultrasonography examination. A large residual stomach volume was found in 69 (28.04%) of the 246 individuals. Fasting hours had no relationship with retained stomach volume (P = 0.47). It was revealed that the association of risk factors had a higher impact on residual stomach volume than fasting time. While present fasting guidelines holds good for healthy persons, but it doesn't hold good in high

risk group individuals. Ultrasound evaluation of preoperative stomach capacity is a valuable screening method in high risk group. [40]

Rajeswari L et al., used ultrasonography to measure the stomach residual volume in patient's undergoing elective surgery who were fasting from both diabetics and non-diabetics group. In both the right lateral and semi-sitting positions, the mean antral CSA and calculated mean GRV were considerably higher in diabetics. In both the groups, considerably more non-diabetic people than diabetic patients had an empty stomach antrum. In comparison to non-diabetics, diabetics had a larger mean volume of stomach aspirate. The current recommendations for fasting before elective surgery in patients with long-term diabetes are unclear. As a result, we advocate for use of point-of-care ultrasonography as an excellent screening tool for assessing risk of aspiration and tailoring anaesthesia administration.[41]

Cunha DD et al. conducted a research to evaluate gastric ultrasonography in quantifying stomach content in fasting patients of both diabetic and non-diabetic group. Regardless of whether they were fasting or not, 75% of subjects had Grade stomach contents on USG. Statistical significance of the data was determined using $P<0.05$. Age and ultrasound results had no statistically significant association. However, the patient's BMI was shown to have a significant relationship with stomach content and volume ($P<0.01$). In current practise, NPO status is determined by taking history with patient, which can be erroneous, and in high risk individuals who are at increased risk of delayed stomach emptying, it increases the risk of aspiration. Before planning the anaesthesia induction and operation, Using stomach ultrasonography as a screening technique before to anaesthesia induction and operation can help to reduce avoidable perioperative problems.[42]

MATERAIL & METHODS

MATERIALS AND METHODS

This was a prospective, single blind observational study.

SOURCE OF DATA:

This study was conducted on 122 patients undergoing elective surgeries at R.L. Jalappa Hospital and Research centre, Tamaka, Kolar, during the academic year January 2021-2022.

Study design: Prospective single blind observational study.

Sample: 122

Duration of study: from January 2021 to May 2022.

Sampling method: Simple random sampling.

METHOD OF COLLECTION OF DATA:

Patients undergoing elective surgery were divided into two groups after obtaining informed consent and fulfilling the inclusion criteria:

Group D-Patients who have history diabetes mellitus (DM)

Group C-Patients who are non-diabetic (control)

PROCEDURE:

-Detailed history of the patient was taken.

-Diabetic patients were evaluated for duration, drug history, control of blood glucose and symptoms of gastropathy.

-Proper physical examination followed by systemic examination was done and relevant investigations were checked.

-Nil per oral (NPO) status was evaluated and fasting duration was noted.

-Preoperative bed-side gastric USG was performed by an anesthesiologist who was unaware of the study population groups, using a low frequency, curvilinear probe.

-Initially study participants were positioned in lying down and switched to right lateral decubitus (RLD) position later.

-Anteroposterior (AP) and cranio-caudal (CC) diameter were measured in RLD position and cross sectional area (CSA) was estimated.

$$CSA = (AP \times CC \times \pi)/4$$

-GV was estimated:

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

INCLUSION CRITERIA

- Age between 18 - 60 years
- ASA grade I,II,III,IV
- Either sex
- Diabetic patients should have at least 6 years History

EXCLUSION CRITERIA

- Patients taking drugs which affects gastric motility.
- Patients with renal failure.

- Hypothyroid patients.
- Patients who have connective tissue disorder
- Past history of gastro-intestinal surgery.
- BMI $\geq$ 30kg/m^2
- Parturients
- Patients with NG conduit insitu

Sample size:

The sample size was predicted grounded on a study by Heena et al., with 90% power, α error 0.05. Sample size was 61 in each group.[45]

$$N_{1=}\frac{(\sigma_1^2+\sigma_2^2/K)(z_{1-\frac{\alpha}{2}}+z_{1-\beta})^2}{\Delta^2}$$

$$N_2=\frac{(K*\sigma_1^2+\sigma_2^2)(z_{1-\frac{\alpha}{2}}+z_{1-\beta})^2}{\Delta^2}$$

$N_{1=}$sample size of group1

N_2=sample size of group2

σ_1 =standard deviation of group 1

σ_2=standard deviation of group 2

Δ=difference in group means

K=ratio =n2/n2

$Z_{1-\alpha/2}$ =two sided Z value (eg. Z=1.96 for 95% confidence interval)

$Z_{1-\beta}$ =power

PARAMETERS TO BE OBSERVED

- Fasting duration
- CC and AP diameter
- Estimate CSA
- Estimate GV using CC and AP diameters

STATISTICAL ANALYSIS

All the patient data was collected on Microsoft windows excel sheet, and the statistical analysis was done on the SPSS v21 operating on windows 10. The descriptive data were summarised as mean, median and proportion, frequency. The summarised data were represented using the tables and figures. The mean difference between the continuous variables were assessed using the student-test and for categorical data chi-square test was used. The diagnostic accuracy was calculated by AUC analysis, Pearson Correlation were measured. The p-value of <0.05 was considered statistically significant.

RESULTS

RESULTS

A total of 122 patients was divided into two groups as:

Group D (n=61): Diabetic patients

Group C (n=61): Non-diabetic patients

Table 1: Mean age of participants included in the study

	N	Min	Max	Mean	SD
Age	122	20.0	75.0	48.60	13.77

The mean age of the participants was found to be 46.60±13.77yrs of age.

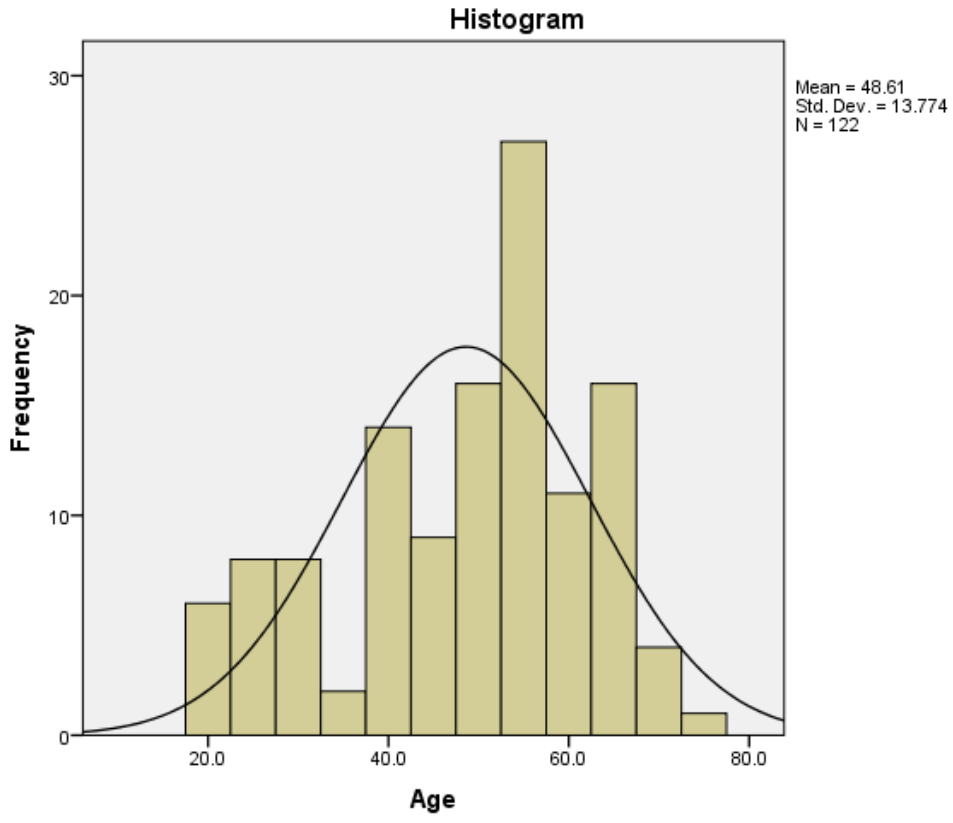

Figure 9: Mean age of the participants included in the study

Table 2: Gender distribution of the patients in the study

		Frequency	Percent
Gender	Female	63	51.6
	Male	59	48.4
	Total	122	100.0

Among the participants, 51.6% were female patients and 48.4% were male patient with marginal female preponderance in the present study.

