The Role of Ultrasound in Functional GI Disorders

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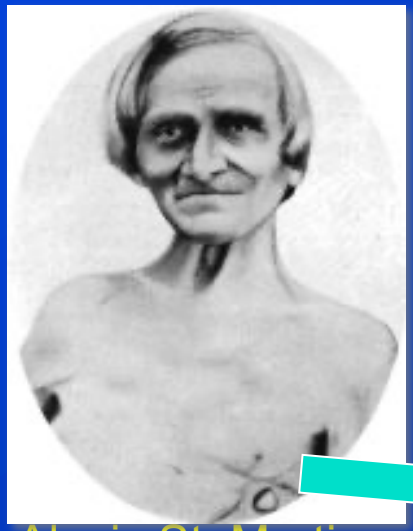
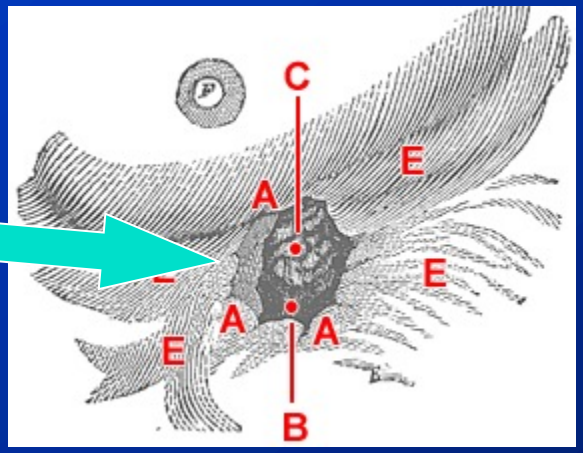
William Beaumont (1785-1853)

Beaumont

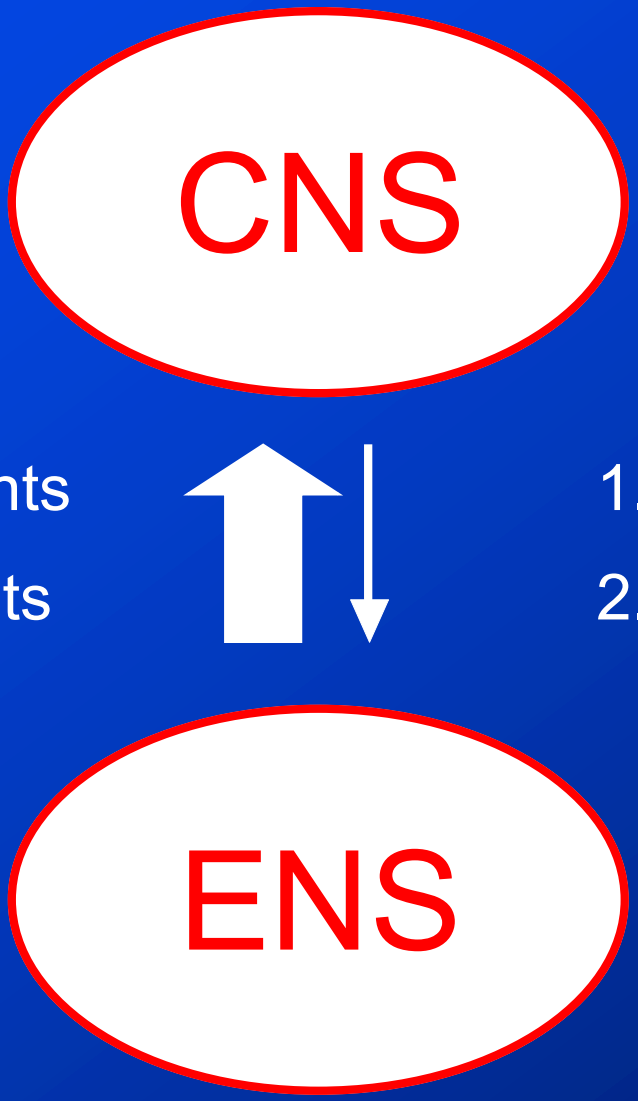


Alexis St. Martin



”St. Martin sometimes became irritable doing experiments (it was stressful for him to have food removed from his stomach), and Beaumont observed that being angry can hinder one's digestion”

The Brain-Gut Axis



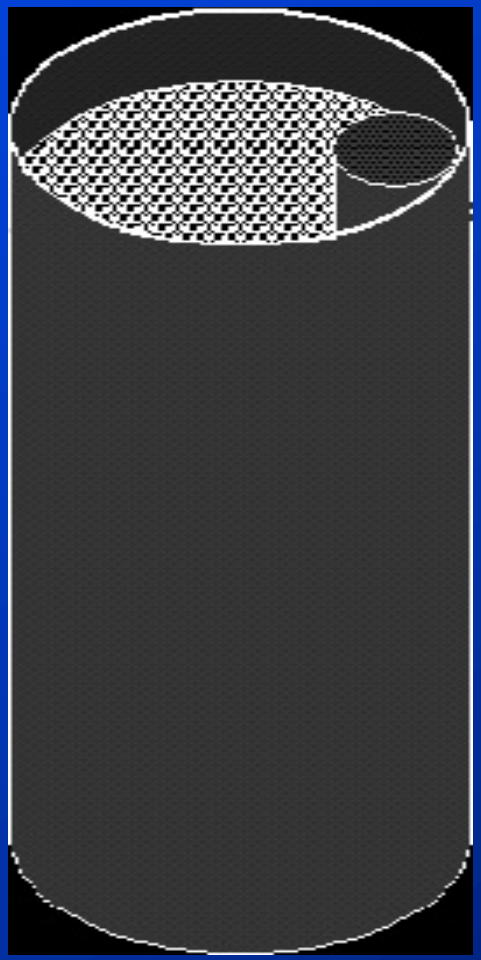
Where does the disease begin?

N. Vagus

90% Afferent

Head

10% efferent



GI-tract

The Gastro-Intestinal Landscape - a great challenge for Functional Imaging

Dyspepsia

- Dyspepsia is the ruin of most things; empires, expeditions and everything else.
  - Thomas de Quincy, 1822.

Functional Bowel Disorders Impact in Life

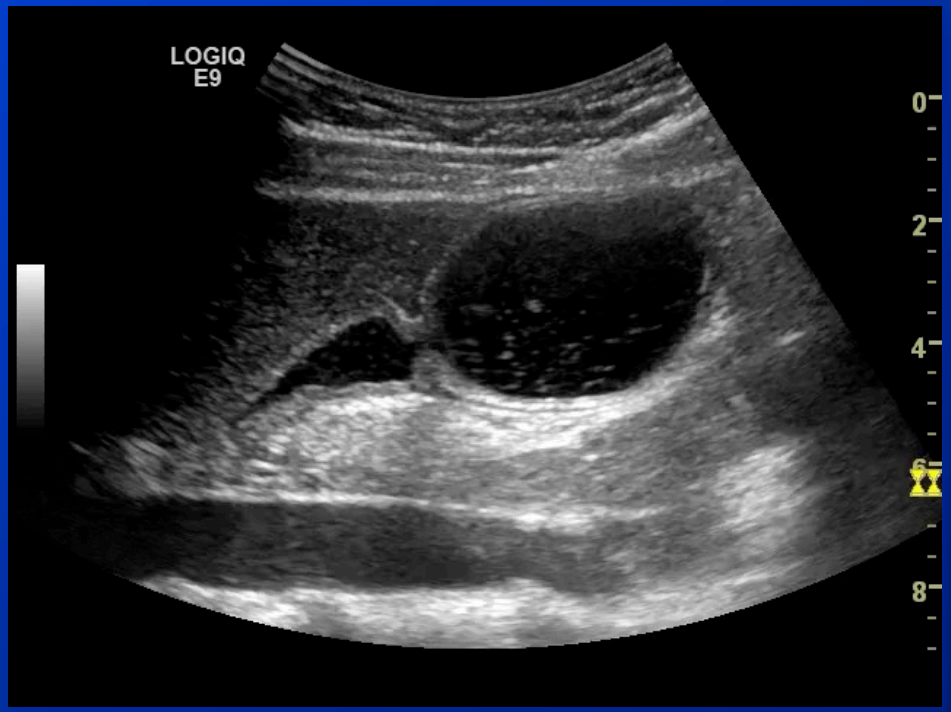
- **Compared to patients with duodenal ulcer; in patients with functional dyspepsia the disorder had a greater negative impact on their quality of life**

- Furthermore:
  - higher scores of depression, trait anxiety, general psychopathology and different somatic complaints (somatization)
  - They were also less satisfied with the health care system
  - Their global assessment of own health was poorer

Wilhelmsen et al., : Dig Dis Sci. 1995;40:1105-11

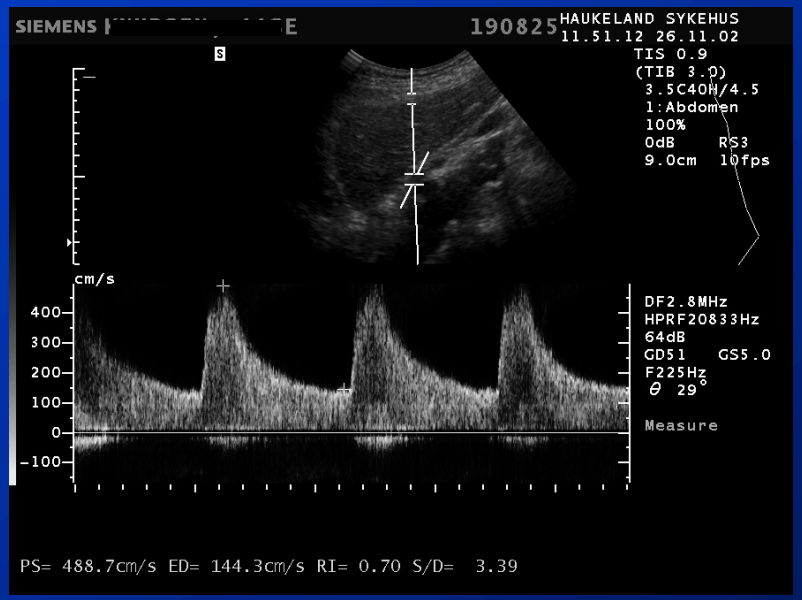
The Role of Ultrasound in FGID

- Rule out organic diseases
- **Detect disturbances in motility**
- **Disclose pathophysiological abnormalities**
- Provide hints for therapy
- Guide further work-up

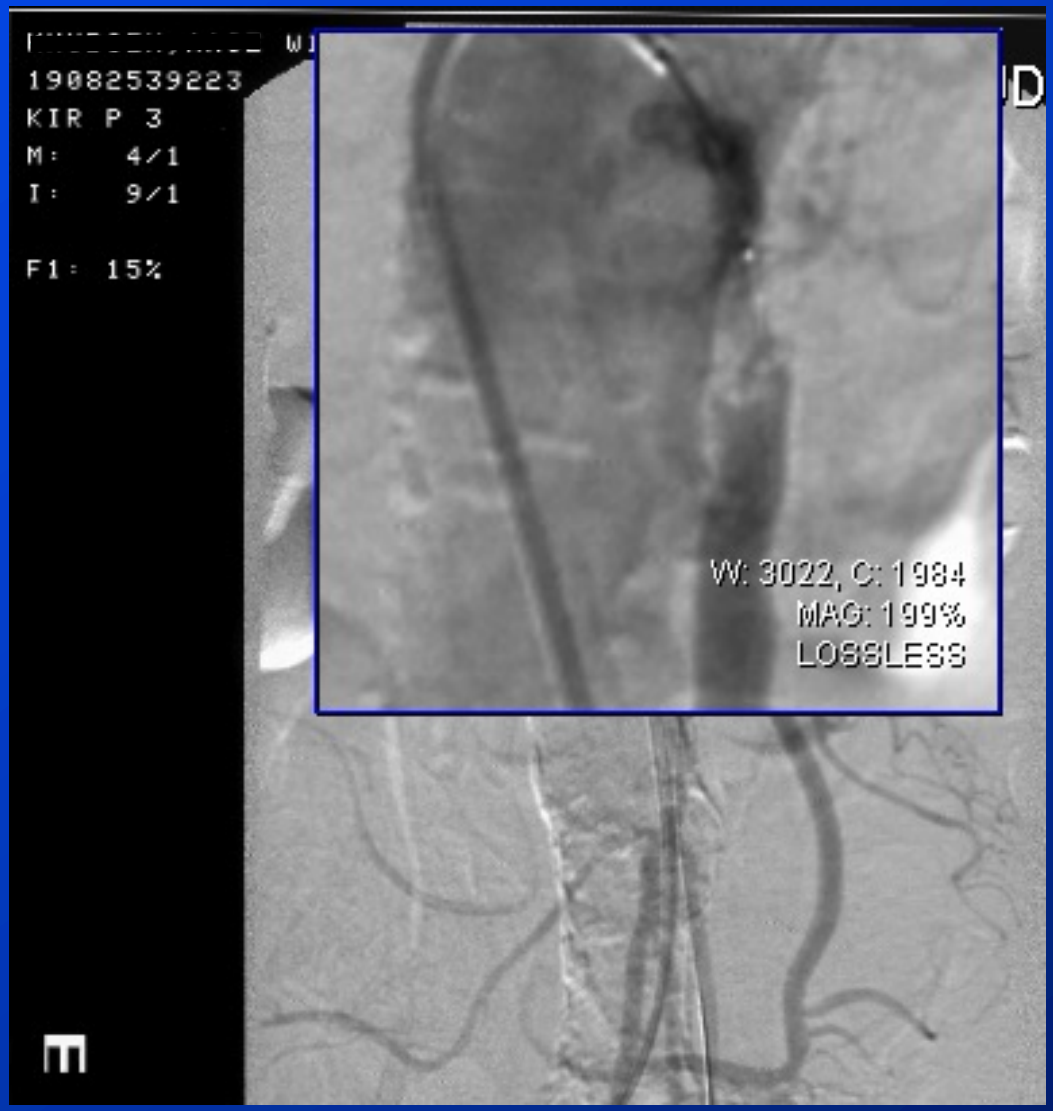


Organic Diseases mimicking FD
If in Doubt – Sound it out !

