

GASTRIC ANALYSIS

• ***YUBRAJ BHATTA***

M.SC CLINICAL BIOCHEMISTRY

PIMLT

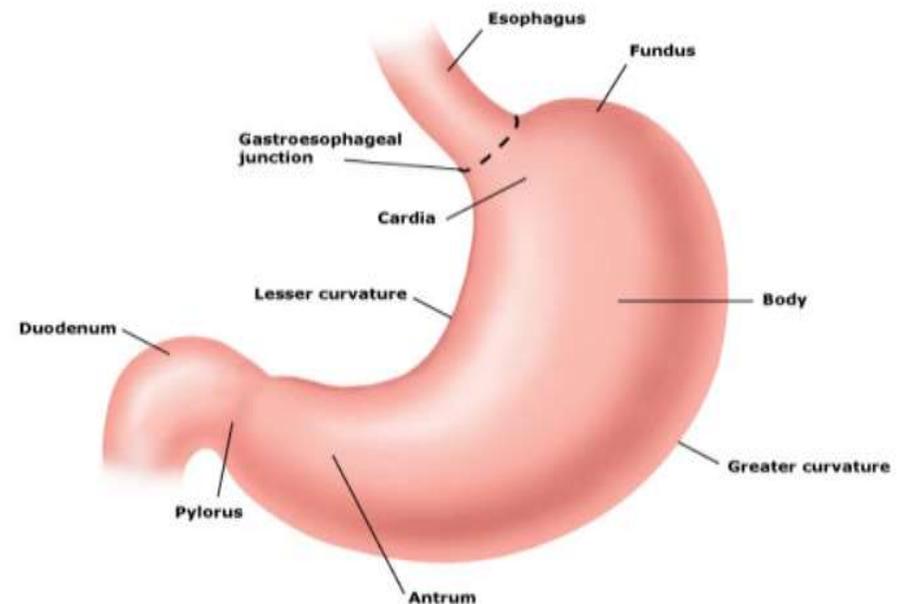
INTRODUCTION

- ❑ IT CONSIST OF **QUANTITATION OF GASTRIC ACID** PRODUCED BY STOMACH.
- ❑ GASTRIC JUICE IS **COLLECTED BY NASOGASTRIC TUBE** AND GASTRIC ACID IS QUANTITATED BY **TITRATION WITH SODIUM HYDROXIDE SOLUTION.**

❖ **ANATOMY OF STOMACH:**

➤ HAVE FOUR DIFFERENT PARTS:

- 1) CARDIA
- 2) FUNDUS
- 3) BODY
- 4) PYLORIC



Cont...

1) CARDIAC ZONE: LINED BY MUCUS SECRETING EPITHELIUM

2) FUNDUS AND BODY:

i) MUCUS SECRETING CELLS: WHICH PROTECT GASTRIC MUCOSA FROM SELF DIGESTION BY FORMING AN OVERLYING THICK LAYER OF MUCUS.

ii) PARIETAL CELLS: SECRET HCL AND IF(INTRINSIC FACTOR)

iii) PEPTIC AND CHIEF CELLS: SECRET PROTEOLYTIC ENZYME CALLED PEPSINOGEN.

3) PYLORIC PART: LINED BY MUCUS SECRETING CELLS AND G-CELLS (GASTRIN SECRETING NEUROENDOCRINE CELLS)

PHYSIOLOGY OF STOMACH

- FOOD INGESTED GET CONVERTED IN CHYME BY MECHANICAL AND CHEMICAL BREAKDOWN
- **CHYME** PASSED TO DUODENUM ONCE PYLORIC SPHINCTER IS RELAXED.

☐ GASTRIC ACID SECRETION HAPPEN IN 3 PHASE.

i) CEPHALIC/ NEUROGENIC PHASE

ii) GASTRIC PHASE

iii) INTESTINAL PHASE

Cont..

i) CEPHALIC/NEUROGENIC PHASE:

- ACTIVATED BY SIGHT, SMELL, TASTE OR THOUGHT OF FOOD THAT CAUSES STIMULATION OF **VAGAL** NUCLEI IN THE BRAIN
- VAGUS NERVE **ACT ON PARIETAL CELLS AND SECRET HCL** AND ACT ON G-CELLS WHICH HELPS IN SECRETION OF **GASTRIN**.

ii) GASTRIC PHASE:

- ENTRY OF SWALLOWED FOOD INTO STOMACH CAUSE **GASTRIC DISTENTION** AND INDUCE GASTRIC PHASE.
- Distension of antrum and increase in ph to neutralize acid when food reach stomach activate G cells which secrete gastrin.