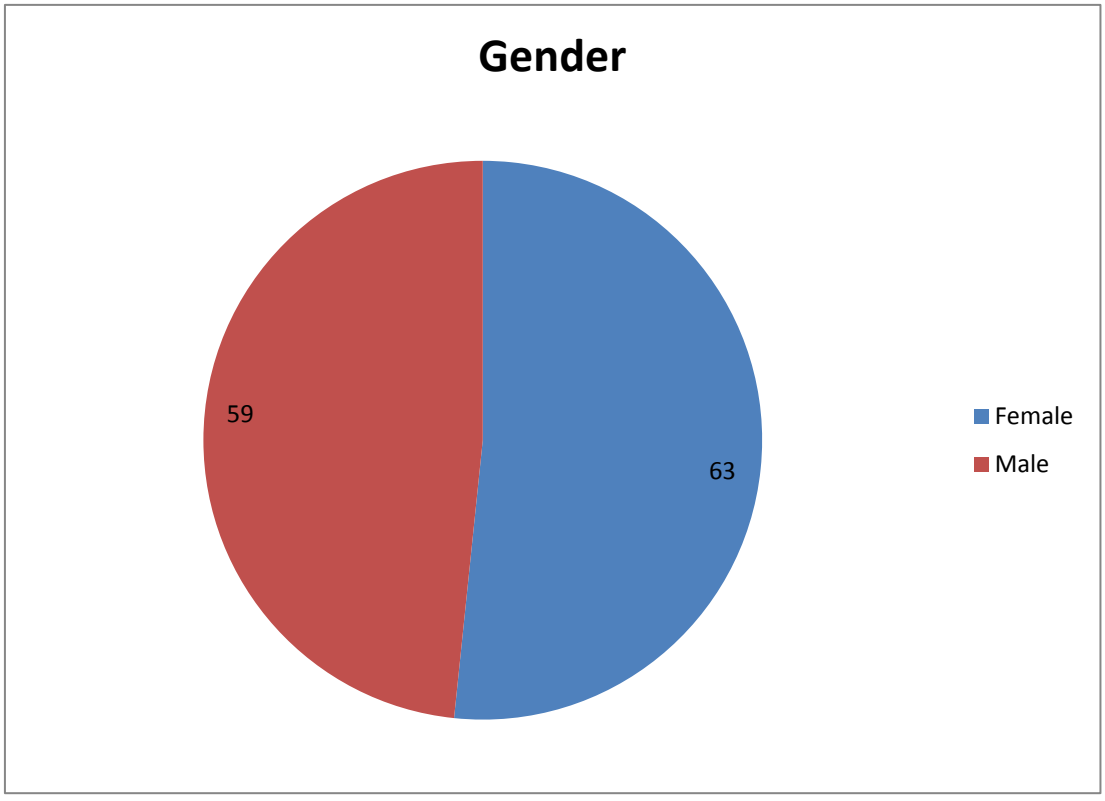

Figure 10: Gender distribution of the patients in the study

Table 3: Comparison of mean age between the groups

	Group C		Group D		p-value
	Mean	SD	Mean	SD	
Age	45.5	15.5	51.7	11.0	0.125

The mean age in group C (45.5±15.5) and in group D was (51.7±11.0), the difference between the groups shows no significant difference.(p>0.05)

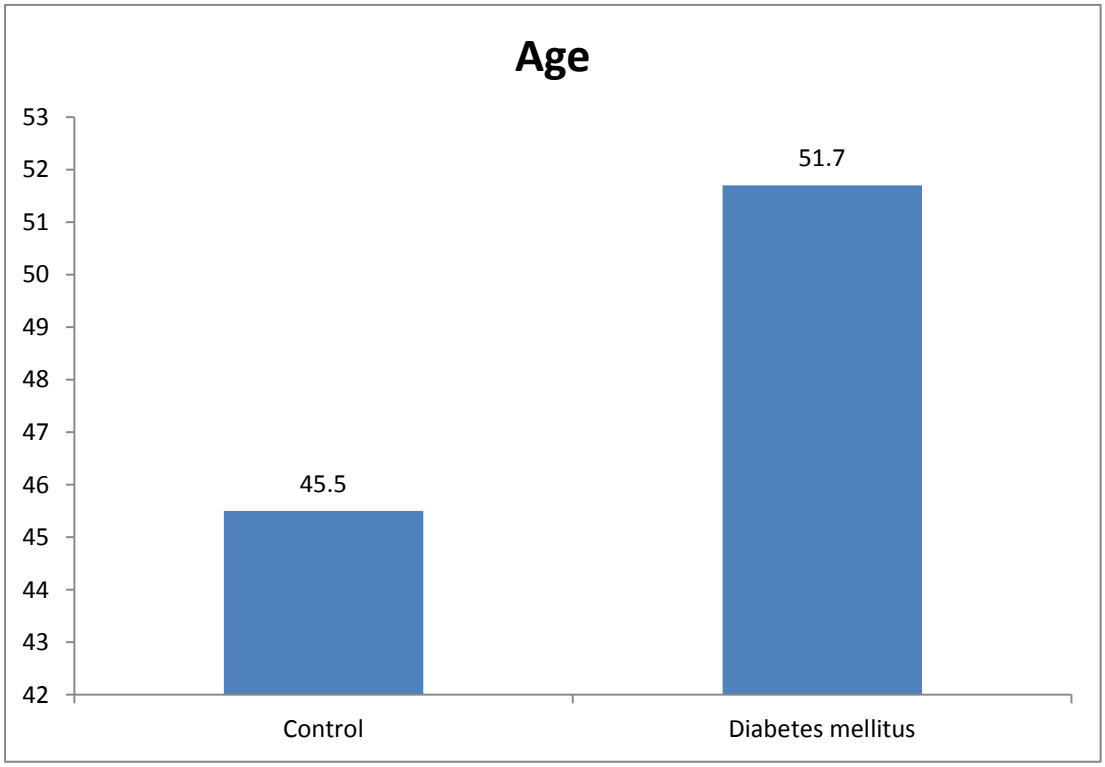

Figure 11: Comparison of mean age between the groups

Table 4: Comparison of distribution of gender between the groups

		Group C		Group D		Chi-square (p-value)
		Count	N %	Count	Column N %	
Sex	Female	31	50.8%	32	52.5%	0.03 (0.866)
	Male	30	49.2%	29	47.5%	

The gender distribution in group C 31(50.8%) were females and 30(49.2%) were males whereas in group D 32(52.5%) were females and 29(47.5%) were males, there is no significant difference noted between the groups.(p>0.05)