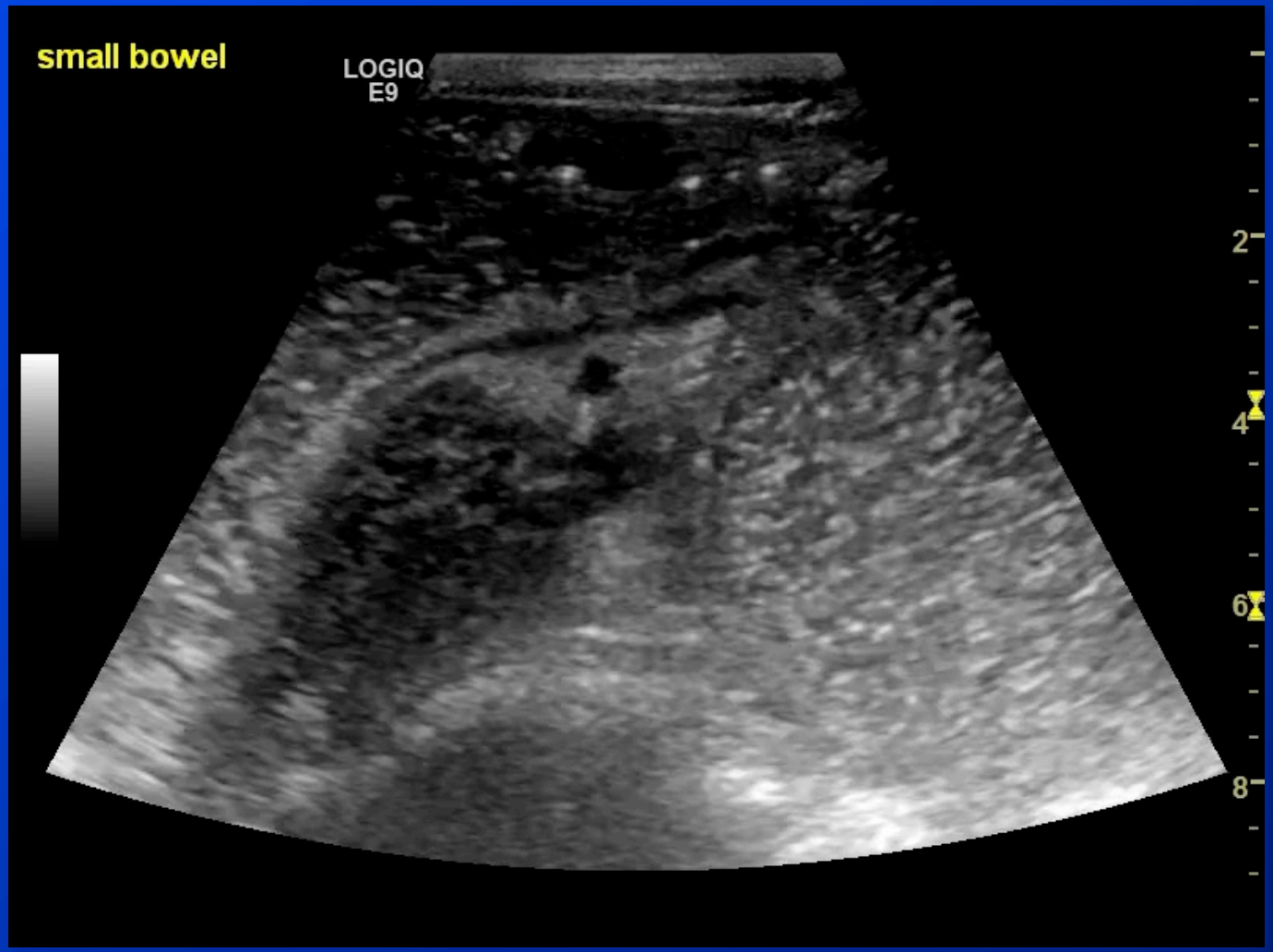
- Peptic Ulcer
- Linitis Plastica (adenocarcinoma)
- Gastritis (H.P.)
- Mb. Crohn
- Biliary Tract Stones
- Chronic Pancreatitis
- Hepatitis (low grade)
- Mesenterial Ischemia
- … Most of these can be ruled out by US !



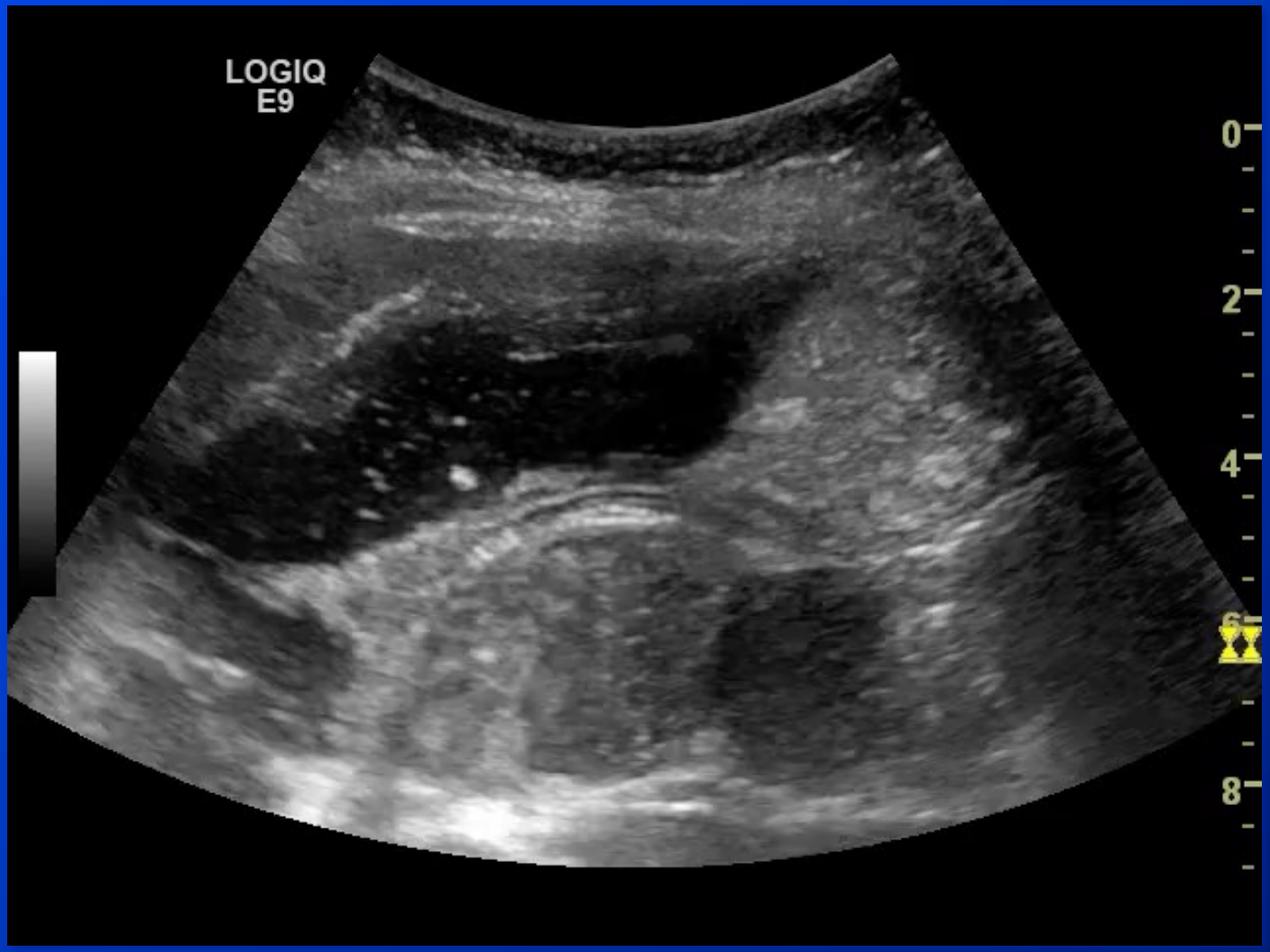
Treatment of stenosis in the coeliac trunc: Angiographic balloon dilatation



Rule out:
Obstruction of small intestine



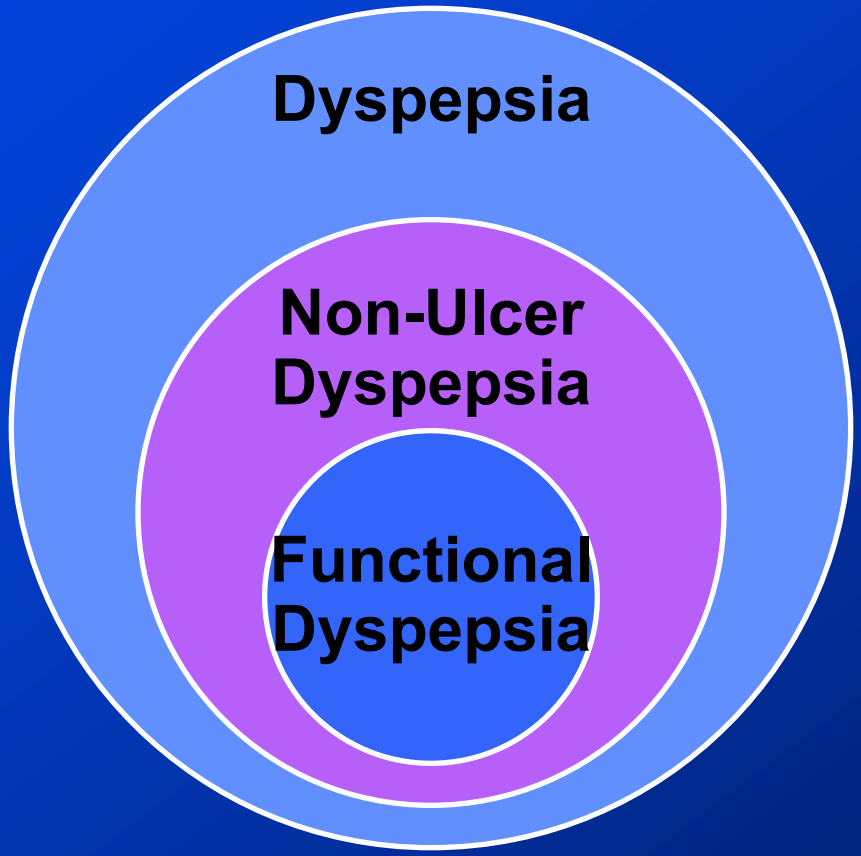
Solid vs. Liquid Gastric Content



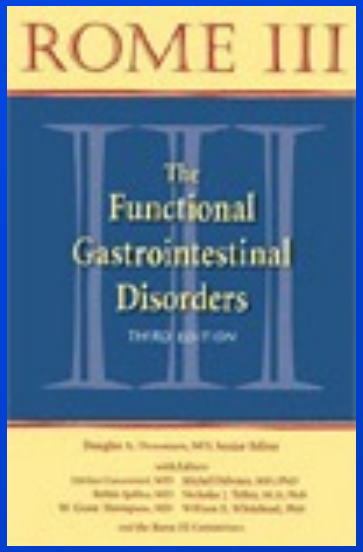
Dyspeptic symptoms

- **Major symptoms:**
  - **epigastric pain or discomfort**
  - **nausea**
  - **bloating**
  - **postprandial fullness**
  - **early satiety**
- Minor symptoms:
  - belching
  - regurgitation
  - vomiting
  - heartburn
  - anorexia

