

# **GASTRIC FUNCTION TEST**

Department of Biochemistry

MGMCH

# Learning Objectives

- Gastric juice- functions, composition, stimulants
- Gastric juice collection
- Gastric juice analysis
  - Qualitative (color, odor, appearance etc)
  - Quantitative
    - [A] Estimation of free & total acidity
    - [B] Estimation of total chlorides
- Clinical significance of gastric juice analysis

# Gastric Function Test

In diseases of the stomach and duodenum alterations of gastric secretion often occur.

Chemical examination of gastric contents has a limited but **specific value** in the diagnosis and assessment of disorders of the upper gastrointestinal tract.

# Gastric Juice

Gastric juice is a clear, pale yellow, odorless fluid with a strong acidic pH ( around 1) and a specific gravity of approximately 1.007

# Composition of gastric juice

- **Pepsinogen** secreted by chief cells
- **Hydrochloric acid** secreted by parietal cells
- **Rennin**
- **Haemopoietic factor**
- **Mucus** secreted by mucous cells
- **Organic acids**
- **Water 98-99%**

# Functions of Gastric juice

- **Water liquefies the food swallowed**
- **HCl**
  - **Acidifies the food and stop the action of salivary amylase**
  - **Kills ingested microbes**
  - **Provides the acidic environment required for action of salivary amylase**
- **Digestive enzymes (Rennin, Pepsin & lipase) act on food**
- **Intrinsic factor helps in absorption of Vit B12**

# CLASSIFICATION

Tests commonly employed for assessing gastric function are:

- A. Examination of resting contents in resting juice (gastric residuum).
- B. Fractional gastric analysis using a test 'meal'.
- C. Examination of the contents after stimulation:
  - "Alcohol" stimulation.
  - Caffeine stimulation.
  - Histamine stimulation.
  - Augmented histamine test.
  - Insulin stimulation.
  - Pentagastrin test.
- D. Tubless gastric analysis.

# Gastric secretion may be caused by

- Factor such as sight, taste or smell
- Hormone (Gastrin)
- Insulin stimulating the vagus
- Histamine a powerful stimulant
- Alcohol (in moderate concentration)



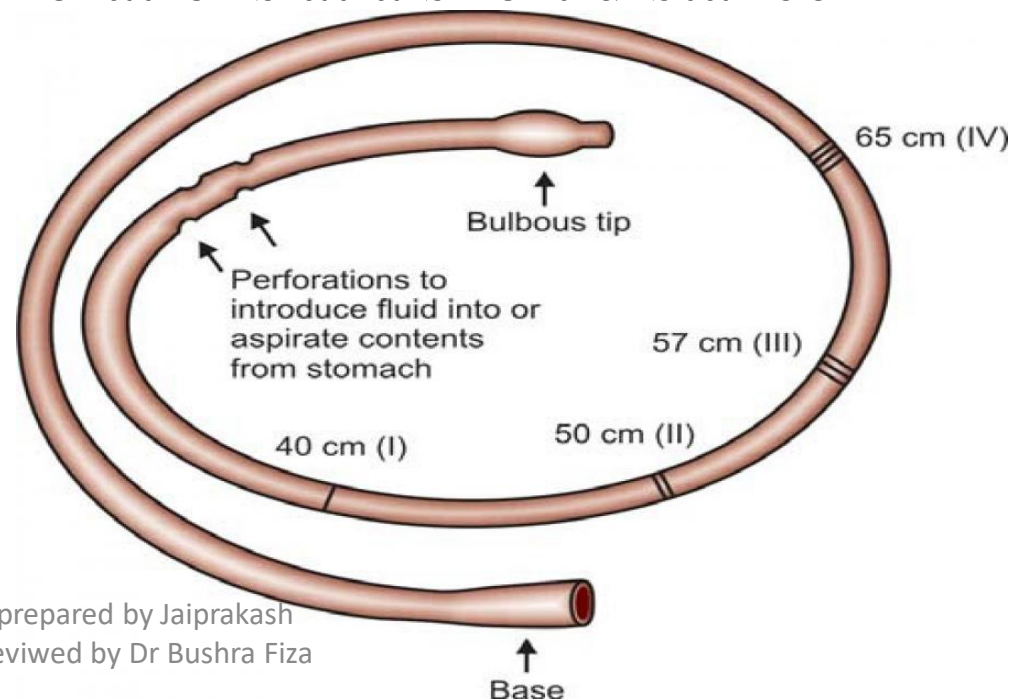
# Gastric juice analysis

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# Gastric juice analysis

## Ryle's tube

- It is a long thin rubber tube having 4 mm diameter.
- There is a lead piece at the tip of tube
- There are a no. of perforations at a short distance away from the tip