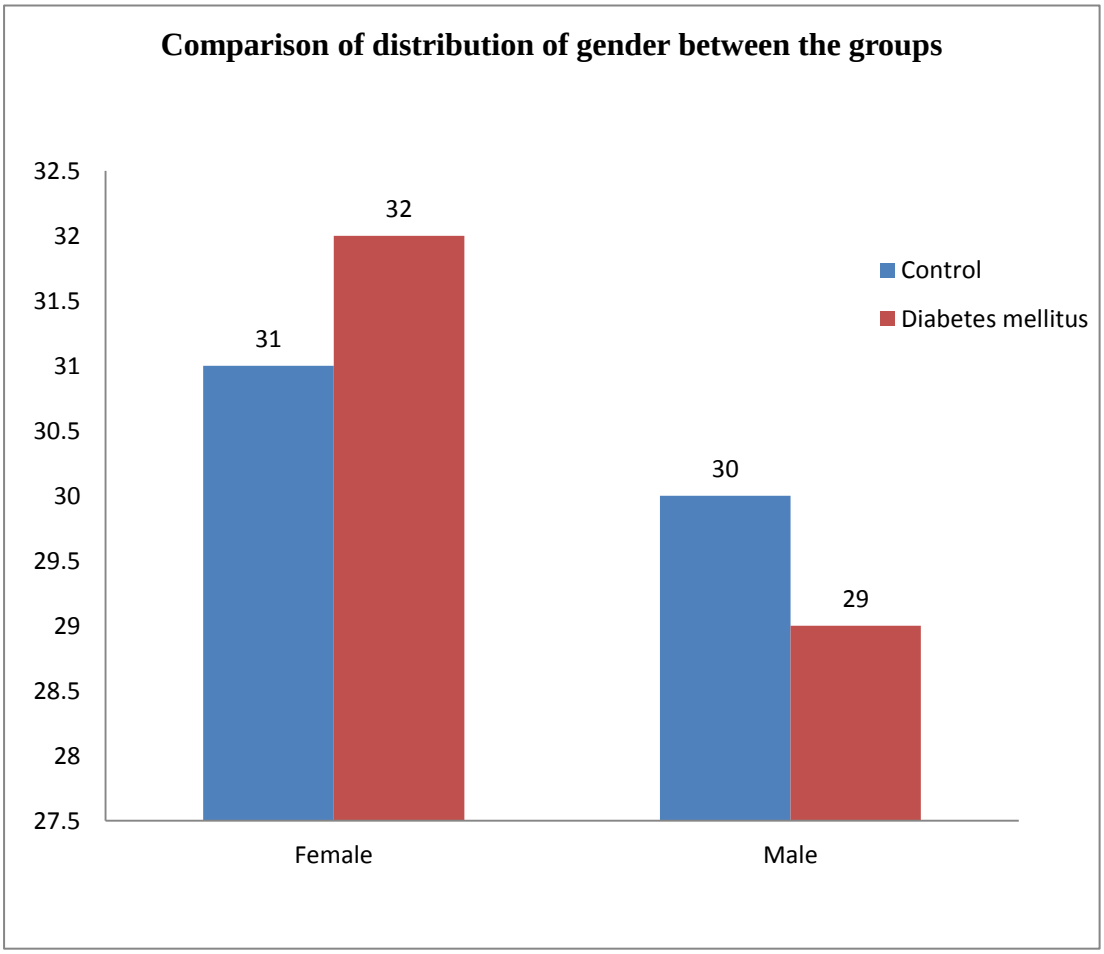

Figure 12: Comparison of distribution of gender between the groups

Table 5: Comparison of the mean duration of fasting between the groups

	Group C		Group D		p-value
	Mean	SD	Mean	SD	
Fasting interval HRS	8.6	0.9	8.8	0.9	0.181

The duration of fasting interval in group C is 8.6± 0.9 and in group D is 8.8±0.9, which is comparable but not statistically significant difference was found.

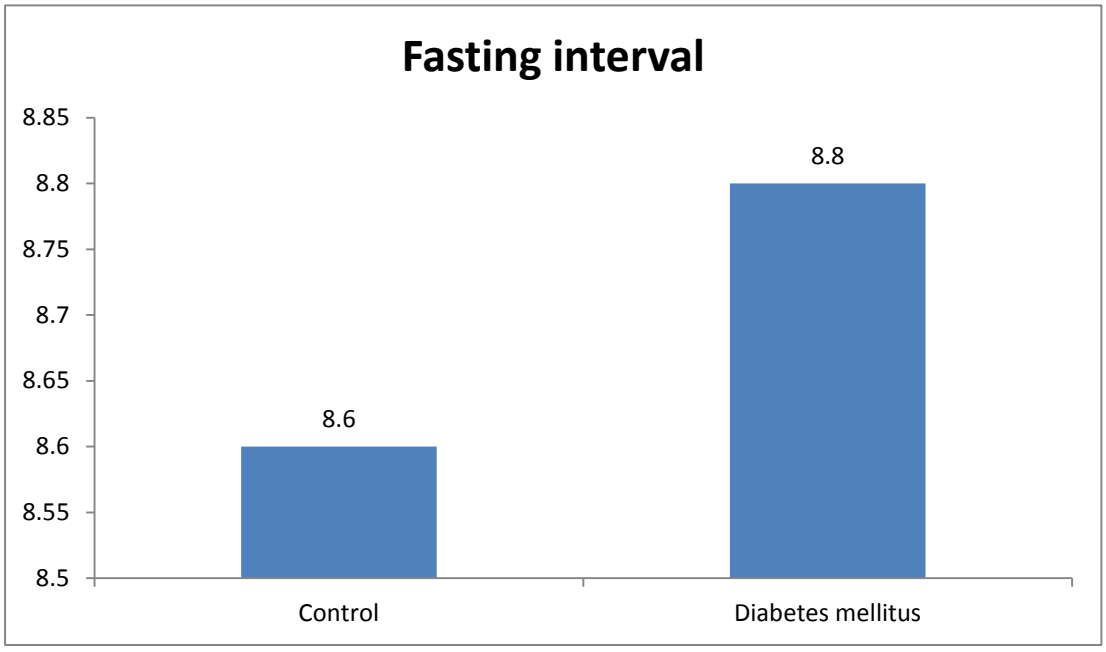

Figure 13: Comparison of the mean duration of fasting between the groups

Table 6: Comparison of the diameters in supine position between the groups

	Group C		Group D		p-value
	Mean	SD	Mean	SD	
CC diameter Supine	1.91	.19	2.15	0.11	0.01*
AP diameter Supine	0.99	0.10	1.36	0.07	0.01*
CSA cm2 supine	1.485	0.212	2.291	0.180	0.01*

The diameters measured in supine position among group C illustrates the CC diameter (1.91±0.19), AP diameter (0.99±0.10), CSA (1.485±0.212) and in group D the CC diameter (2.15±0.11) , AP diameter (1.36±0.07), CSA (2.291±0.180). Among the groups there is significant higher mean level of CC , AP diameter and CSA in group D when compared to group C. ($p<0.05$)

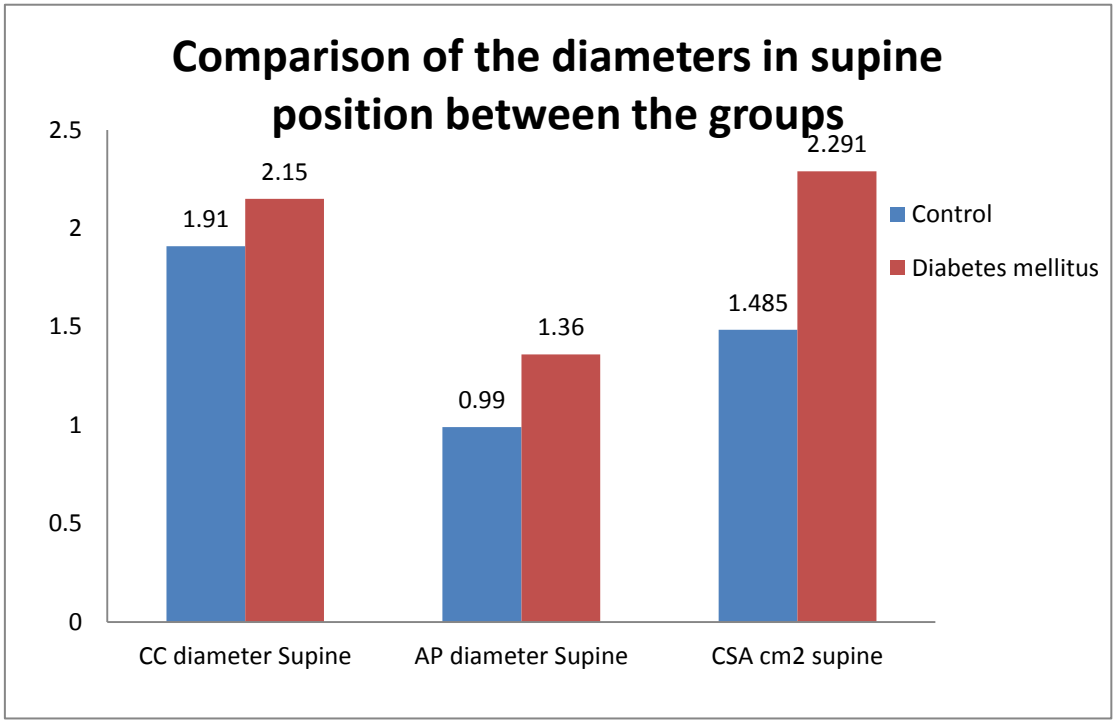

Figure 14: Comparison of the diameters in supine position between the groups

Table 7: Comparison of the diameters in right lateral position between the groups