Dyspepsia Terms



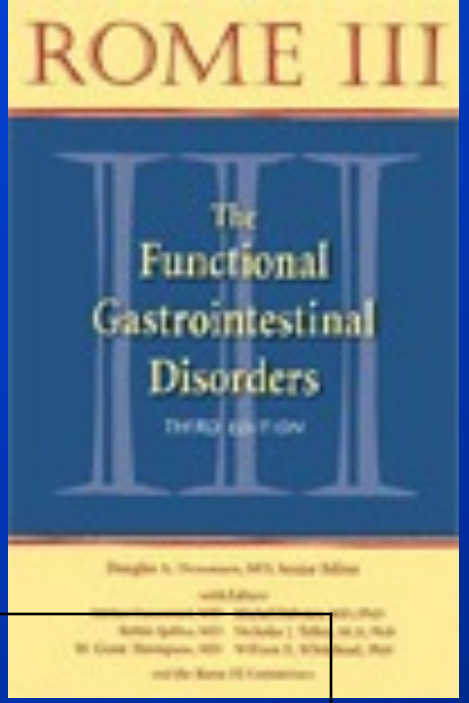
Classification
8 major groups



- A. Functional Esophageal Disorders
- B. Functional Gastroduodenal Disorders
- C. Functional Bowel Disorders
- D. Functional Abdominal Pain Syndrome
- E. Functional Gallbladder and Sphincter of Oddi Disorders
- F. Functional Anorectal Disorders
- G. Childhood Functional GI Disorders: Infant/Toddler
- H. Childhood Functional GI Disorders: Child/Adolescent

ROME II
Diagnostic Criteria For The Functional Gastrointestinal Disorders

http://www.romecriteria.org/index.html



FD:

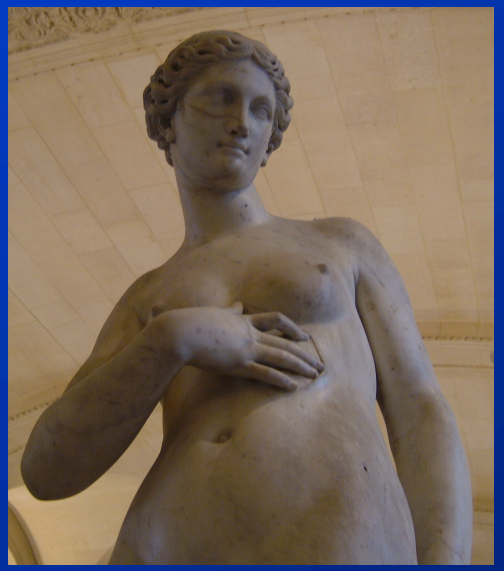
Epigastric Pain Syndrome

- At least 3 months, with onset at least 6 months previously, with ALL of pain and burning that is: intermittent and localized to the epigastrium of at least moderate severity, at least once per week.

Postprandial Distress Syndrome

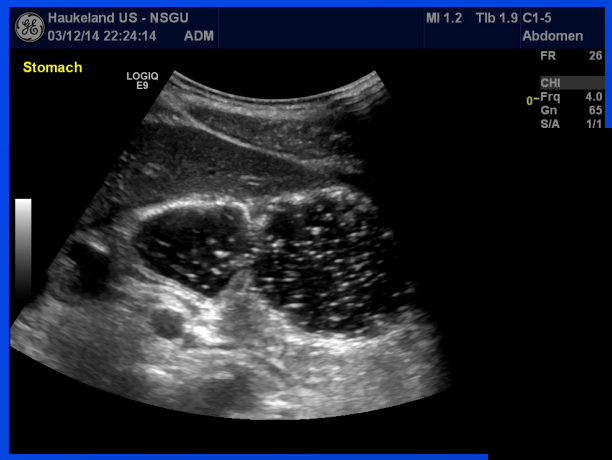
- Bothersome postprandial fullness
  -occurring after ordinary-sized meals and att least several times a week
  or
- Early satiation
  that prevents finishing a regular meal

Ultrasound can be used to study different aspects of gastric motility

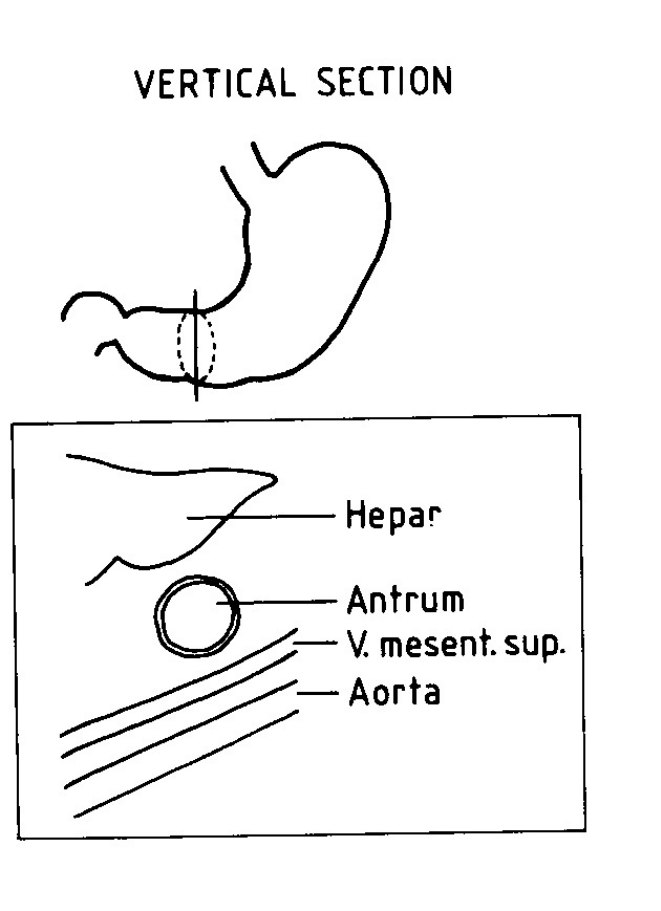


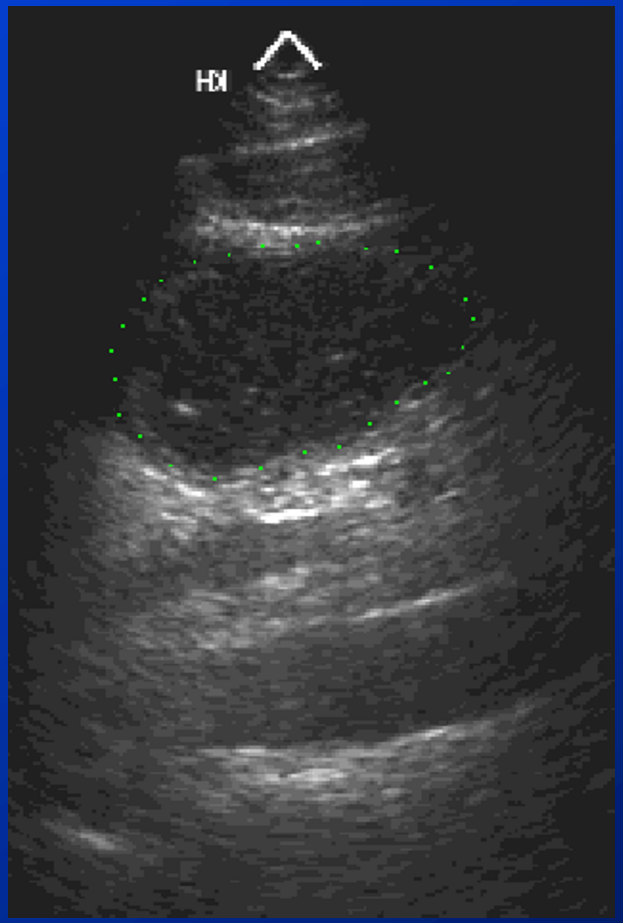
- Visualize contractions
- Study gastric emptying
- Measure transpyloric flow
- Evaluate meal accommodation
- Assess intragastric distribution of meals
- Estimate strain in the gastric wall

Gastric contractility



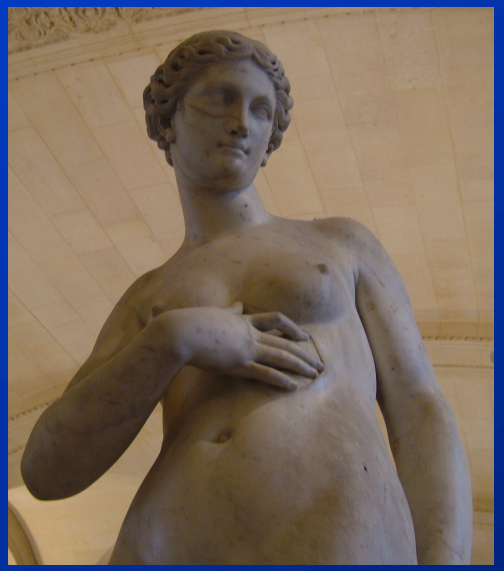
Measurement of the antrum





Hausken T et al., Gastroenterology 1991;100:59-63.

Ultrasound can be used to study different aspects of gastric motility



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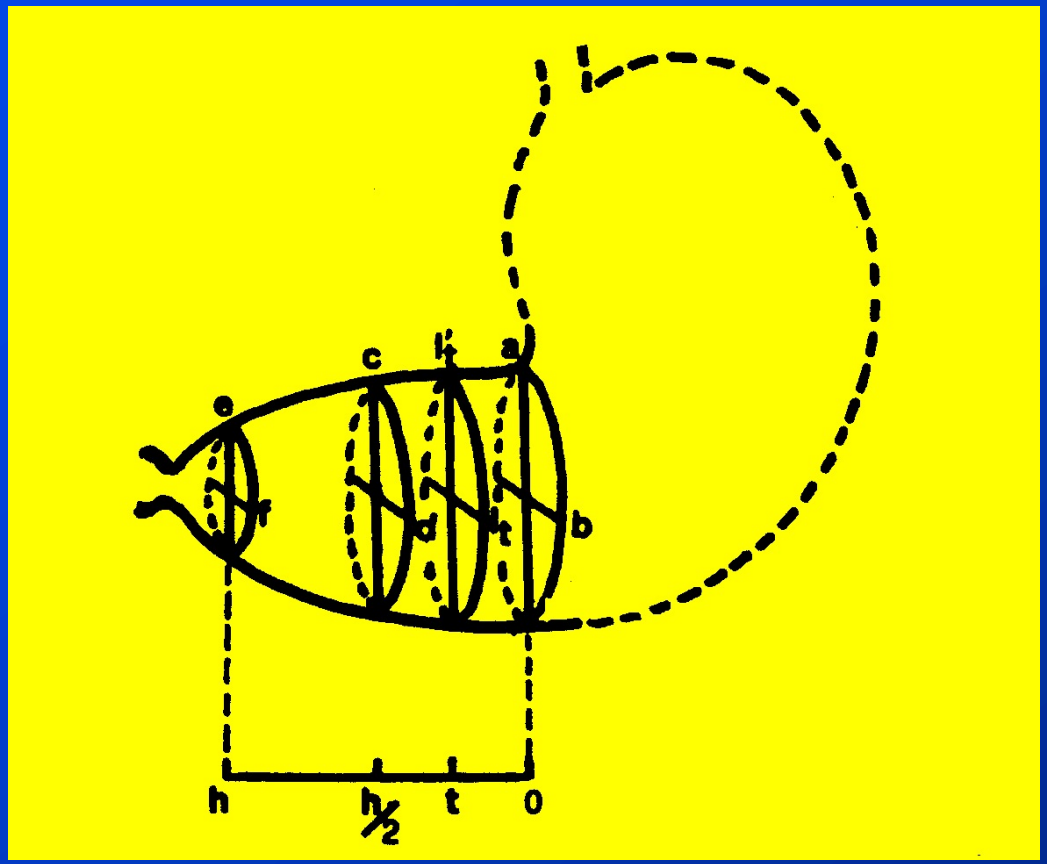
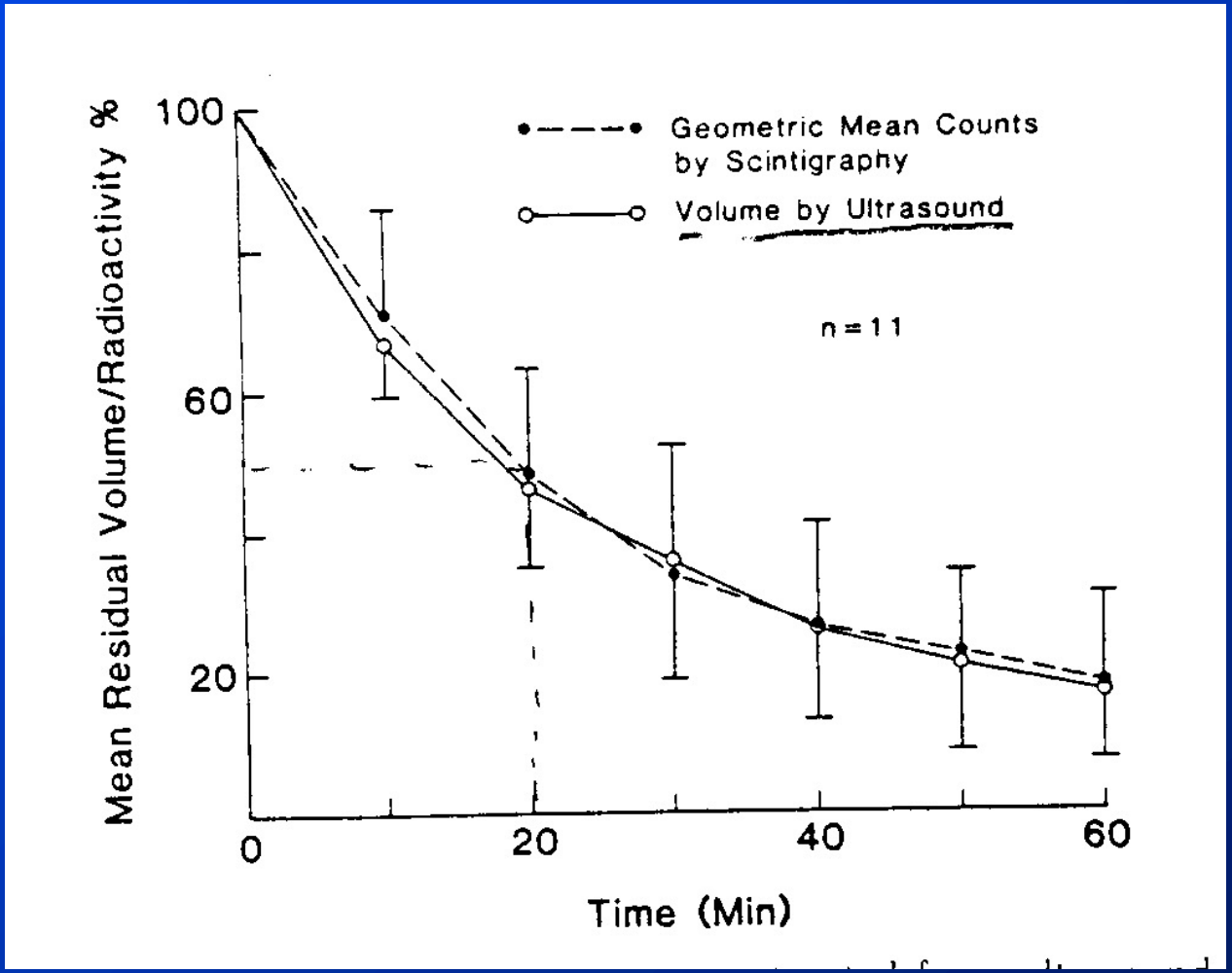
Estimation of gastric emptying