# Gastric juice analysis

- When the **first mark** (single line) is at the level of incisor teeth, the tip has reached the **cardiac end of oesophagus**.
- When the **second mark** (double line) is at the level of incisor teeth, the tip has reached the **pyloric region of stomach**.
- When the **third mark** (triple line) is at the level of incisor teeth, the tip has reached the **duodenum**.

# Gastric juice analysis

- Ryle's tube is passed into the stomach, and gastric juice is collected periodically before and after stimulation by administering a test meal.
- The gastric juice samples are thus collected are examined qualitatively and quantitatively.
- This is k/a Fractional Test Meal (FTM)

# Gastric juice analysis

Stimulants used:

- **Histamine:** A large dose of histamine is given to obtain maximum gastric secretion.
- **Betazol** (3-beta-amino ethyl pyrrazole): this is a synthetic analogue of histamine
- **Pentagastrin:** Most preferred stimulant. It is very potent with very few side effects. Effective in low dose.

# Gastric juice analysis- Qualitative

- Physical examination
  - Volume: 30-60 ml
  - Appearance: clear and watery liquid
  - Color: pale yellow (normal)
    - Brownish red (presence of excess blood)
    - yellow (presence of fresh bile)
    - Greenish (presence of old bile)
    - Red (presence of small amt of blood)
  - Odor: odorless (normal)
    - typical odor in case of presence of pathological constituents.

# Gastric juice analysis- Qualitative

- Chemical examination
  - Test for Chloride
  - Gunzberg's test for HCl
  - Ufflemann's test for presence of lactic acid
  - Iodine test for starch
  - Benzidine test for blood
  - Test for pepsin

# Preparation of the patient.

- The patient will take light evening meal and fast for 12 hours overnight and also on the next morning till the test is completed.
- Introduction of the tube.
- On the next morning, the patient is asked to swallow the bulbous end of the Ryle tube into the throat and the process of swallowing will be continued till the third marking reaches the teeth.



# Aspiration of gastric juice

- The fasting contents will be completely withdrawn by means of syringe, measured and kept for analysis. This is total resting juice.
- The patient is now administered 50-80 cc liquid meal (7% alcohol) into the stomach with the help of a syringe.

# Aspiration of gastric juice

- 10-15 ml of gastric juice is aspirated at every 15 minutes up to 2:30 hours (10 samples).

# Analysis of gastric juice

- Each aspirated fasting sample along with 10 samples after the test meal are tested separately.
- Physical examination
- Amount: Resting juice 15-50ml. Increase resting juice indicates pyloric stenosis, peptic ulcer or gastric malignancy.

# EXAMINATION OF RESTING CONTENTS

## **Volume:**

In most normal cases after a night's fast only 20 to 50 ml of resting contents is obtained. Volume greater than 100 to 120 ml is considered abnormal. An increase in volume of resting contents may be due to:

- Hypersecretion of gastric juice
- Retention of gastric contents due to delayed emptying of the stomach
- Due to regurgitation of the duodenal contents.

# Consistency:

The normal resting gastric juice is fluid in consistency and does not contain food residues. It may contain small amounts of mucus. Food residues are present in carcinoma of the stomach.

## Colour

- **In more than 50 per cent of normal individuals,** the gastric residuum is clear or colourless, or it may be slightly yellow or greenish due to regurgitation of bile from duodenum.
- **A bright red or dark red or brown colour in the** residuum is due to presence of blood-fresh/or altered blood.

## **Bile:**

**Bile may be found occasionally but is not usually of any particular significance.**

A small amount may be regurgitated from the duodenum as stated above, as a result of nausea which some people may experience in swallowing the tube.

**Increase quantities of bile is abnormal which may result from intestinal obstruction or ileal stasis.**

## **Blood:**

**Normally blood should not be present.** amount of fresh bright blood may be traumatic.

## **Mucus:**A small

Normally mucus is present in only small amounts.

Increased mucus is found in gastritis and in gastric carcinoma. Presence of mucus is inversely proportional to the amount of HCl present.