RLD	Group D		Group D		p-value
	Mean	SD	Mean	SD	
CC diameter RLD	1.896	0.072	2.428	.120	0.01*
AP diameter RLD	1.02	0.14	1.77	.12	0.01*
CSA RLD	1.523	0.202	3.368	.286	0.01*

The diameters measured in RLD position among group C illustrates the CC diameter (1.89±0.072), AP diameter (1.02±0.14), CSA (1.523±0.202) and in group D the CC diameter (2.42±0.12) , AP diameter (1.77±0.12), CSA (3.36±0.286). Among the groups there is significant higher mean level of CC, AP diameter and CSA in group D when compared to group C. ($p<0.05$)

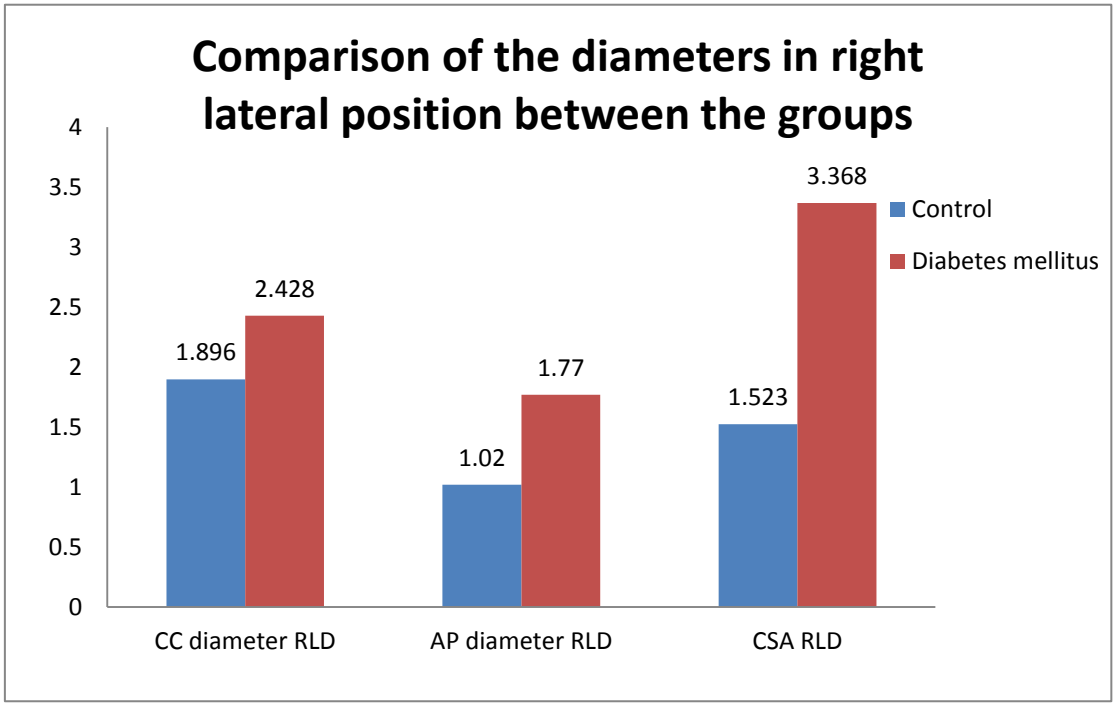

Figure 15: Comparison of the diameters in right lateral position between the groups

Table 8: Comparison of the gastric volume between the groups

	Group C		Group D		p-value
	Mean	SD	Mean	SD	
Gastric Volume(GV)	-8.991	20.554	9.963	14.520	0.01

The calculated mean Gastric volume is(-8.9 ±20.554) in Group C whereas in Group D (9.963±14.520).The results were statistically significant within the groups.

DISCUSSION

DISCUSSION

DM is contemplated as a high-risk condition which constitutes a deliberate challenge to anaesthetists in various aspects. The most dreaded complication is aspiration of gastric contents since diabetics are likely to be full stomach because of autonomic gastropathy. [5,6]

In present practice,the history of NPO status is obtained through patients, which is inaccurate, and in those at higher risk for delayed stomach emptying, it may provide a larger risk for aspiration. Prior to arranging the anaesthetic induction and procedure, using stomach ultrasonography as a screening tool can assist minimise unnecessary perioperative complications. [42] USG is extensively accessible and is shown to be a viable bed-side evaluation method to assess stomach contents in real-time.USG is performed before induction to check diabetic patients' fasting gastric volume (GV) to see whether it is greater than the suggested safe limit.[4]

So in this study, we evaluated fasting gastric volume pre-operatively using USG in diabetics and healthy individuals undergoing elective surgical procedures

Total of 122 patients fulfilling inclusion criteria are included and divided into two groups after obtaining informed consent as; Group D (n=61): Patients who have history of diabetes mellitus (DM) and Group C (n=61): Patients who are non diabetic (controls)

The mean age of the participants was found to be 46.60±13.77yrs of age. Among the participants, 51.6% were female patients and 48.4% were male patient with marginal female preponderance in the present study. The mean age of patients and gender distribution between the groups was found to be comparable.

Similar to present study Cunha DD et al., documented the similar mean age between the groups. The diabetes group had a mean age of 49.3 ±16.4 years, whereas the nondiabetic group had a mean age of 49.4 ±16.8 years. [42]

In a study by Sharma G et al., majority of the patients were in age of 60yrs with 57% were male and 43% were female patients.[36] The mean age in Cunha D et al., in diabetic group was 49.3 ± 16.4 years and in the nondiabetic group 49.4 ± 16.8 years with 68% male patients and 32% female.[42]

Acute intraoperative aspiration of stomach contents is a feared and possibly deadly complication linked with morbidity from pneumonitis or aspiration pneumonia. The amount, type, and acidity of the gastrointestinal contents can all affect the degree of lung damage.[43] Sonography in both the lying down and RLD position among patients is critical for adequate risk classification. In the supine position, the antrum may look empty, but it may seem full in the RLD position. The visible rise in GV in the RLD position is most likely because of stomach contents tend to the gastric outlet. [2,44]

On comparison of the interval of fasting between the groups, it was comparable. Among the patients, there is a significant higher mean level of CC diameter, AP diameter and CSA in a supine position in cases compared to controls. ($p<0.05$) Similarly, there is significant higher mean level of CC diameter, AP diameter and CSA in RLD position in cases compared to controls. ($p<0.05$) The gastric volume was significantly higher in cases (76.16±4.18) compared to the controls (49.23±2.95) in the study. ($p<0.05$)

Similar to present study Rajeswari L et al., documented in both the right lateral and semisitting positions, diabetic individuals exhibited significantly higher mean antral CSA and estimated mean GRV. In both the right lateral (p =0.0001) and semi-sitting postures, the gastric antrum looked empty in a considerably larger frequency of non-diabetic individuals than diabetic patients. [41]

Another study by Harmagatti A et al., documented that inspite of 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 difference was significant. When compared to non-diabetic individuals, those with chronic diabetes had larger Residual GV and antral CSA. The clinical importance of these results requires further data before specific advice for diabetes individuals can be developed. [39]

In study by Sharma G et al., documented that Diabetics and CKD patients demonstrated statistically significant increase in CSA among supine and RLD. They discovered an rise in calculated stomach capacity when patients BMI rose. [36] Patients with Chronic diabetes resulted in higher residual GV in comparison to healthy individuals after 8 NPO hours for elective surgeries in a study conducted on 25 Diabetes Mellitus patients with 6 years of history and 25 normal healthy controls on Ultrasound. [34]