- *Volumes of the antrum estimated by 2D ultrasound*
- *Assumptions regarding geometrical shape has to be made prior to volume estimation*

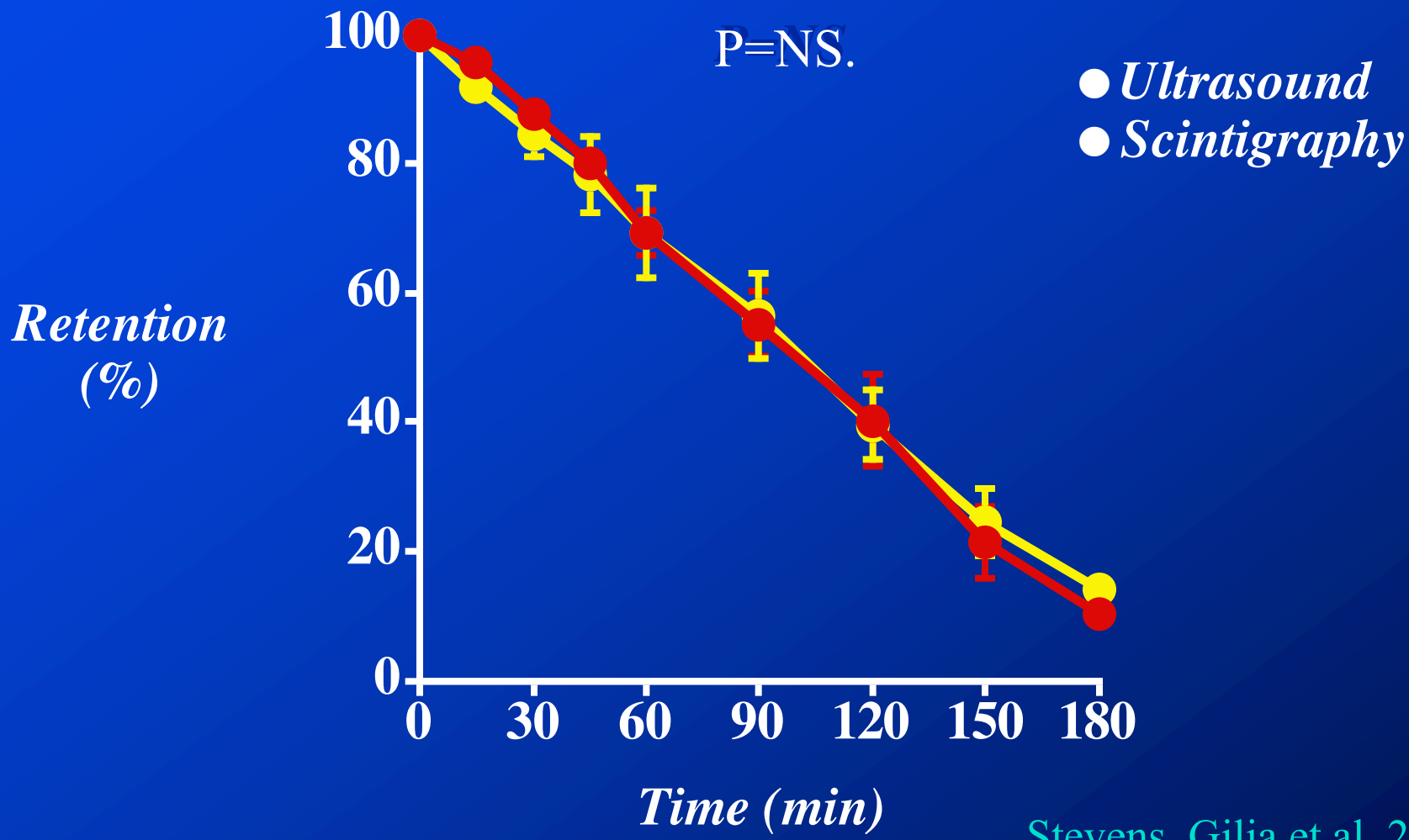
Bolondi et al., Gastroenterology 1985

Validation - scintigraphy



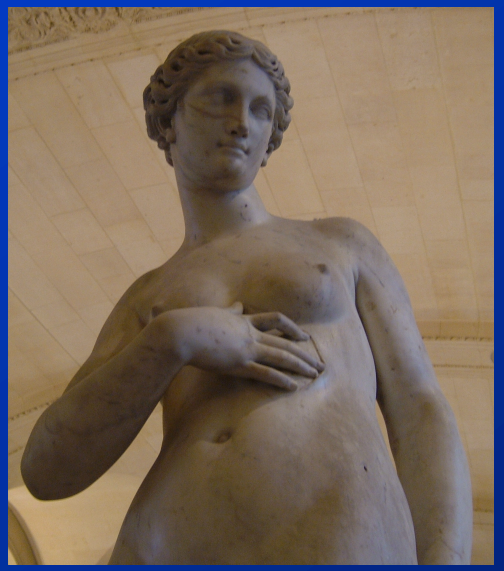
Holt et al., Gastroenterology 1986

Total gastric emptying of dextrose drink (75g/300ml) in Diabetic Gastroparesis



Stevens, Gilja et al. 2007

Ultrasound can be used to study different aspects of gastric motility



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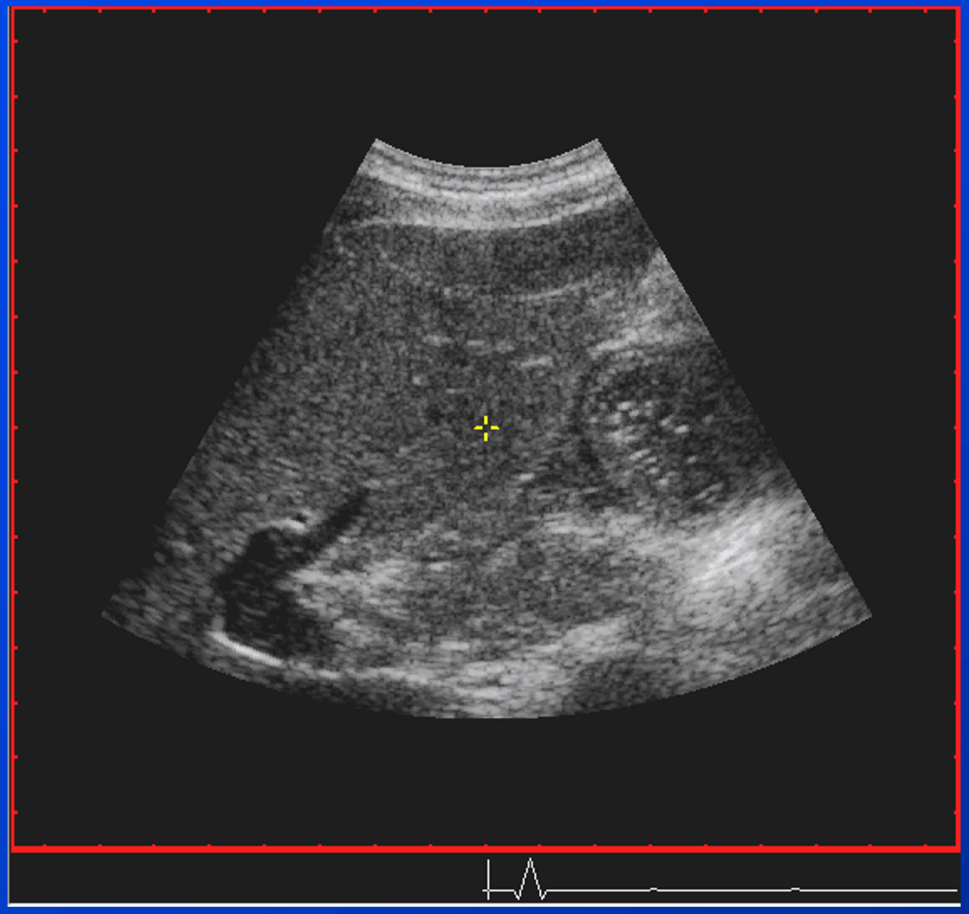
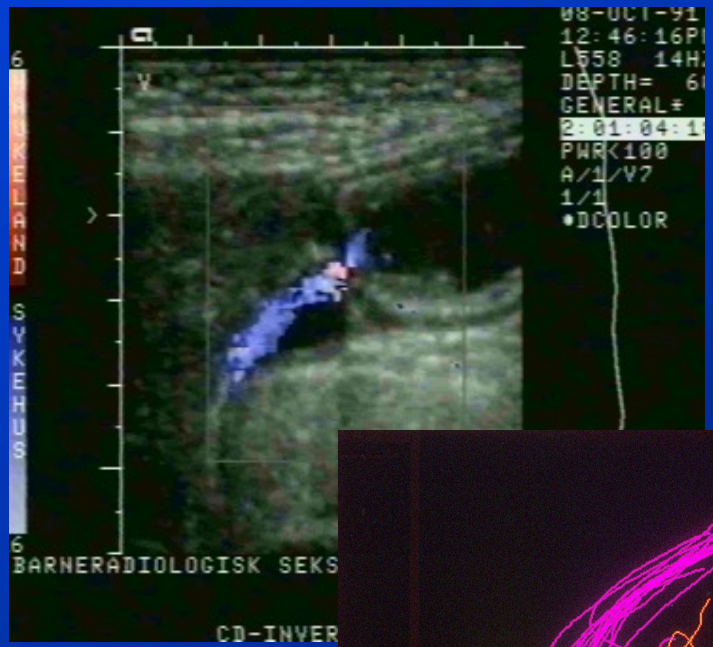
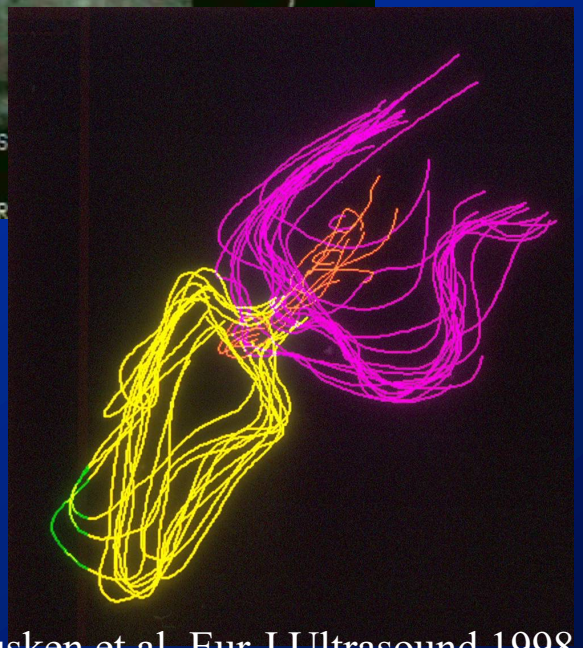
Flow in the Antro-Duodenal Segment