**Note:** Swallowed saliva may account for excess of mucus.



# Gastric juice analysis: Quantitative

## [A] Determination of free & total acidity

- **Free acidity**- Acidity due to HCl acid
- **Combined acidity**- acidity due to organic acids like lactic acid, citric acid, butyric acid, other fatty acids
- **Total acidity = Free acidity + Combined acidity**

# Gastric juice analysis: Quantitative

- (0.01 N) NaOH soln.
- Topfer reagent (0.1% methyl orange in Abs. alcohol)
- Phenolphthalein soln.

# Determination

- Determination of acidity by titration and plotting graph:
- Method: 1ml of filtered gastric fluid is treated with 2drops of Topfer s reagent and titrated with 0.01 N NaOH solution.
- The end point is indicated by the disappearance of all traces of red colour and appearance of yellow, orange colour or canary yellow. Note the burette reading.

# Interpretation

- In normal condition---
- The total acidity varies from 50-70
- Free acidity “ “ “ 35-55
- Combined acidity “ “ 10-15

# IN HYPER-CHLORHYDRIA

- High total acidity:- 100 – 110
- High free acidity :- 60 – 100
- But combined acidity :- 10 – 15
- Resting juice:- increase
- Caused by
  - Chronic duodenal ulcer
  - Chronic appendicitis
  - Chronic colitis
  - Chronic amoebic dysentery.

# IN HYPO-CHLORHYDRIA

- Decrease of free acidity. Caused by—
- Chronic gastritis
- Chronic gastric ulcer.

# ACHLORHYDRIA

- This term is used when there is no secretion of free acidity (HCl). But pepsin may still be present.
- Caused by---
- Gastric carcinoma
- With pyloric obstruction (stenosis)
- Pernicious anaemia.

- Under microscope: Malignant cells, RBC, acid fast bacilli and other can be identified.



# **FRACTIONAL TEST MEAL (FTM)**

- The fasting contents are aspirated using a Ryle's tube and secretion is stimulated by giving test meals. Different samples are collected and the acidity of each sample is measured.

# Pentagastrin Stimulation Test

- It is a modified version of FTM test. The gastric juice secreted for the next one hour is collected which represents basal secretion. The gastric secretion is now stimulated by giving pentagastrin in a dose  $6 \mu\text{g}/\text{Kg}$  body weight.
- The gastric secretion is collected every 15 minutes for the next one hours. This represents the maximum secretion. The collection samples are measured for acidity by titrating with N/10 NaOH to pH 7.4.

- Basal acid output (BAO):  
The minimum amount of gastric hydrochloric acid produced by an individual in a given period.
- Maximal acid output (MAO):  
On the pentagastrin test, the output of gastric acid for 1 hour after administration of pentagastrin, expressed as mmol/hr.

# CLINICAL SIGNIFICANCE

## **Zollinger-Ellison syndrome:**

The underlying defect in this condition is carcinoma of the gastrin-producing cells. Excess gastrin causes a persistent stimulation of the parietal cells, resulting in marked increase in the acid output even in the unstimulated state. Consequently, the ratio of the basal acid output and the maximum acid output rises up to 0.6% (Normal: BAO, 0–17 mmol/h; MAO, 4.7–58.4 mmol/h).

## **In pernicious anaemia:**

**The basic pathology is gastric** mucosal atrophy with lack of intrinsic factor and in great majority of cases “true” achlorhydria. Some occasional young persons with pernicious anaemia have been found to have acid secretion.

## **Following gastrectomy**

Gastrectomy entails removal of a portion of the acid-secreting stomach wall. It is performed for treating acid hypersecretion.

# Gastric juice analysis: Quantitative

## [B] Determination of total chlorides

- Estimation of free and total acidity may give false impression of hypochlorhydria or achlorhydria.
- However, the total chloride content of gastric juice remains unaffected.
- Total chloride is estimated by titration of gastric juice with silver nitrate (0.1 N), in presence of nitric acid using 0.1 N ammonium thiocyanate and ferric ammonium sulphate.

# Gastric juice analysis: Quantitative

## [B] Determination of total chlorides

- Interpretation
  - Normal range 55 – 110 mEq/L
  - Slightly sub normal in gastric ulcer
  - Absent in pernicious anemia
  - Low in gastric carcinoma
  - High in duodenal ulcer
  - Very high in Zollinger Ellison syndrome



THANK  
YOU