Sabry R et al., found that compared to control group, the diabetic group had a greater median antral CSA and a higher estimated stomach residual volume. In addition, the diabetes group had a larger aspirated GV through the NG tube than the control group. The association between computed residual stomach volume using ultrasonic measurements

and volume of aspirated gastric contents via NG tube was extremely excellent. After fasting for 8 NPO hours for an elective surgical procedure, Chronic diabetics had a greater residual GV than healthy controls. [34]

Diabetics had a larger mean volume of stomach aspirate when compared to non-diabetics. In individuals with long-standing diabetes, the current fasting guidelines for elective surgery are inconclusive. As a result, we recommend that point-of-care ultrasound be used as an effective screening tool to assess aspiration risk and tailor anaesthetic management. [41] While current fasting recommendations are acceptable for healthy people, they are insufficient in patients with risk factors. In individuals with risk factors, ultrasound measurement of preoperative stomach capacity is a useful screening technique. [40]

Garima et al. discovered that fasting for 10 hours did not ensure an empty stomach and that comorbidities such as diabetes made patients more likely to have hazardous gastric contents when utilising bedside GUS on adult patients coming for elective surgery.[36] Following the current preoperative fasting guidelines, about half of type 2 diabetes patients have a full stomach. The use of preoperative ultrasonography to measure stomach content in type 2 diabetes patients is recommended.[37]

Our research discovered NPO > 6-10 hours will not ensure an bare stomach, independent of comorbid conditions. As a result, it is obvious that bedside ultrasonography may be utilised to assess the status of stomach contents and may be used to stratify aspiration risk. It could be useful in a variety of therapeutic situations where the risk of aspiration is unknown or uncertain.

CONCLUSION

CONCLUSION

The present study concluded that the antral cross-sectional area and thereby fasting gastric volumes, measured using point-of-care ultrasonography in right lateral decubitus position, were significantly higher in patients suffering from Type 2 diabetes mellitus compared to healthy individuals of similar age group.

This quantitative assessment of gastric contents using POC ultrasound is a valuable tool in identifying patients at risk of pulmonary aspiration of gastric contents, and helps the perioperative physicians in decision making.

Further studies with larger sample size and having patients with associated comorbidities such as obesity, should be conducted to evaluate the effect of factors that delay gastric emptying in diabetic patients, who are subjected for elective surgeries under anaesthesia.

POC gastric ultrasound should be routinely performed in all patients with risk factors for pulmonary aspiration of gastric contents, as it is simple, valid, non invasive tool that helps in decision making.

LIMITATION

LIMITATIONS

- The sample size studied was relatively small to draw conclusions
- Effect of obesity on fasting gastric volume was not evaluated, as obesity coexists in diabetics and can be a confounding factor
- The relation between the duration of diabetes mellitus and fasting gastric volume was not studied, as it is said that long standing diabetics have higher degree of autonomic gastropathy
- We did not study the incidence of pulmonary aspiration of gastric contents in our study participants in whom there was enhanced residual gastric volume
- Our study participants had a prolonged fasting interval prior to elective surgery as it was technically difficult to follow the standard fasting guidelines. Hence calculation of gastric volumes after a minimum mandatory fasting period was not evaluated

SUMMARY

SUMMARY

The present Prospective observational study -Single blinded conducted on 122 patients undergoing elective surgeries at RL Jalappa hospital, Tamaka, Kolar during academic year January 2021-2022 were divided into two groups after obtaining informed consent and fulfilling the inclusion criteria: Group D (n=61) Patients who have history diabetes mellitus (DM) and Group C (n=61): Patients who are non diabetic (control).. The following parameters were measured as CC diameter and AP diameter,CSA and GV using CC and AP diameters. All the patient data was collected on Microsòft windows excel sheet, and the "statistical analysis was performed on the SPSS v21 operating on windows 10. A p-valùe òf <0.05 was considered statistically significant".

Our study evaluate the fasting GV in two groups Diabetics(Group D) and Non-diabetics(Group C) respectively.

Total of 122 patients fulfilling inclusion criteria are included and divided into two groups after obtaining informed consent as:

Group D (n=61): Patients who have history diabetes mellitus (DM)

Group C (n=61): Patients who are non diabetic (control)

The mean age of the participants was found to be 46.60±13.77yrs of age.

Among the participants, 51.6% were female patients and 48.4% were male patient with marginal female preponderance in the present study.

On comparison of the mean age between the group, there is no noteworthy difference noted.(p>0.05)

On comparison of gender distribution among two groups, there is no remarkable difference noted between the distribution of male and female patients between the groups.($p>0.05$)

On comparison of the interval of fasting between the groups, it was comparable.

Among the patients there is significant higher mean level of CC diameter, AP diameter and CSA in supine position in cases compared to controls. ($p<0.05$)

Similarly, there is significant higher mean level of CC diameter, AP diameter and CSA in RLD position in cases compared to controls. ($p<0.05$)

The gastric volume was significantly higher in cases (76.16 ± 4.18) compared to the controls (49.23 ± 2.95) in the study. ($p<0.05$)

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ANNEXURES

PROFORMA

Comparative study of fasting gastric volume in diabetic and non- diabetic patients undergoing elective surgeries using ultrasonography:A prospective observational study

Investigators: Dr P Yashwanth / Dr Vishnuvardhan V

Age/Sex: **UHID No. :**

Ward: **ASA grade:**

- **Past medical history:**
- **Medication History:**
- **General physical examination:**

Height: Weight: Pulse rate: BP:

Pallor/icterus/cyanosis/clubbing/lymphadenopathy/edema

- **Systemic examination:**

RS - **CVS -**

CNS - **P/A -**

- **Diagnosis :**
- **Surgery:**

History of diabetes:

- **Group C:** Patient who are non diabetic undergoing ultrasound assessment before elective surgery
- **Group D** :Patient who are diabetic who are undergoing ultrasound assessment before elective surgery

	SUPINE	**RLD**
Fasting interval		
Cranio-caudal diameter(CC)		
Antero-Posterior diameter(AP)		
Cross sectional Area		
Gastric volume(GV)		

PATIENT INFORMATION SHEET

TITLE: Comparative study of fasting gastric volume in diabetic and non- diabetic patients undergoing elective surgeries using ultrasonography

Investigators: Dr Yashwanth P / Dr Vishnuvardhan V

Study Location : R L Jalappa Hospital and Research Centre attached to Sri Devaraj Urs Medical College, Tamaka , Kolar.

Details - All Patients posted for elective surgeries will be included in this study both diabetic and non diabetic will be included. Patients with other co morbidities will be excluded.

This study aims to reduce the incidence of intraoperative and peri operative aspiration in patients especially diabetics undergoing elective surgeries under general anaesthesia. Patient and the attenders will be completely explained about the procedure being done i.e., peri-operative ultrasound assessment.

Ultrasound assessment will be avoided in patients who are taking medication for upper gastro intestinal tract, Chronic kidney disease, Hypothyroidism, Connective tissue disorder ,On anti depressant medication ,previous oesophageal or abdominal surgery ,Obese patients ,Pregnant patients ,patients with nasogastric tube in-situ

Please read the information and discuss with your family members. You can ask any question regarding the study. If you agree to participate in the study we will collect information. Relevant history will be taken. This information collected will be used only for dissertation and publication.

All information collected from you will be kept confidential and will not be disclosed to any outsider. Your identity will not be revealed. There is no compulsion to agree to this study. The care you will get will not change if you don't wish to participate. You are required to sign/ provide thumb impression only if you voluntarily agree to participate in this study.

For any further clarification you are free to contact,

Dr Yashwanth P

(Post Graduate in Anaesthesiology)

Mobile no:8121595789

Dr. Vishnuvardhan V

(Associate Professor in Anaesthesiology)

Mobile no:9008909768

INFORMED CONSENT FORM

Comparitive study of fasting gastric volume in diabetic and non- diabetic patients undergoing elective surgeries using ultrasonography

Date:

I, _____ aged _____ ,after being explained in my own vernacular language about the purpose of the study and the risks and complications of the procedure, hereby give my valid written informed consent without any force or prejudice for performing ultrasound. The nature and risks involved have been explained to me to my satisfaction. I have been explained in detail about the study being conducted. I have read the patient information sheet and I have had the opportunity to ask any question. Any question that I have asked, have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research. I hereby give consent to provide my history, undergo physical examination, undergo the procedure, undergo investigations and provide its results and documents etc., to the doctor / institute etc., For academic and scientific purpose the operation / procedure etc., may be video graphed or photographed. All the data may be published or used for any academic purpose. I will not hold the doctors / institute etc., responsible for any untoward consequences during the procedure / study.