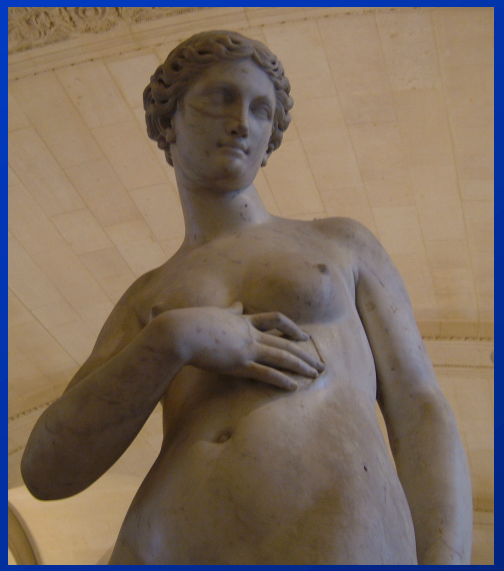


Hausken et al., Gastroenterology 1992, 102,1583 - 1590

Hausken et al. Eur J Ultrasound 1998

Transpyloric flow

Ultrasound can be used to study different aspects of gastric motility



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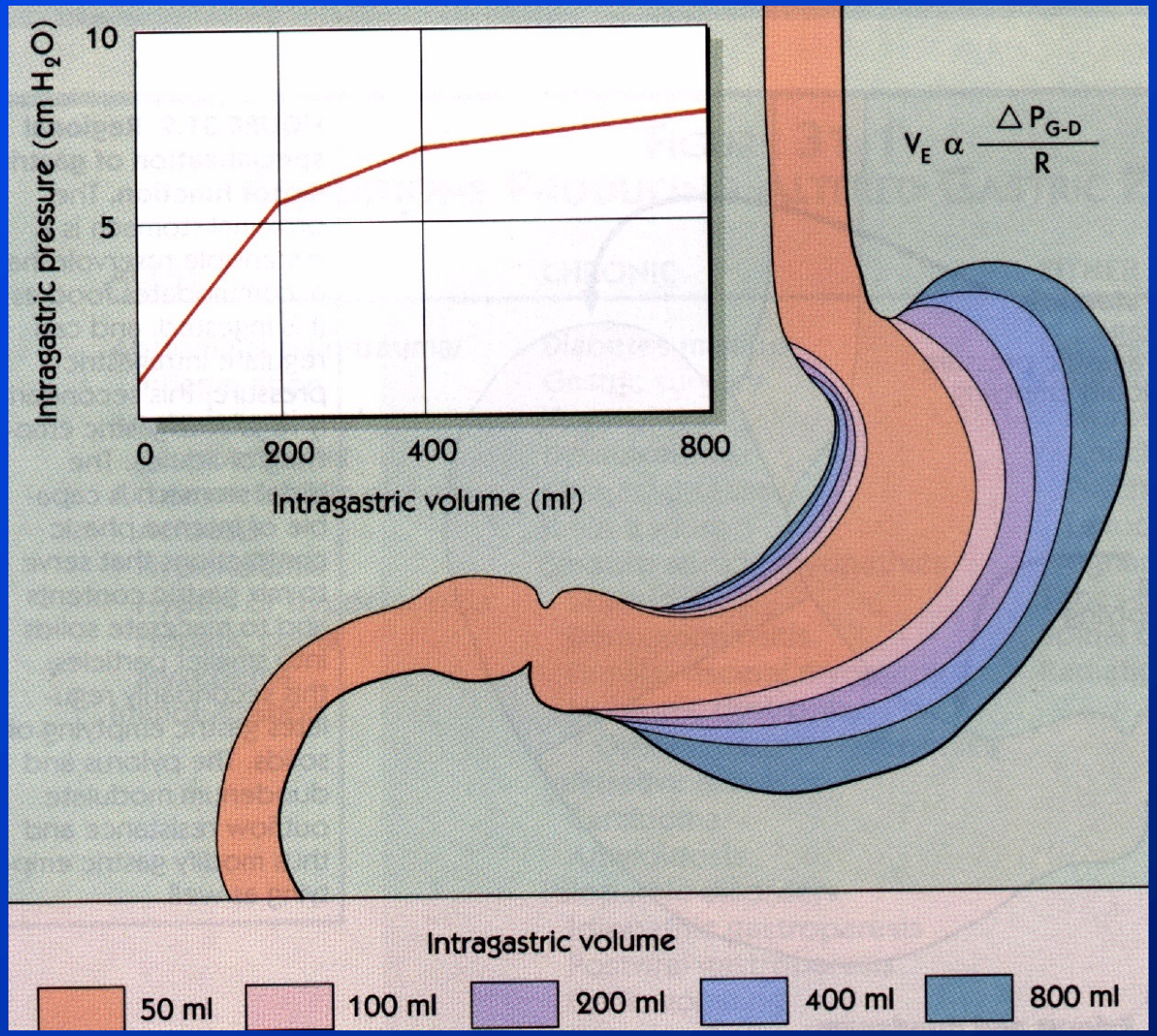
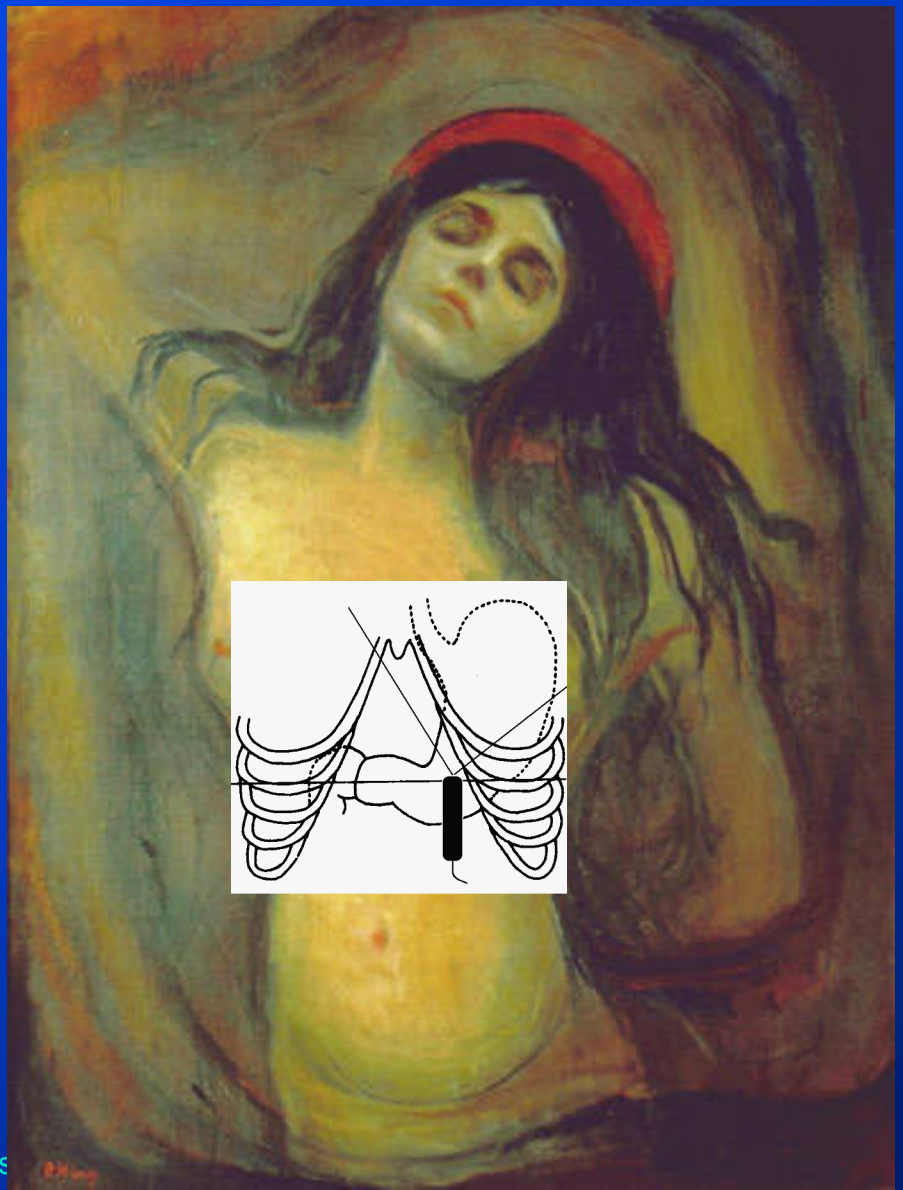
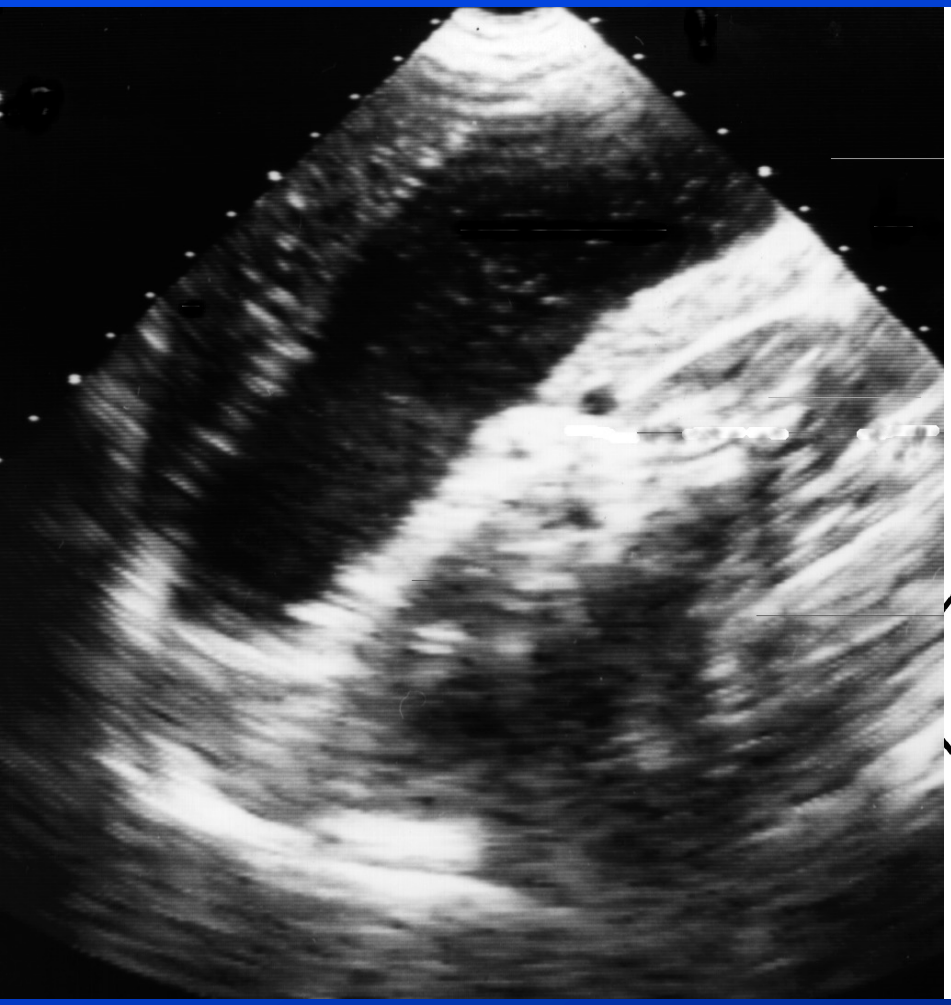
The Accommodation Reflex