Cont..

iii) INTESTINAL PHASE:

- ENTRY OF DIGESTED PROTEIN INTO DUODENUM CAUSES AN INCREASE IN ACID OUTPUT FROM THE STOMACH.
- CERTAIN HORMONES AND ABSORBED AMINO ACIDS STIMULATE PARIETAL CELLS TO SECRET ACID.

Composition of Gastric juice:

➤ HCL(Parietal cells):

Secretion is **stimulated** by histamine, acetylcholine(ACH), gastrin and
Inhibited by somatostatin (D cells of pancreas)

➤ INTRINSIC FACTOR (Parietal cells):

HELPS IN ABSORPTION OF VITAMIN B12 IN TERMINAL ILEUM

➤ Pepsin (Chief cells):

SECRETION IS STIMULATED BY VAGUS NERVE..

HELPS IN DIGESTION OF PROTEIN LEAD TO FORMATION OF LARGE POLYPEPTIDE MOLECULE.

➤ **Mucus**

INDICATIONS OF GASTRIC ANALYSIS

- AMOUNT OF ACID SECRETED BY THE STOMACH IS DETERMINED ON GASTRIC JUICE SAMPLE
- GASTRIC ACID OUTPUT IS ESTIMATED BEFORE AND AFTER STIMULATION OF PARIETAL CELLS.(BASAL , PEAK ACID OUTPUT)
- **USE TO RULE OUT PEPTIC ULCERS.**
 - 1) To determine recurrent peptic ulcer disease
 - i) **DETECT ZOLLINGER-ELLISON SYNDROME:**
 - **RARE DISEASE IN WHICH MULTIPLE MUCOSAL ULCERS DEVELOPS IN THE STOMACH, DUODENUM AND UPPER JEJUNUM DUE TO GROSS HYPERSECRETION OF ACIDS IN STOMACH**
 - **EXCESSIVE ACID PRODUCTION IS BECAUSE OF GASTRIN PRODUCING TUMOR OF PANCREAS.**

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ii) DETERMINE THE CAUSE OF RAISED FASTING SERUM GASTRIN LEVEL:

Hypergastrinemia can be seen in →

- ACHLORHYDRIA
- Z-E SYNDROME
- ANTRAL G-CELL HYPERPLASIA

iii) TO SUPPORT DIAGNOSIS OF PERNICIOUS ANAEMIA(PA):

- FAILURE OF SYNTHESIS IN INTRINSIC FACTOR RESULT DEFICIENT DEFECTIVE ABSORPTION OF VITAMIN B12.
- GASTRIC ANALYSIS CAN BE DONE IN ABSENCE OF SCHLLING TEST.

iv) DISTINGUISH BETWEEN BENIGN AND MALIGNANT ULCER:

- HYPERSECRETION OF ACID LEADS TO DUODENAL PEPTIC ULCER.
- ACHLORHYDRIA—GASTRIC CARCINOMA

v) TO DECIDE THE TYPE OF SURGERY TO BE PREPARED IN A PATIENT WITH PEPTIC ULCER

- GASTRECTOMY
- VAGOTOMY

vi) DYSPEPSIA (DIGESTIVE DYSFUNCTION).