A copy of this Informed Consent Form and Patient Information Sheet has been provided to the participant.

_____ _____

(Signature & Name of Pt. Attendant) (Signature/Thumb impression & Name of Patient/Guardian)

(Relation with patient)

Witness 1:

Witness 2:

_____

(Signature & Name of Research person /doctor)

KEY TO MASTER CHART

UHID.	UNIQUE HEALTH IDENTIFICATION NUMBER
NA	NOT APPLICABLE
S.NO.	SERIAL NUMBER
CC.	CRANIO CAUDAL
AP	ANTERO-POSTERIOR
CSA.	CROSS SECTIONAL AREA
RLD.	RIGHT LATERAL DECUBITUS
GV.	GASTRIC VOLUME
ML	MILLI LITRES
YRS	YEARS
HRS	HRS

									supine				RLD		
S.No.	Group	Age	Sex	UHID	Diagnosis	Surgery	HISTORY OF DIabetes(yrs)	fasting interval(HRS)	CC DIAMETER	AP DIAMETER	CSA(cm2)	CC DIAMETER	AP DIAMETER	CSA	GV
1	C	53	Male	932863	CA Stomach post NACT	subtotal gastrectomy	NA	8	1.96	0.8	1.23088	1.89	1.11	1.6468515	-16.7959681
2	C	53	female	925690	Cholelithiasis	Laproscopic cholecystectomy	NA	9	1.45	1.11	1.2634575	1.78	1.09	1.523057	-18.6033678
3	C	20	Male	933115	Rt Deivated nasal septum	Septoplasty +Turbinoplasty	NA	8	1.48	0.9	1.04562	1.86	1.04	1.518504	23.5701584
4	C	42	Male	932192	CA right buccal mucosa	Wide local excission +mrnd+PMMC flap	NA	10	1.67	0.96	1.258512	1.78	0.98	1.369354	-6.7674316
5	C	22	Male	935749	Fracture lt ZMC	ORIF	NA	8	1.97	0.98	1.515521	1.96	1.11	1.707846	23.7745516
6	C	60	female	936007	LT CSOM	left tympanoplast with mastoidectomy	NA	9	1.89	1.11	1.6468515	1.89	1.02	1.513323	-27.7054842
7	C	60	female	931529	carcinoma rt kidney	Radical nephrectomy	NA	8	2.11	1.04	1.722604	1.92	0.96	1.446912	-28.6750848
8	C	57	Male	933349	Cholelithiasis	Laproscopic cholecystectomy	NA	9	1.92	1.17	1.763424	1.98	0.99	1.538757	-23.4941478
9	C	58	Male	935676	Ca stomach	Total Gastrectomy	NA	8.5	1.98	1.11	1.725273	1.86	1.02	1.489302	-25.4961908
10	C	28	male	934370	chronic adeno tonsillitis	Adeno tonsillectomy	NA	8	1.78	0.89	1.243597	1.98	0.96	1.492128	12.9450688
11	C	53	female	936875	right inverted papilloma	FESS	NA	9	1.92	0.76	1.145472	1.87	0.98	1.438591	-19.8365714
12	C	50	male	939696	right nasal polyposis	FESS	NA	9	1.75	0.95	1.3050625	1.92	0.98	1.477056	-15.4349824
13	C	48	female	937511	Ca right breast	right lymphectomy	NA	8	2.11	0.89	1.4741515	1.96	0.89	1.369354	-14.4474316
14	C	28	female	941427	fracture lt ZMC	ORIF	NA	9	2.12	0.94	1.564348	1.96	0.87	1.338582	10.7032972
15	C	55	female	940951	Ca cervix	Lt PCNL + cystoscopy	NA	8	1.92	0.92	1.386624	1.89	1.01	1.4984865	-21.5220971
16	C	62	male	925303	B/l Nasal polyposis	Excision	NA	8	1.78	0.96	1.341408	1.87	1.03	1.5119885	-30.2849679
17	C	32	Male	935006	right Deviated nasal septum	FESS	NA	9	1.89	0.86	1.275939	1.88	0.9	1.32822	5.432012
18	C	20	Male	941179	chronic tonsillitis	tonsillectomy	NA	10	1.98	0.85	1.321155	1.96	0.93	1.430898	22.2911108
19	C	54	female	936249	Ca right breast	MRND	NA	11	1.98	0.92	1.429956	1.89	0.96	1.424304	-21.3251616
20	C	63	female	936441	Ca lt buccal mucosa	composite rescetion +lt MRND	NA	8	2.12	1.02	1.697484	1.96	1.06	1.630916	-29.8286264
21	C	42	female	943380	l3-l4,l4-l5 IVDP	spinal fusion with implant	NA	11	2.4	1.05	1.9782	1.89	0.97	1.4391405	-5.7485487
22	C	56	female	943802	Ca ovary	Exploratory laprotomy	NA	10	2.2	0.98	1.69246	1.99	0.97	1.5152855	-22.5568317
23	C	45	female	945078	mass per abdomen	Exploratory laprotomy	NA	9	2.32	0.89	1.620868	2.11	0.94	1.556969	-7.8682526
24	C	24	female	940355	cholelithiasis	Laproscopic cholecystectomy	NA	8	1.95	0.93	1.4235975	1.94	0.92	1.401068	16.7355928
25	C	65	female	944696	Ca lt breast	simple mastectomy	NA	8	1.96	0.96	1.477056	1.95	0.94	1.438905	-35.191987

									supine				RLD		
S.No.	Group	Age	Sex	UHID	Diagnosis	Surgery	HISTORY OF DIabetes(yrs)	fasting interval(HRS)	CC DIAMETER	AP DIAMETER	CSA(cm2)	CC DIAMETER	AP DIAMETER	CSA	GV
26	C	24	female	949845	recurrent appendicites	Exploratory laprotomy	NA	8	1.67	0.98	1.284731	1.72	0.92	1.242184	14.4158864
27	C	40	male	947500	rt nasal mass	FESS	NA	9	1.87	0.89	1.3064755	1.86	0.89	1.299489	-5.2274606
28	C	54	female	950130	Cholelithiasis	Laproscopic cholecystectomy	NA	9.5	1.93	0.82	1.242341	1.98	0.98	1.523214	-19.8810756
29	C	30	female	945613	papillary carcinoma of thyroid	Total thyroidectomy	NA	8	1.87	0.92	1.350514	1.86	0.96	1.401696	9.0647616
30	C	65	Male	945476	CA right buccal mucosa	composite rescetion +lt MRND	NA	9	1.78	0.87	1.215651	1.84	0.92	1.328848	-36.7988192
31	C	22	Male	949514	L4-L5 IVDP with Rt LL radiculopathy	Discectomy with fusion	NA	8	1.89	0.86	1.275939	1.92	0.87	1.311264	17.9844544
32	C	50	female	36172	right renal calculi	right pcnl +DJ	NA	8.5	1.89	0.9	1.335285	1.87	0.99	1.4532705	-15.7822507
33	C	70	male	35061	right renal cell carcinoma	Decompression with fusion implant	NA	8	1.78	1.11	1.551003	1.88	0.86	1.269188	-44.0698552
34	C	38	female	37459	right renal calculi	rt pcnl +DJ stenting	NA	9	1.9	1.12	1.67048	1.94	1.12	1.705648	3.2624608
35	C	24	female	37059	right renal calculi	right pcnl +DJ	NA	9.5	1.87	1.08	1.585386	1.96	1.02	1.569372	19.1928312
36	C	24	Male	40256	fracture lt body mandible	spinal decompression with fusion	NA	11	1.88	1.09	1.608622	1.89	1.11	1.6468515	20.3240319
37	C	65	male	35280	carcinoma lt GBS	composite rescetion +lt MRND	NA	10	1.87	1.13	1.6587835	1.9	1.12	1.67048	-31.810992
38	C	29	female	20285	carcinoma left buccal mucosa	composite rescetion +lt MRND	NA	9	1.9	1.06	1.58099	1.92	1.04	1.567488	12.7653248
39	C	50	male	41538	fracture mandible	ORIF	NA	9	1.92	1.08	1.627776	1.87	1.02	1.497309	-15.1392886
40	C	62	male	23864	C6-C7 intervertibral disc prolapse	Decompresion with laminectomy	NA	8	1.93	1.02	1.545351	1.85	1.11	1.6119975	-28.8248365
41	C	43	female	45489	L4-L5 IVDP with Rt LL radiculopathy	spinal fusion withn implant	NA	8	1.67	1.04	1.363388	1.89	1.08	1.602342	-4.6458068
42	C	67	male	43751	L1 Compression fracture	Spinal fusion with implant	NA	9	1.78	0.92	1.285516	1.86	0.96	1.401696	-38.2952384
43	C	56	female	42138	right ovarian tumor	Exploratory laprotomy	NA	8	1.97	0.96	1.484592	1.88	0.98	1.446284	-23.5642536
44	C	55	female	37934	carcinoma lt lower GBS	composite rescetion +lt MRND	NA	8	1.92	0.95	1.43184	1.89	0.89	1.3204485	-24.1214519
45	C	63	male	44295	L3-L5 PIVD	spinal fusion with implant	NA	9	1.97	0.96	1.484592	1.86	0.92	1.343292	-34.0279368
46	C	34	female	46197	Cholelithiasis	Laproscopic cholecystectomy	NA	8	1.87	1.02	1.497309	1.85	1.06	1.539385	5.955021
47	C	29	female	45905	right otosclerosis	right exploratory tympanotomy	NA	8	1.92	0.98	1.477056	1.92	0.94	1.416768	10.5648128