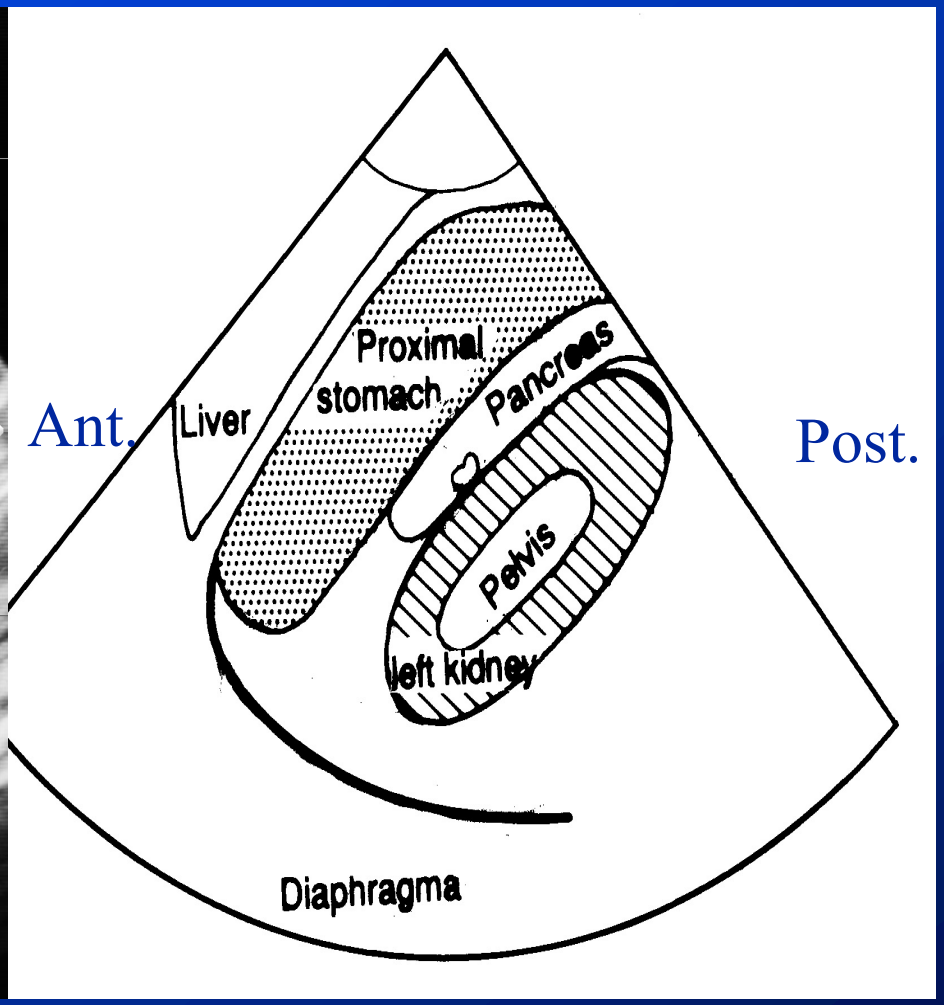


Scanning of the Proximal Stomach



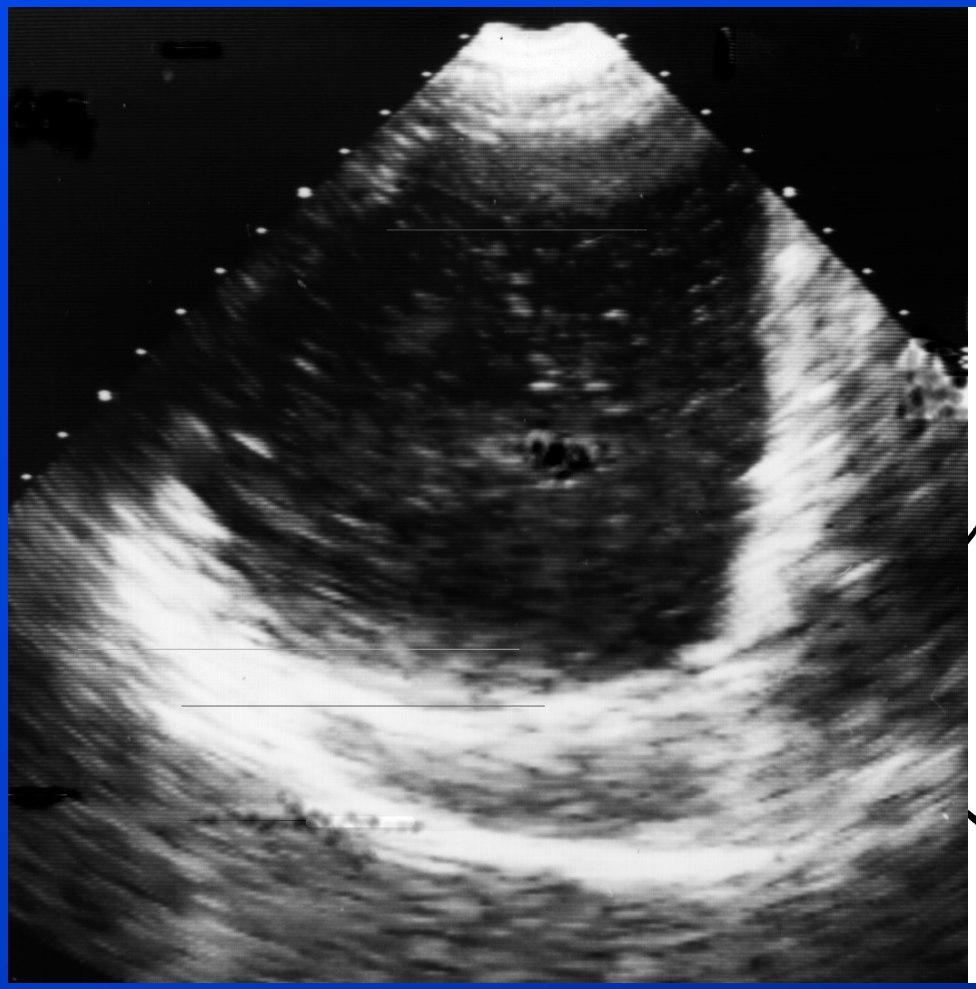
Sagittal section

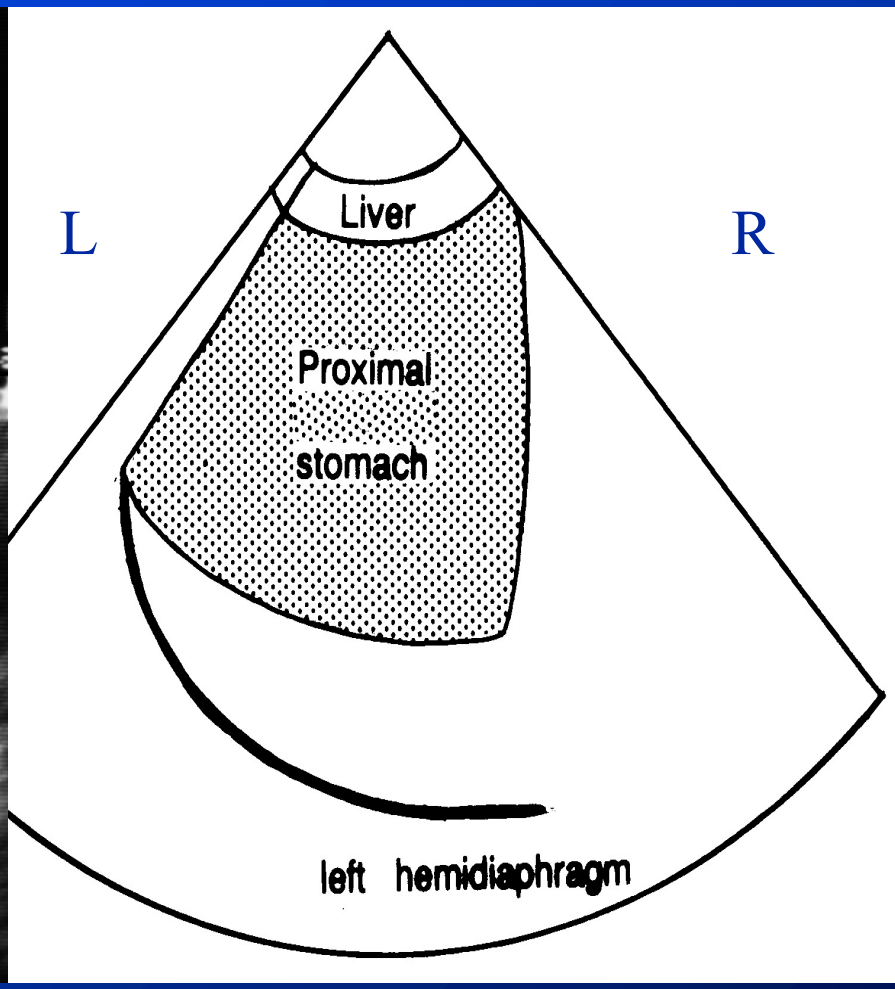




Gilja et al., J Ultrasound Med 1995;14(2):81-89

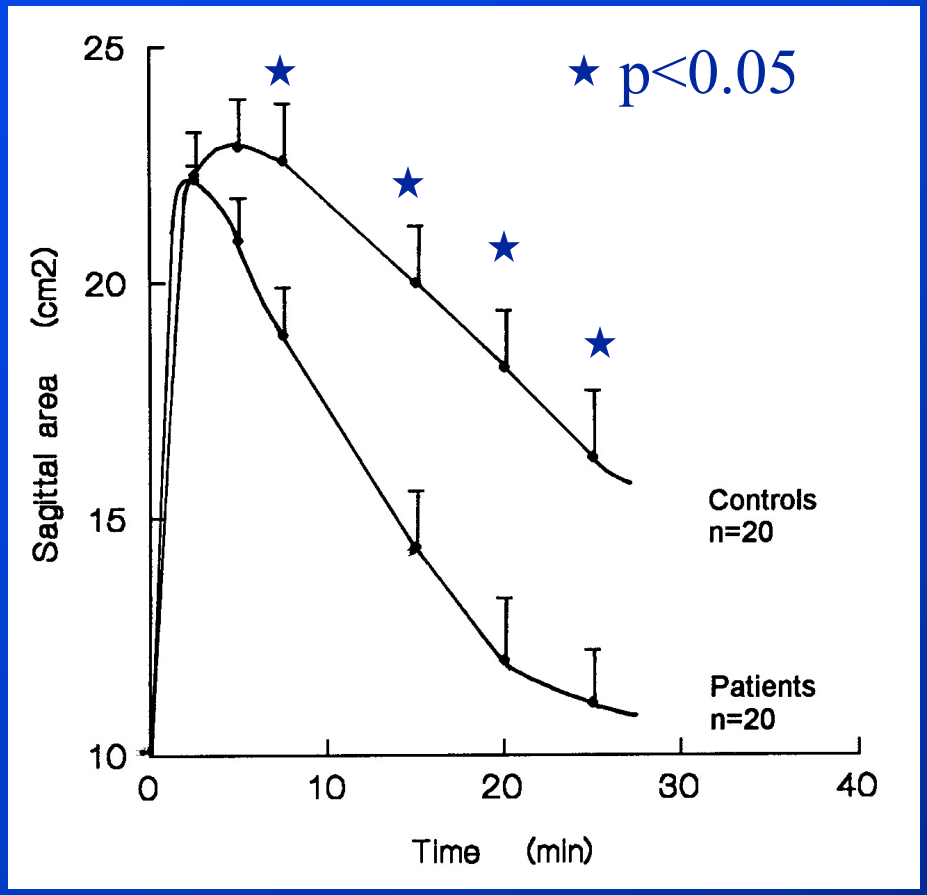
Oblique frontal section

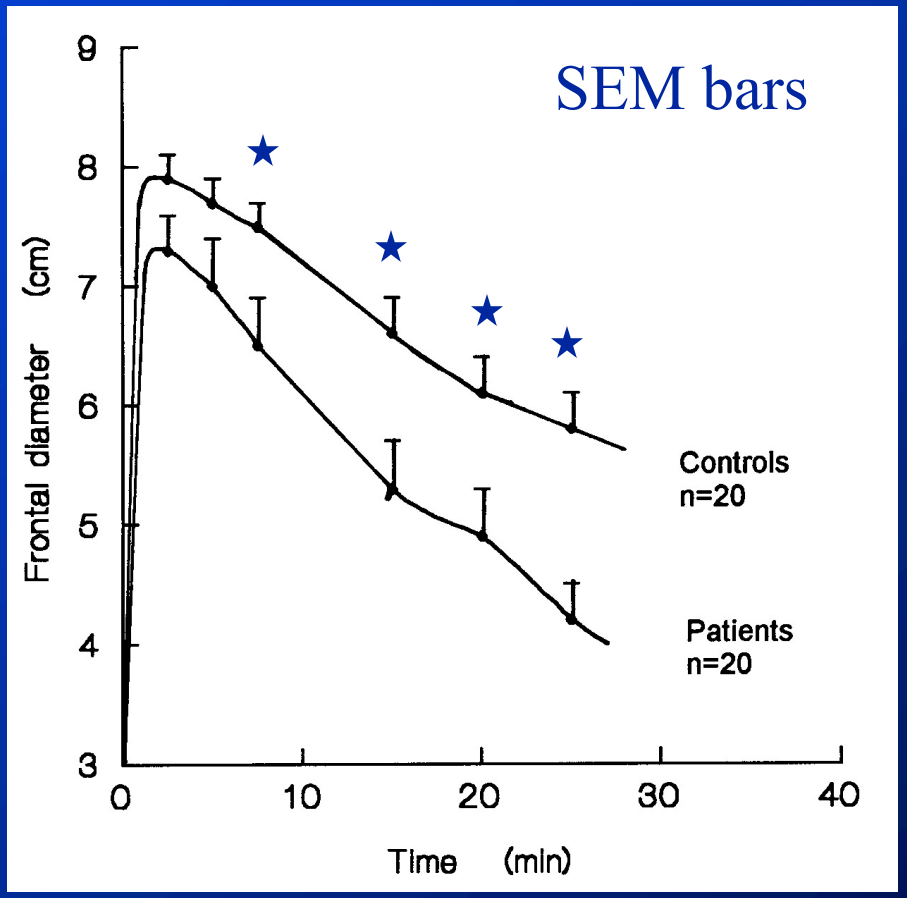




Gilja et al., J Ultrasound Med 1995;14(2):81-89