METHODS OF GASTRIC ANALYSIS

- TO ASSESS THE GASTRIC ACID SECRETION IN **FASTING** STATE AND **AFTER INJECTING PENTAGASTRIN** (DRUG STIMULATING GASTRIC ACID SECRETION)
 - i) **BAO (BASAL ACID OUTPUT)**: AMOUNT OF HCL SECRETED WITHOUT ANY EXTERNAL STIMULI (VISUAL, OLFACTORY AND AUDITORY)
 - ii) **MAO (MAXIMUM ACID OUTPUT)**: MAXIMUM AMOUNT OF HCL SECRETED BY STOMACH FOLLOWING STIMULATION OF PENTAGASTRIN. FIRST FOUR SAMPLE IN GAP OF 15 MINUTES ARE ANALYSED AFTER SITMULATION
 - iii) **PAO (PEAK ACID OUTPUT)**: CALCULATED FROM FIRST FOUR 15 MINUTES SAMPLES, INDICATES GREATEST POSSIBLE ACID SECRETORY CAPACITY AND IS PREFERRED OVER MAO.

COLLECTION OF SAMPLES:

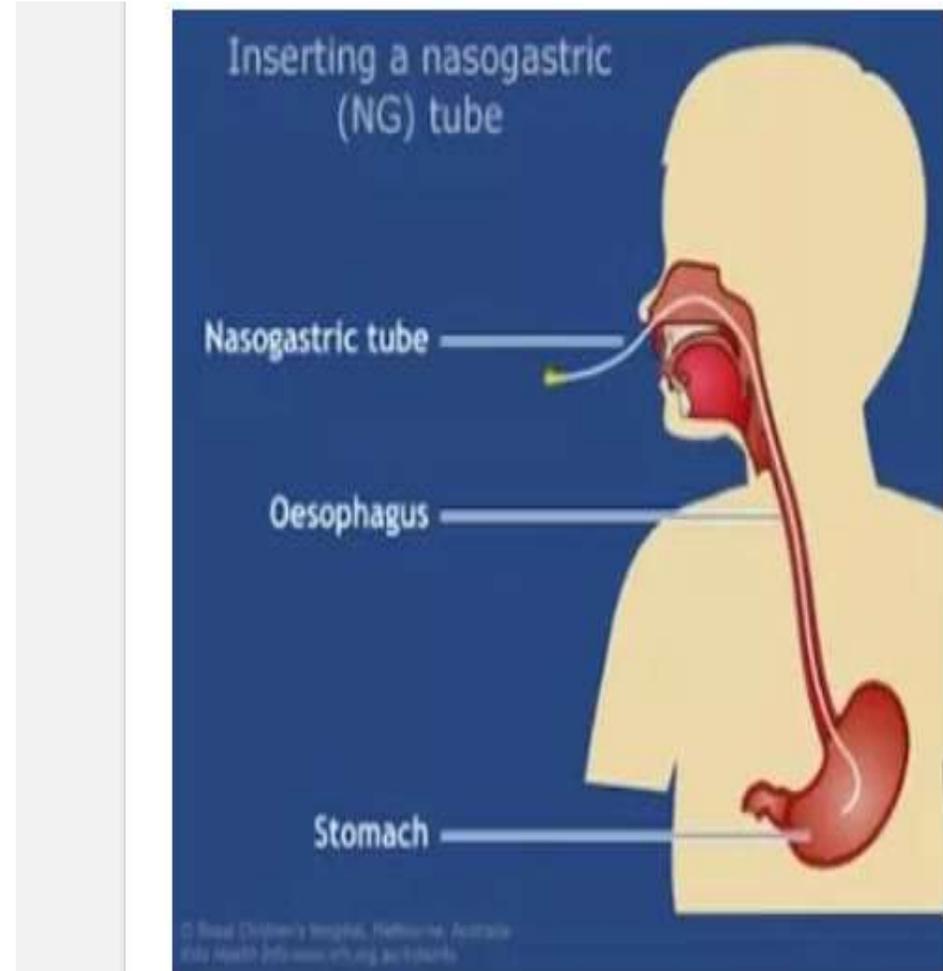
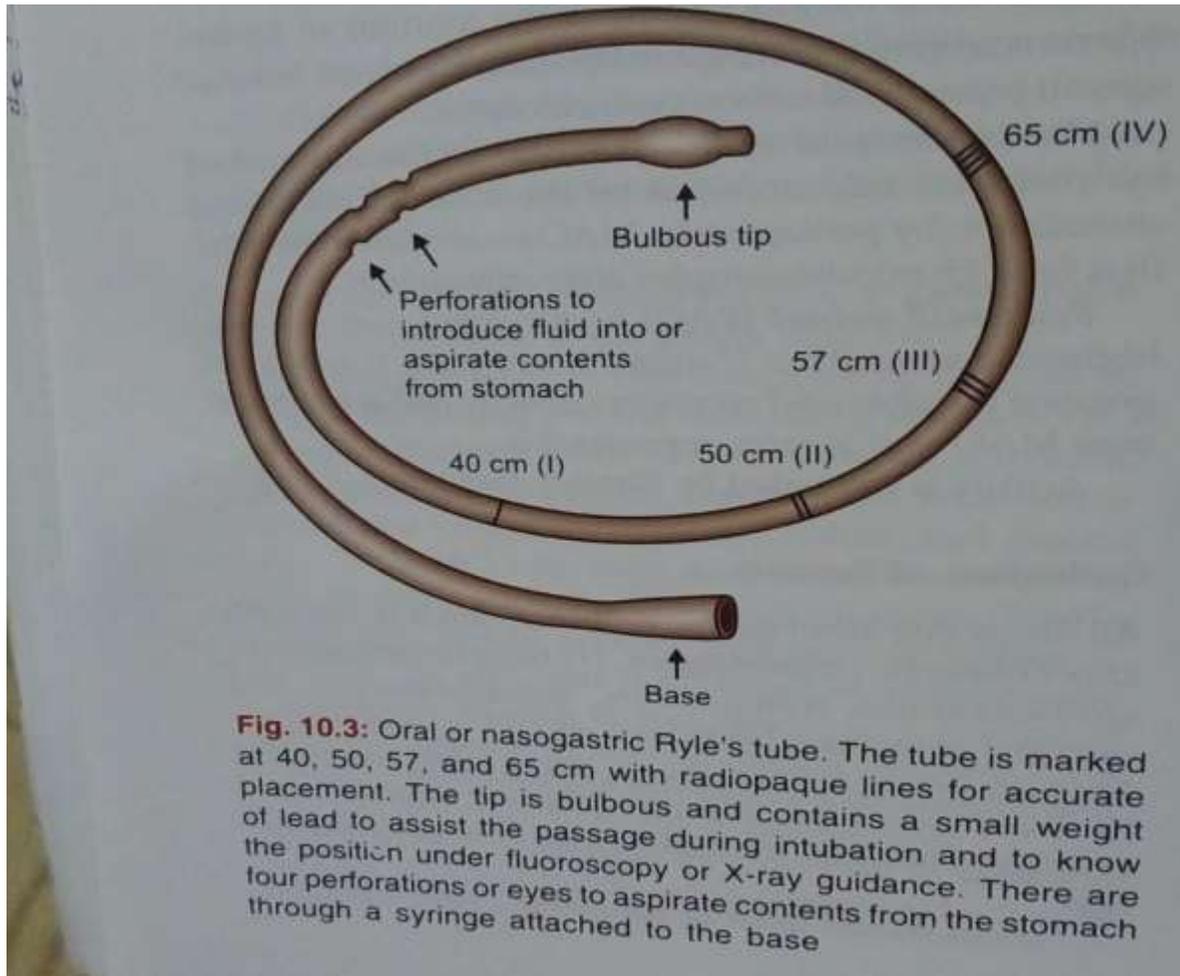
Patient preparation:

- **DRUGS** AFFECTING ACID SECRETION SHOULD BE AVOIDED FOR 24HRS.
(Eg: ANTACIDS, ANTIHISTAMINE, ANTIDEPRESSANTS, TANQUILIZERS)
- **PROTEIN PUMP INHIBITORS (E.g: Pantoprazole)** SHOULD BE STOPPED PRIOR **5 DAYS** TO THE TEST.
- PATIENTS SHOULD BE RELAXED AND FREE FROM ALL SOURCE OF SENSORY STIMULATION.
- SHOULD BE OVERNIGHT **FASTING**
- SAMPLE CAN BE ASPIRATED **ORALLY** OR BY **NASOGASTRIC TUBE**(PVC, SILICONE) OR BY **ENDOSCOPY** PROCEDURE..
- ☐ **MOST COMMONLY USED METHOD IS ORAL OR NASOGASTRIC SECRETION..**

PROCEDURE:

- INSERTED ORALLY OR BY NOSE
- IT IS A FLEXIBLE TUBE HAVING A SMALL DIAMETER AND BULBOUS END WHICH IS MADE HEAVY BY A SMALL WEIGHT OF LEAD.
- END IS PERFORATED WITH SMALL HOLES TO ALLOW ENTRY OF GASTRIC JUICE INTO TUBE
- END OF TUBES ARE RADIOPAQUE AND HELP IN POSITIONING UNDER FLUROSCOPE OR X-RAY GUIDANCE
- THE PATIENT IS EITHER SITTING OR RECLINING ON LEFT SIDE
- TUBE HAVE MARKING ON IT →
 - 40CM= TIP TO ESOPHAGEAL JUNCTION
 - 50CM= BODY OF STOMACH
 - 57CM= PYLORIC ANTRUM
 - 65CM= DUODENUM

IMAGE SHOWING NASOGASTRIC TUBE / INSERTION



Continue...

- POSITION CAN BE VERIFIED BY FLUOSCOPE OR BY WATER RECOVERY TEST.
- **WATER RECOVERY TEST**: 50ML OF WATER IS INSERTED INSIDE PATIENT BODY, IF 90% OR MORE WATER IS RECOVERED BACK IT IS BELIEVED THAT NASOGASTRIC TUBE IS PLACED PROPERLY.
- ❑ **FOR ESTIMATION OF BAO(BASAL ACID OUTPUT):**
 - ✓ **FASTING 12HRS-** OVERNIGHT SECRETION IS ASPIRATED AND DISCARDED FOLLOWED BY ASPIRATION OF GASTRIC JUICE SECRETION AT 15 MINUTES (INTERVAL OF 1HR – **4 SAMPLES** ARE REQUIRED)
 - ✓ CENTRIFUGE AND REMOVE PARTICULATE MATTER,
 - ✓ EACH SAMPLE IS ANALYSED FOR **VOLUME,PH, ACIDITY**
 - ✓ **ACID OUTPUT OF ALL SAMPLES IS SUMMED UP** AND RESULT IS EXPRESSED IN mmol/hr

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AFTER BAO,

- **PENTAGASTRIN** (6mg/kg body weight) injected to patient subcutaneously/
intramuscular
- IMMEDIATELY AFTER 15 MINUTES **4 SAMPLES** ARE COLLECTED WITH GAP OF 15 MINUTES TILL 1HR FOR ESTIMATION OF **MAO & PAO**.
- **MAO** IS CALCULATED FROM THE FIRST FOUR 15 MINUTES SAMPLE AFTER STIMULATION.
- **PAO** IS CALCULATED FROM **TWO CONSECUTIVE 15 MINUTES SAMPLES SHOWING HIGHEST ACIDITY**.

CONTRAINDICATIONS TO GASTRIC ANALYSIS

NOT COMMONY PERFORMED BECAUSE

- i) IT IS AN **INVASIVE** PROCEDURE THAT IS TRAUMATIC AND UNPLEASANT FOR THE PATIENTS.
- ii) INFORMATION OBTAINED IS **NOT DIAGNOSTIC** IN ITSELF.

TITRATION:

- GASTRIC ACIDITY IS ESTIMATED BY TITRATION WITH END POINT BEING DETERMINED EITHER BY NOTING THE **CHANGE IN COLOR** OF INDICATOR SOLUTION OR TILL THE DESIRED **PH** IS REACHED.
- EXPRESSED IN mmol/ltr.

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FREE ACIDITY:

- Refer to the concentration of HCL present in a free or uncombined form in a solution.
- Alkali +gastric acid (Topfer's reagent added as a indicator) Or ph when reach 3.5 measure free acidity

COMBINED ACIDITY:

- AMOUNT OF **HCL COMBINE WITH PROTEIN AND MUCIN** WITH OTHER WEAK ACIDS PRESENT IN THE GASTRIC JUICE..