									supine				RLD		
S.No.	Group	Age	Sex	UHID	Diagnosis	Surgery	HISTORY OF DIabetes(yrs)	fasting interval(HRS)	CC DIAMETER	AP DIAMETER	CSA(cm2)	CC DIAMETER	AP DIAMETER	CSA	GV
48	C	55	male	46643	C5-C6,C6-C7 ivdp	spinal fusion with implant	NA	9	1.95	0.96	1.46952	1.97	0.92	1.422734	-22.6280836
49	C	65	female	44187	Ca left buccal mucosa	composite rescetion +lt MRND	NA	8.5	1.87	0.97	1.4239115	1.89	0.95	1.4094675	-35.6217745
50	C	48	male	43941	Ca left lateral border of toungue	hemi glosectomy + compartment resection	NA	9	1.95	0.87	1.3317525	1.96	0.85	1.30781	-15.345974
51	C	75	female	108965	appendicular mass	exploration	NA	8	1.87	0.98	1.438591	1.87	0.89	1.3064755	-49.9254577
52	C	26	MALE	118008	LACERATION OVER RIGHT HAND	WOUND DEBRIDEMENT	NA	8	1.89	1.11	1.6468515	1.86	0.98	1.430898	14.6111108
53	C	21	female	111877	acute appendicitis	appendicectomy	NA	8	1.92	0.99	1.492128	1.72	1.12	1.512224	22.1984704
54	C	45	femaLE	92161	necrotising fascitis	debridement	NA	9	1.87	1.2	1.76154	1.89	1.13	1.6765245	-6.1227423
55	C	26	male	111959	LACERATION LUMBAR REGION	WOUND exploration	NA	8.5	1.56	1.09	1.334814	1.9	1.34	1.99861	22.899706
56	C	41	MALE	112039	Fracture of proximal phalynx	crif +k wire fixation	NA	7	1.67	1.1	1.442045	1.76	1.34	1.851344	1.5496224
57	C	56	FEMALE	110982	Cholelithiasis	Laproscopic cholecystectomy	NA	8	1.98	1.12	1.740816	1.68	1.45	1.91226	-16.761004
58	C	53	MALE	104781	RENAL CALCULUS	rt pcnl +DJ stenting	NA	6	2.1	1	1.6485	1.97	1.12	1.732024	-15.5524496
59	C	59	MALE	109365	BPH	TURP	NA	8	2.1	1.2	1.9782	1.98	1.12	1.740816	-23.1040864
60	C	35	MALE	110055	fracture mandible	ORIF	NA	8	2.5	1.1	2.15875	1.96	1.56	2.400216	17.2431536
61	C	45	female	109877	Umbilical hernia	mesh repair	NA	9	2.6	1.2	2.4492	2.12	1.82	3.028844	13.6211224
	GROUP D														
1	D	53	Male	932863	CA Stomach post NACT	subtotal gastrectomy	6	8	2.28	1.39	2.487822	2.43	1.82	3.471741	9.8474186
2	D	53	female	925690	Cholelithiasis	Laproscopic cholecystectomy	7	9	2.12	1.36	2.263312	2.54	1.79	3.569081	11.2685826
3	D	44	female	933115	Rt Deivated nasal septum	Septoplasty +Turbinoplasty	7	8	2.01	1.4	2.20899	2.34	1.8	3.30642	18.953732
4	D	42	Male	932192	CA right buccal mucosa	Wide local excission +mrnd+PMMC flap	9	8	2.3	1.42	2.56381	2.46	1.78	3.437358	23.4254268
5	D	53	Male	935749	Fracture lt ZMC	ORIF	8	8	2.22	1.32	2.300364	2.46	1.89	3.649779	12.4467734
6	D	60	female	936007	LT CSOM	left tympanoplast with mastoidectomy	6	9	2.12	1.32	2.196744	2.34	1.88	3.453372	0.6192312
7	D	60	female	931529	carcinoma rt kidney	Radical nephrectomy	10	9	2.02	1.45	2.299265	2.12	1.85	3.07877	-4.849958