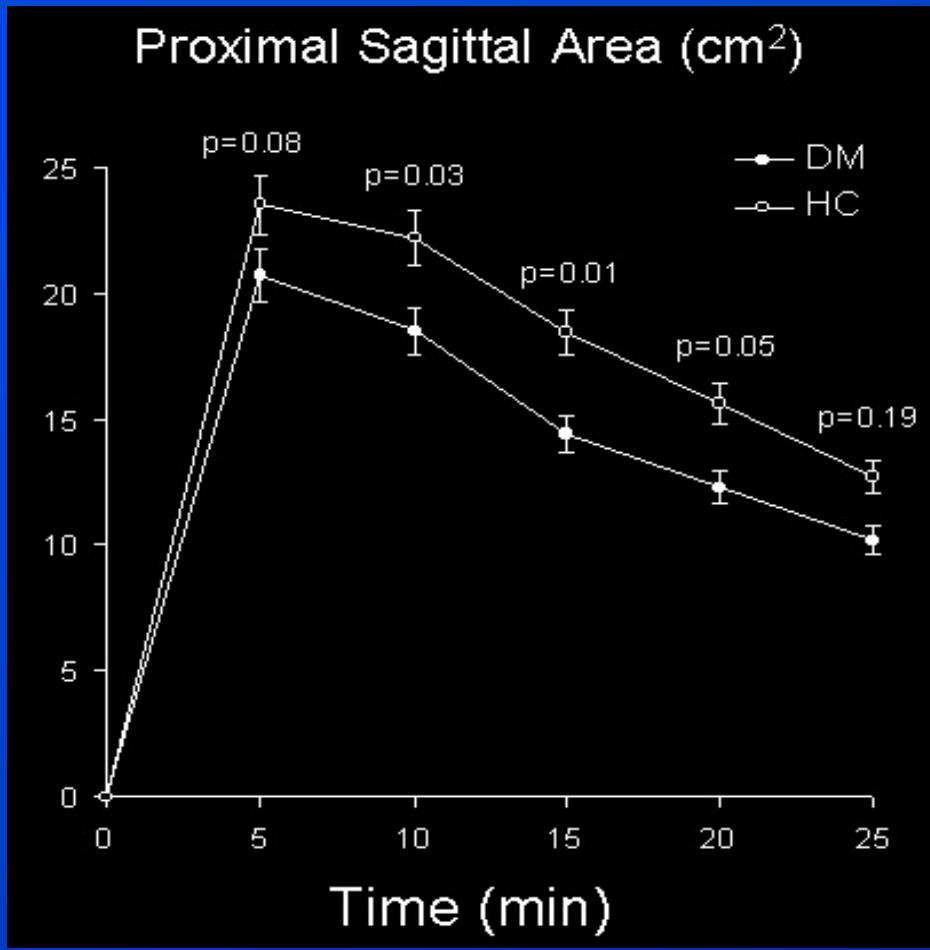
Size of the proximal stomach in functional dyspepsia

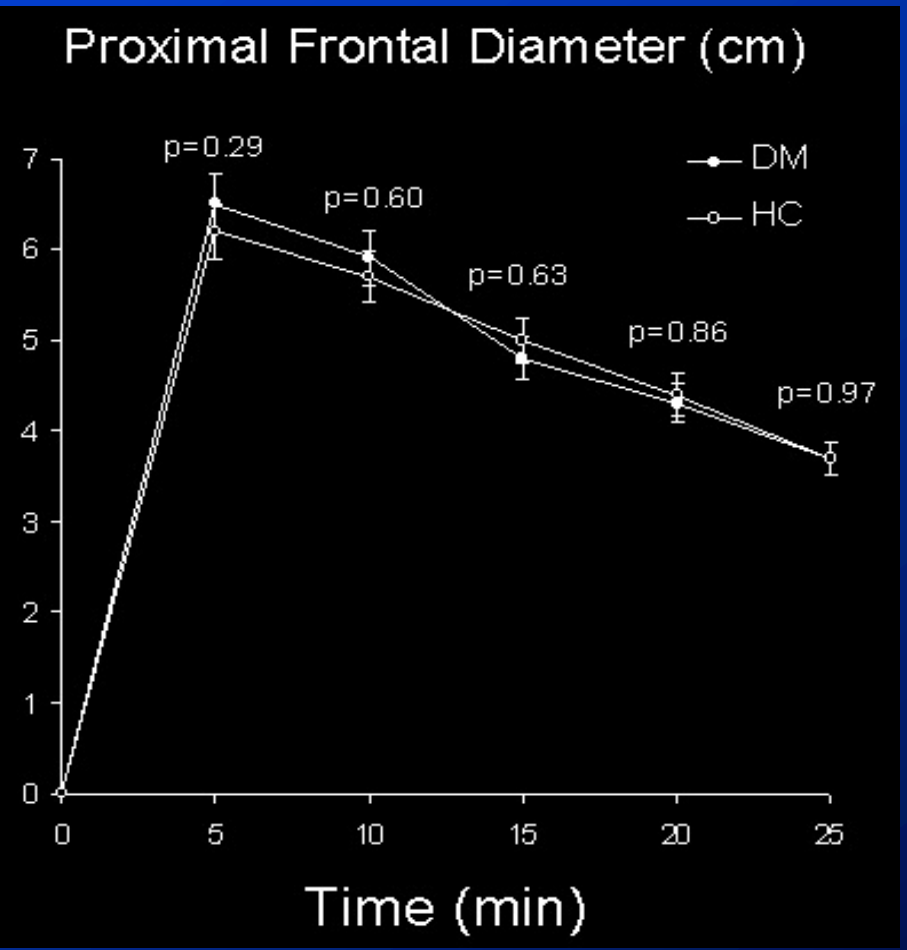




Gilja OH et al, Dig Dis Sci 1996;41:689-696

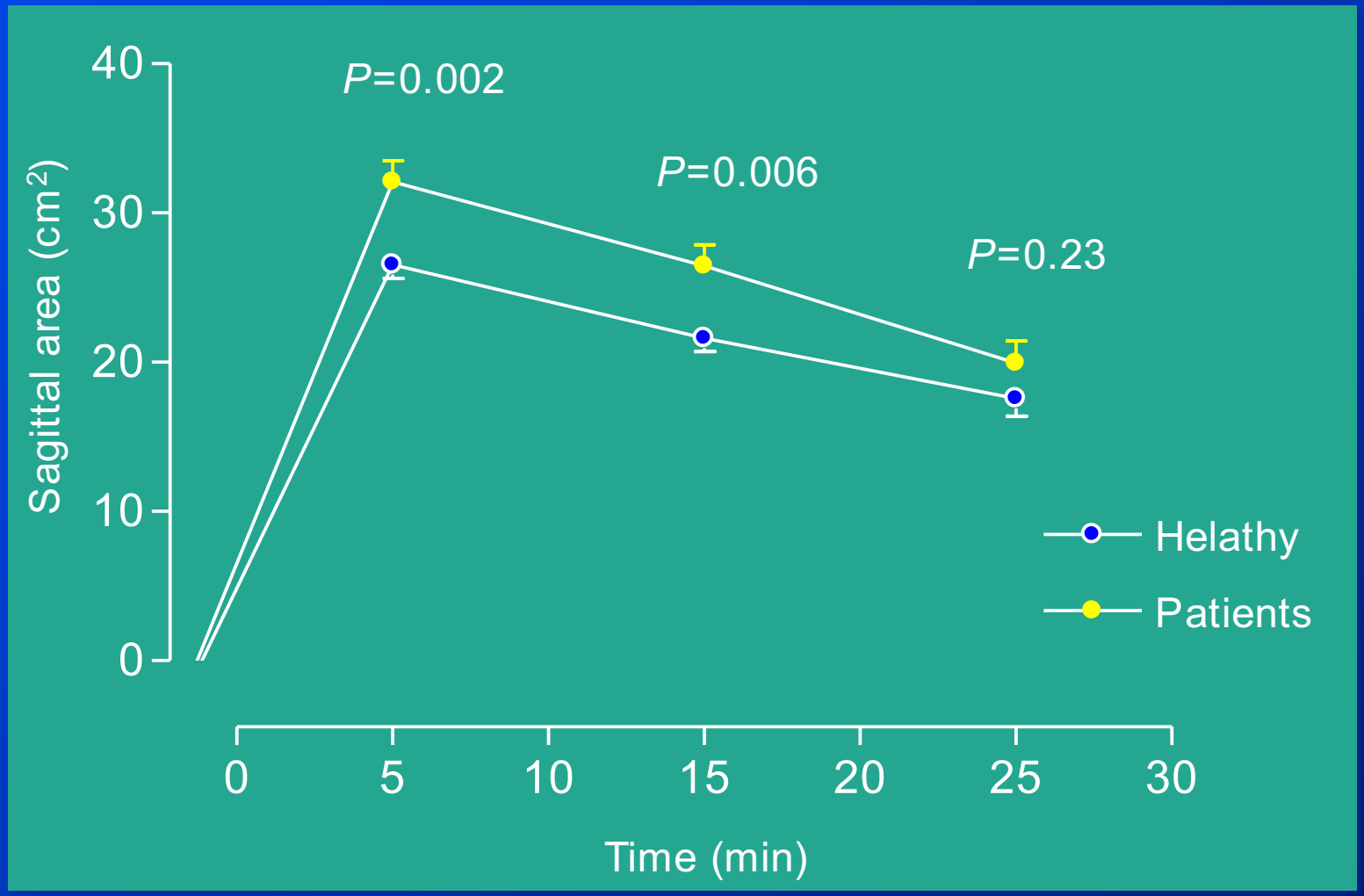
Accommodation in Diabetes





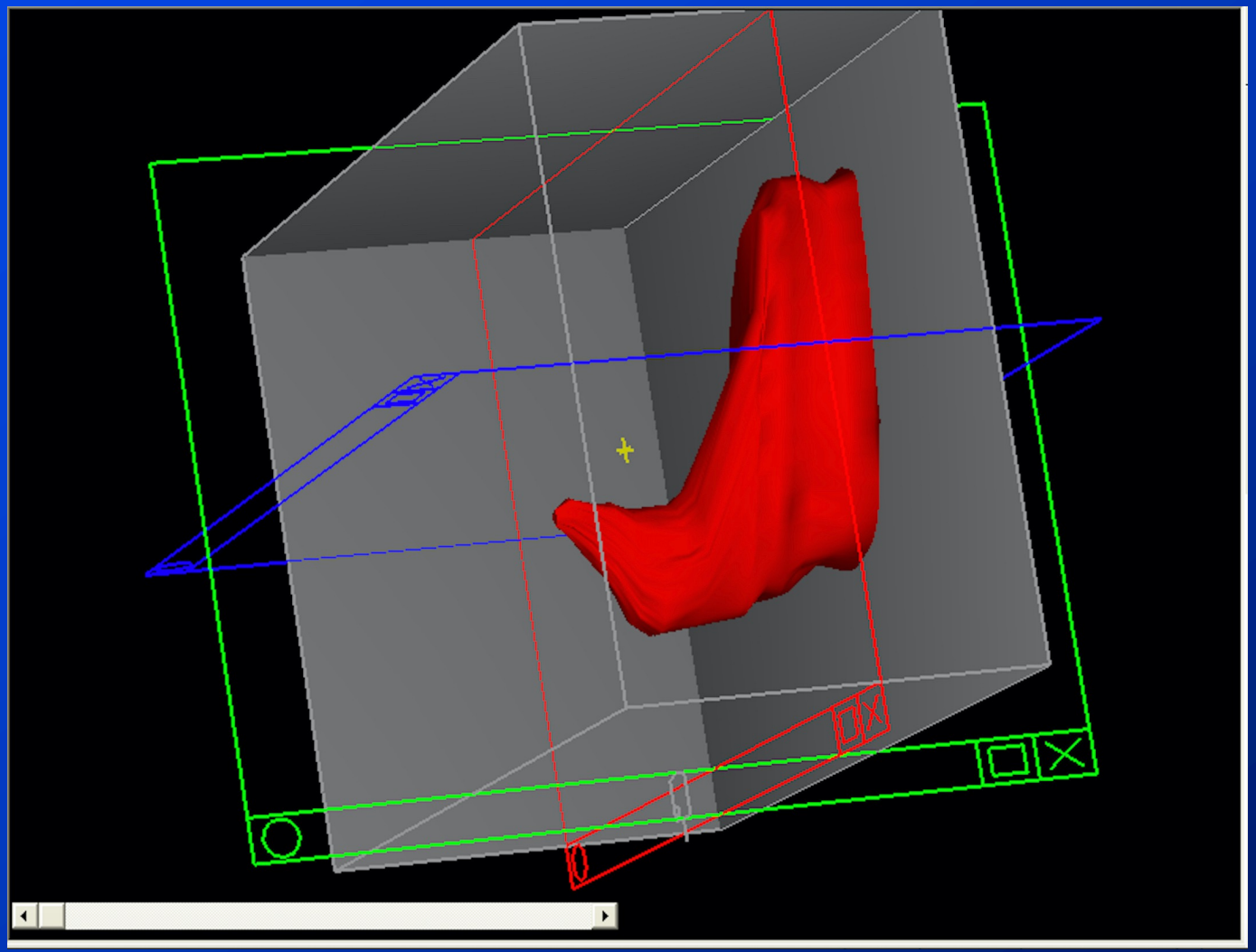
Undeland et al. Scand J Gastroenterol. 1998;33:236-241.