TOTAL ACIDITY:

- **SUM OF COMBINED AND FREE ACIDITY IS TOTAL ACIDITY.**
- **ALKALI IS ADDED TO ACID WHICH CHANGE COLOR AND MEASURE TOTAL ACIDITY.**

INTERPRETATION OF RESULT:

i) VOLUME:

Normal: 20-100 (usually less than 50 ml)

Cause of increase volume of acids:

Delayed emptying of stomach → pyloric **stenosis (narrowing)**.

Increase gastric secretion → duodenal ulcer and ZE syndrome

ii) Colour:

Normal colourless with faint pungent odour.

Red: fresh blood in seen in trauma, bleeding from ulcer/ cancer.

Brown: old haemorrhage

Yellowish green: Bile regurgitation

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iii) **pH**: normal (1.5-3.5)

More than 7 pH indicate Achlorhydria.

iv) **BAO**: normal upto 5mEq/hr

Duodenal ulcer: 5-15 mEq/hr

ZE syndrome: more than 20 mEq/hr

Normal BAO seen in gastric ulcer and in some patients with duodenal ulcer.

v) **PAO**: normal: 1-20 mEq/hr

Duodenal ulcer: 20-60 mEq/hr

ZE syndrome: >60 mEq/hr

Achlorhydria: 0 mEq/hr

Normal PAO seen in gastric ulcer and gastric carcinoma.

Other test for gastric analysis:

i) Hollander's test (insulin hypoglycemia test):

- ✓ DONE FOR THE CONFIRMATION OR COMPLETENESS OF VAGOTOMY.
- ✓ HYPOGLYCEMIA IS A POTENT STIMULUS FOR GASTRIC JUICE SECRETION AND IS MEDIATED BY VAGUS NERVE.

PROCEDURE:

- ✓ 0.15-0.2 UNITS/KG OF INSULIN IS ADMINISTERED INTRAVENOUSLY AND ACID OUTPUT IS ESTIMATED EVERY 15 MINUTES UPTO 2HRS (8 SAMPLES WILL BE COLLECTED.
- ✓ VAGOTOMY IS COMPLETE WHEN BLOOD GLUCOSE IS $<45\text{mg/dl}$ (which is insulin induced hypoglycemia).

Cont...

DISADVANTAGE OF HOLLANDER TEST:

CHANCES OF HAVING:

- ✓ MYOCARDIAL INFARCTION,
- ✓ SHOCK AND
- ✓ DEATH

ii) **FRACTIONAL TEST MEAL:**

- ✓ In past test, test meal (e.g. Oat meal, alcohol) were administered orally to stimulate secretion of gastric juice and determine MAO or PAO
- ✓ Currently PENTAGASTRIN is used to stimulate gastric juice secretion.

iii) TUBELESS GASTRIC ANALYSIS:

- ✓ CATION EXCHANGE RESIN WITH AZURE DYE IS GIVEN ORALLY TO PATIENT.
- ✓ ONCE THE BODY START METABOLISING THAT IS TAKEN TO BLOOD STREAM AND REACHES KIDNEY.
- ✓ EXCRETED URINE IS MEASURED PHOTOMETRICALLY.

DISADVANTAGE:

IT WILL SHOW FALSE RESULT WHEN KIDNEY AND LIVER FUNCTION IS IMPAIRED.

iv) **SPOT CHECK OF GASTRIC pH:**

- FASTING PATIENTS NASOGASTRIC SECRETION WILL TAKEN AND pH IS MEASURED .
- Ph more than five (>5.0) → HYPOCHLORHYDRIA IN MALE
- Ph more than seven (>7.0) → HYPOCHOLORHYDRIA IN FEMALE

v) **CONGO RED TEST** DURING **ESOPHAGO-GASTRO-DUODENO-SCOPY:**

- DONE FOR THE COMPLETENESS OF VAGOTOMY.
- DYE CONGO RED IS SPRAYED IN THE STOMACH DURING THE **ESOPHAGOGASTRODUODENOSCOPY.**
- IF IT TURNS RED INDICATE PRESENCE OF FUNCTIONAL PARIETAL CELLS IN STOMACH WITH CAPACITY OF PRODUCING ACID.

REFERENCES:

- ESSENTIALS OF CLINICAL PATHOLOGY BY SHIRISH M KAWTHALKAR

THANK YOU