									supine				RLD		
S.No.	Group	Age	Sex	UHID	Diagnosis	Surgery	HISTORY OF DIabetes(yrs)	fasting interval(HRS)	CC DIAMETER	AP DIAMETER	CSA(cm2)	CC DIAMETER	AP DIAMETER	CSA	GV
8	D	57	Male	933349	Cholelithiasis	Laproscopic cholecystectomy	10	8	2.02	1.26	1.997982	2.45	1.72	3.30799	2.336654
9	D	58	Male	935676	Ca stomach	Total Gastrectomy	8	9	2.28	1.27	2.273046	2.41	1.6	3.02696	-3.046384
10	D	63	male	934370	chronic adeno tonsillitis	Adeno tonsillectomy	8	10	2.12	1.34	2.230028	2.5	1.43	2.806375	-12.666925
11	D	53	female	936875	right inverted papilloma	FESS	7	9	2.01	1.45	2.2878825	2.51	1.89	3.7239615	13.5298379
12	D	50	male	939696	right nasal polyposis	FESS	10	8	2.3	1.36	2.45548	2.34	1.74	3.196206	9.6646076
13	D	48	female	937511	Ca right breast	right lymphectomy	7	9	2.22	1.4	2.43978	2.45	1.67	3.2118275	12.4526815
14	D	56	female	941427	fracture lt ZMC	ORIF	8	8	2.12	1.42	2.363164	2.47	1.78	3.451331	5.7094326
15	D	55	female	940951	Ca cervix	Lt PCNL + cystoscopy	9	9	2.02	1.32	2.093124	2.5	1.82	3.57175	8.74755
16	D	62	male	925303	B/l Nasal polyposis	Excision	7	10	2.02	1.32	2.093124	2.51	1.79	3.5269265	-0.8668731
17	D	42	Male	935006	right Deviated nasal septum	FESS	8	11	2.28	1.45	2.59521	2.54	1.8	3.58902	25.639692
18	D	20	Male	941179	chronic tonsillitis	tonsillectomy	9	9	2.12	1.26	2.096892	2.53	1.78	3.535169	53.0134674
19	D	54	female	936249	Ca right breast	MRND	8	10	2.01	1.27	2.0038695	2.12	1.89	3.145338	3.8019348
20	D	63	female	936441	Ca lt buccal mucosa	composite rescetion +lt MRND	7	11	2.3	1.34	2.41937	2.43	1.88	3.586194	-1.2815676
21	D	42	female	943380	l3-l4,l4-l5 IVDP	spinal fusion with implant	7	10	2.22	1.45	2.526915	2.54	1.85	3.688715	27.095239
22	D	56	female	943802	Ca ovary	Exploratory laprotomy	8	9	2.12	1.36	2.263312	2.34	1.72	3.159468	1.4482328
23	D	45	female	945078	mass per abdomen	Exploratory laprotomy	8	9	2.02	1.4	2.21998	2.46	1.6	3.08976	14.510496
24	D	50	female	940355	cholelithiasis	Laproscopic cholecystectomy	6	8	2.02	1.42	2.251694	2.46	1.43	2.761473	3.3175058
25	D	65	female	944696	Ca lt breast	simple mastectomy	6	10	2.24	1.32	2.321088	2.34	1.89	3.471741	-5.5125814
26	D	43	female	949845	recurrent appendicites	Exploratory laprotomy	8	11	2.2	1.32	2.27964	2.12	1.74	2.895708	14.2373368
27	D	40	male	947500	rt nasal mass	FESS	9	9	2.38	1.45	2.709035	2.45	1.67	3.2118275	22.6926815
28	D	54	female	950130	Cholelithiasis	Laproscopic cholecystectomy	7	8	2.3	1.26	2.27493	2.41	1.78	3.367493	7.0453978
29	D	30	female	945613	papillary carcinoma of thyroid	Total thyroidectomy	8	10	2.17	1.27	2.1633815	2.5	1.82	3.57175	40.74755
30	D	65	Male	945476	CA right buccal mucosa	composite rescetion +lt MRND	7	9	2.15	1.34	2.261585	2.51	1.79	3.5269265	-4.7068731
31	D	42	Male	949514	L4-L5 IVDP with Rt LL radiculopathy	Discectomy with fusion	8	9	2.28	1.45	2.59521	2.34	1.8	3.30642	21.513732
32	D	50	female	36172	right renal calculi	right pcnl +DJ	9	8	2.12	1.36	2.263312	2.45	1.78	3.423385	12.981421

									supine				RLD		
S.No.	Group	Age	Sex	UHID	Diagnosis	Surgery	HISTORY OF DIabetes(yrs)	fasting interval(HRS)	CC DIAMETER	AP DIAMETER	CSA(cm2)	CC DIAMETER	AP DIAMETER	CSA	GV
33	D	70	male	35061	right renal cell carcinoma	Decompression with fusion implant	10	10	2.01	1.4	2.20899	2.47	1.89	3.6646155	-9.0966137
34	D	38	female	37459	right renal calculi	rt pcnl +DJ stenting	6	8	2.3	1.42	2.56381	2.5	1.88	3.6895	32.2267
35	D	52	female	37059	right renal calculi	right pcnl +DJ	9	9	2.22	1.32	2.300364	2.51	1.85	3.6451475	13.6591535
36	D	45	Male	40256	fracture lt body mandible	spinal decompression with fusion	10	9	2.12	1.32	2.196744	2.54	1.72	3.429508	19.4708168
37	D	65	male	35280	carcinoma lt GBS	composite rescetion +lt MRND	8	9	2.02	1.45	2.299265	2.53	1.6	3.17768	-9.805872
38	D	29	female	20285	carcinoma left buccal mucosa	composite rescetion +lt MRND	7	9	2.02	1.26	1.997982	2.12	1.43	2.379806	24.6251676
39	D	50	male	41538	fracture mandible	ORIF	6	10	2.12	1.27	2.113534	2.43	1.89	3.6052695	15.6369347
40	D	62	male	23864	C6-C7 intervertibral disc prolapse	Decompresion with laminectomy	7	8	2.14	1.34	2.251066	2.54	1.74	3.469386	-1.7069644
41	D	43	female	45489	L4-L5 IVDP with Rt LL radiculopathy	spinal fusion withn implant	8	9	2.08	1.45	2.36756	2.34	1.67	3.067623	16.7472958
42	D	67	male	43751	L1 Compression fracture	Spinal fusion with implant	12	9	2.07	1.34	2.177433	2.46	1.78	3.437358	-8.5745732
43	D	56	female	42138	right ovarian tumor	Exploratory laprotomy	12	10	2.05	1.45	2.3334125	2.46	1.82	3.514602	6.6331892
44	D	55	female	37934	carcinoma lt lower GBS	composite rescetion +lt MRND	10	9	2.06	1.36	2.199256	2.34	1.79	3.288051	4.6055446
45	D	42	female	99699	ABNORMAL UTERINE BLEEDING	TOTAL ABDOMINAL HYSTERECTOMY	6	8	2.28	1.4	2.50572	2.12	1.8	2.99556	16.975176
46	D	65	FEMALE	105749	CARCINOMA CERVIX IIB	EXPLORATORY LAPROTOMY	7	8	2.12	1.42	2.363164	2.45	1.78	3.423385	-6.218579
47	D	38	female	117981	ABNORMAL UTERINE BLEEDING	TAH	8	9	2.01	1.32	2.082762	2.41	1.89	3.5755965	30.5637089
48	D	42	female	116706	ABNORMAL UTERINE BLEEDING	tah	8	8	2.3	1.32	2.38326	2.5	1.88	3.6895	27.1067
49	D	45	male	60828	incisional hernia	mesh plasty	9	8	2.22	1.45	2.526915	2.51	1.85	3.6451475	22.6191535
50	D	52	female	112259	carcinoma ascending colon	right hemicolectomy	6	8	2.12	1.26	2.096892	2.34	1.72	3.159468	6.5682328
51	D	50	male	119752	pseudocyst over right ear	excision	7	9	2.02	1.27	2.013839	2.45	1.6	3.0772	7.92712
52	D	50	male	112283	hernia	hernioplasty	8	8	2.02	1.34	2.124838	2.47	1.43	2.7726985	3.4813981
53	D	26	male	119236	right inguinal hernia	hernioplasty	6	8	2.32	1.45	2.64074	2.5	1.89	3.709125	47.873225
54	D	67	female	112915	CARCINOMA CERVIX IIB	radical hysterectomy	8	8	2.43	1.36	2.594268	2.51	1.74	3.428409	-8.7052286

									supine				RLD		
S.No.	**Group**	**Age**	**Sex**	**UHID**	**Diagnosis**	**Surgery**	**HISTORY OF DIabetes(yrs)**	**fasting interval(HRS)**	**CC DIAMETER**	**AP DIAMETER**	**CSA(cm2)**	**CC DIAMETER**	**AP DIAMETER**	**CSA**	**GV**
55	D	65	female	107301	b/l ureteric calculi	b/l ursl+dj stenting	8	8	2.28	1.4	2.50572	2.54	1.67	3.329813	-7.5847302
56	D	51	male	118256	trigeminal neuralgia	MVD+TEFLON	8	10	2.12	1.42	2.363164	2.53	1.78	3.535169	13.3334674
57	D	70	MALE	116945	MENINGIOMA	EXCISION	8	9	2.01	1.32	2.082762	2.12	1.82	3.028844	-18.3788776
58	D	59	FEMALE	318303	PARAUMBILICAL HERNIA	REPAIR WITH MESH PLASTY	8	9	2.3	1.32	2.38326	2.434	1.79	3.4201351	1.41397246
59	D	70	FEMALE	94262	COLITIS	Exploratory laprotomy	9	8	2.22	1.45	2.526915	2.34	1.8	3.30642	-14.326268
60	D	50	MALE	120916	PERITONITIS	EXPLORATORY LAPROTOMY	8	9	2.12	1.26	2.096892	2.54	1.78	3.549142	14.8174732
61	D	55	MALE	120879	ACUTE INTESTINAL obstruction	EXPLORATORY LAPROTOMY	8	8	2.02	1.27	2.013839	2.5	1.89	3.709125	10.753225