Proximal stomach in patients with reflux oesophagitis



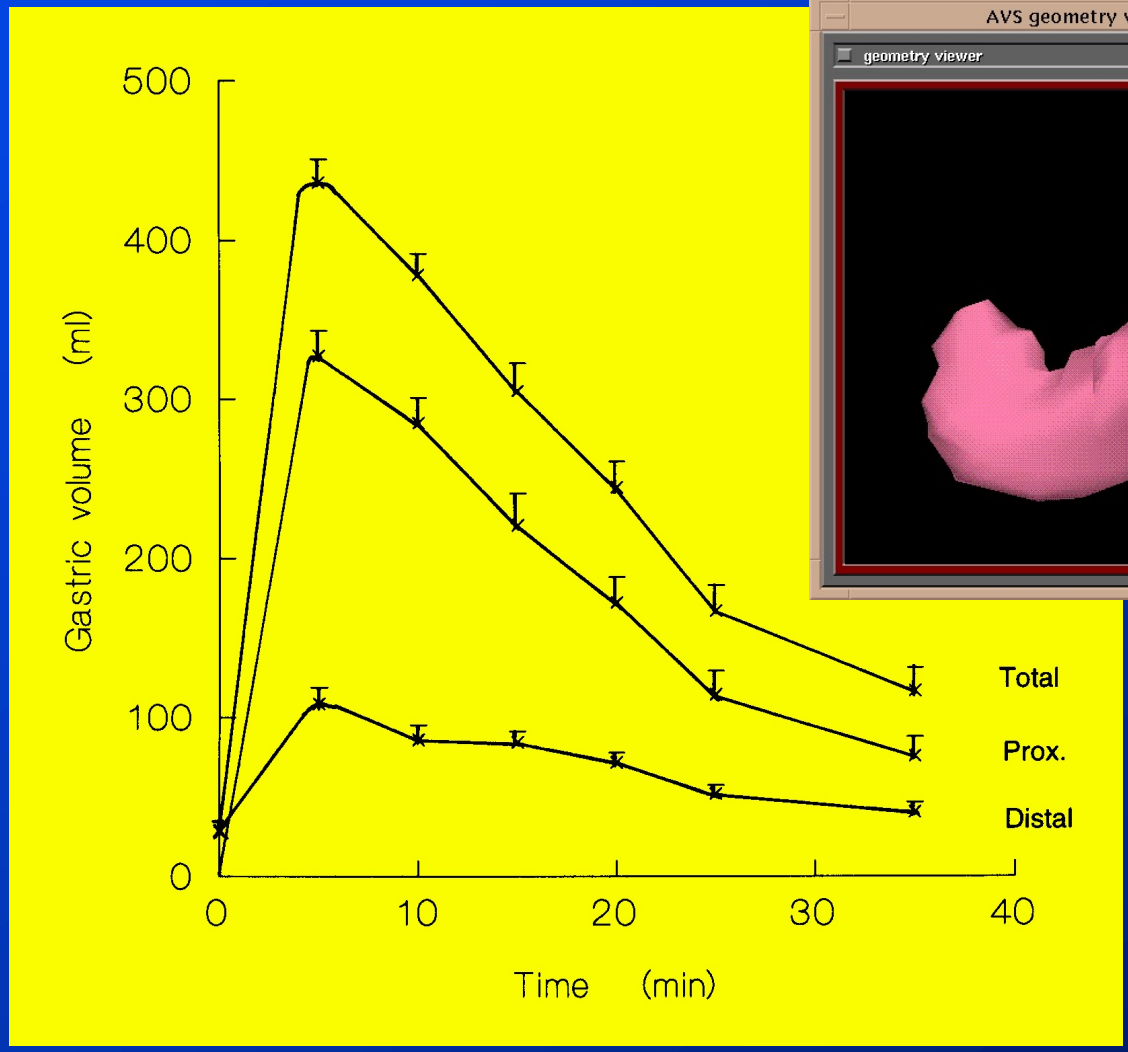
Tefera et al., Dig Dis Sci 2001

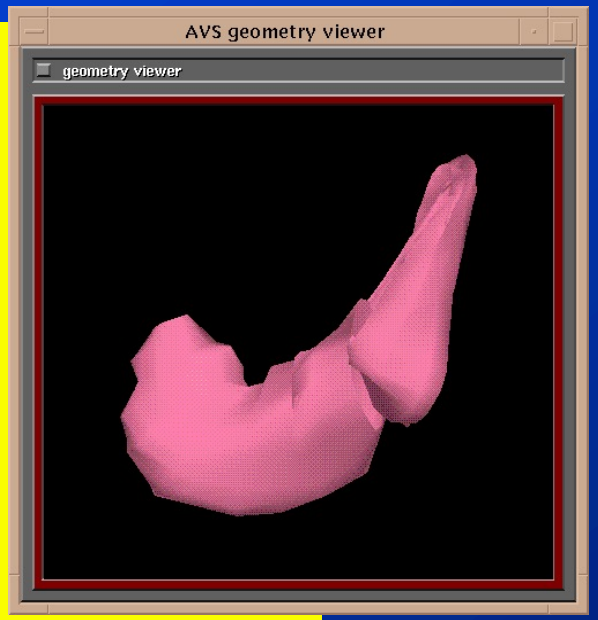
3D image reconstruction of the fluid-filled stomach



3D-US and Intragastric Distribution

- 16 healthy subjects
- T-50=22.1 min
  SD=3.8 min

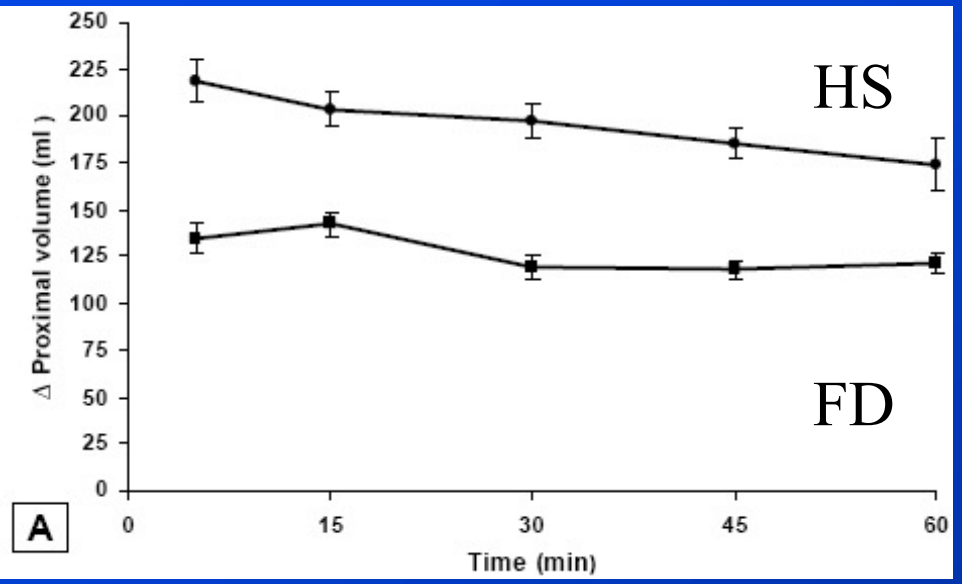


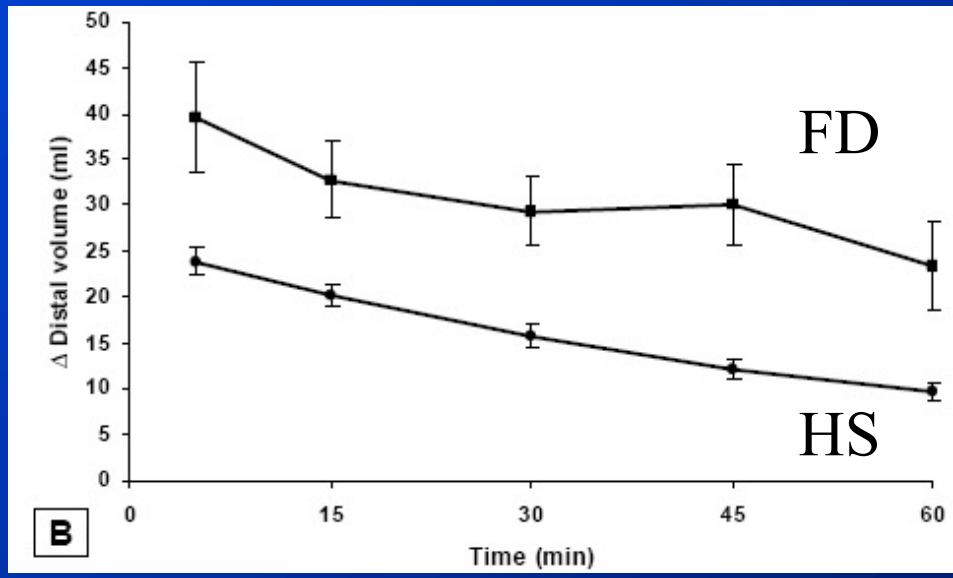


SEM bars are denoted

Gilja OH et al., Gastroenterology 1997;113:38-49

3D-US of the Proximal and Distal Stomach in Functional Dyspepsia

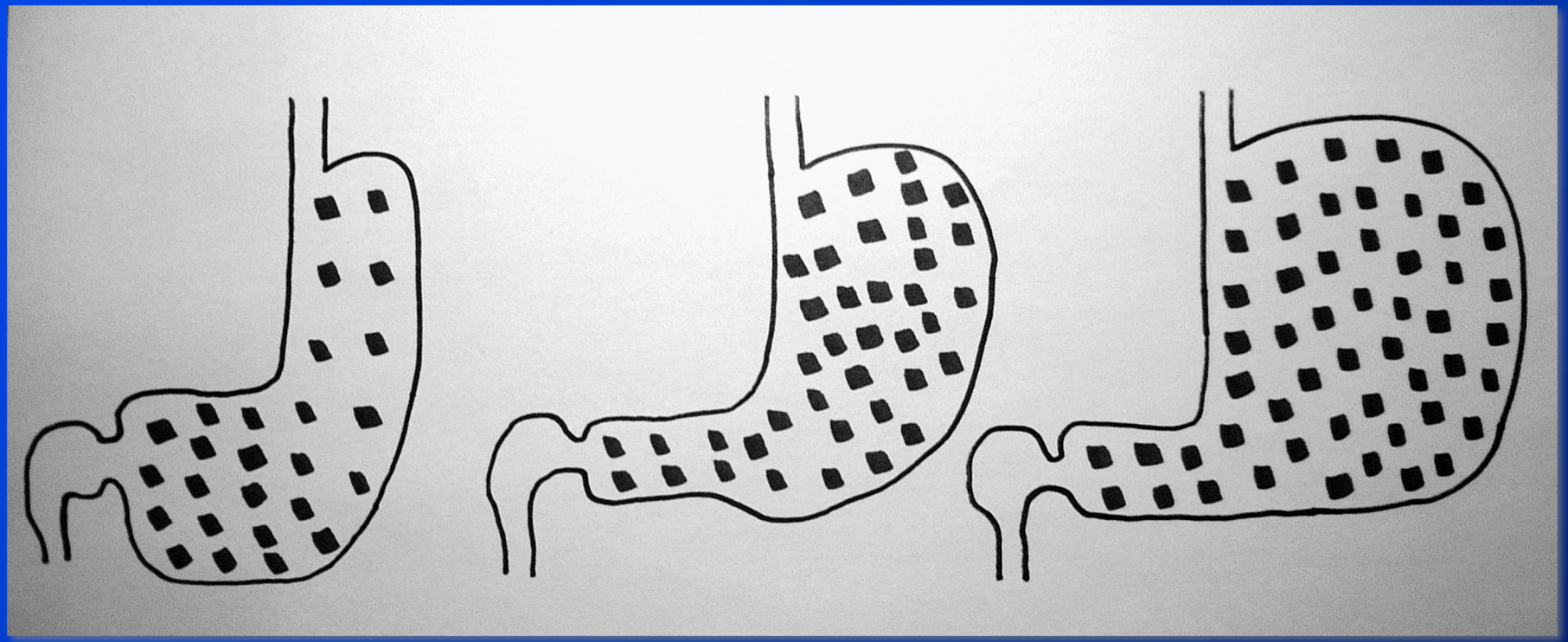




Mean proximal (A) and distal (B) volumes in FD (squares) and HS (circles). Note the significantly smaller proximal volume in FD (ANOVA<0.001) and significantly larger distal volume in FD (ANOVA=0.001) compared to HS using 3D ultrasound

Mundt and Samsom, Gut 2006

Gastric Accommodation in Health and Disease

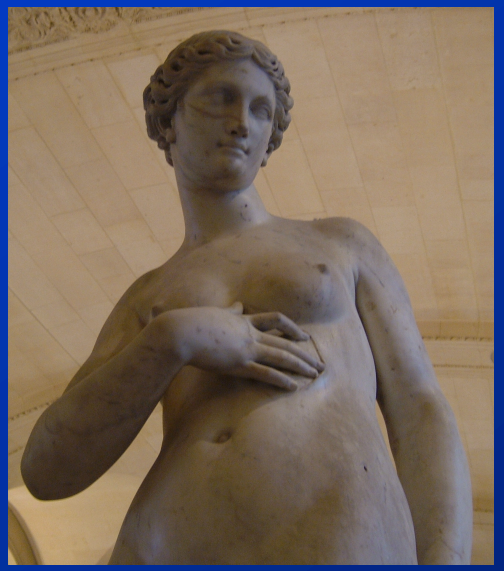


Functional dyspepsia

Normal stomach

Reflux esophagitis

Ultrasound can be used to study different aspects of gastric motility



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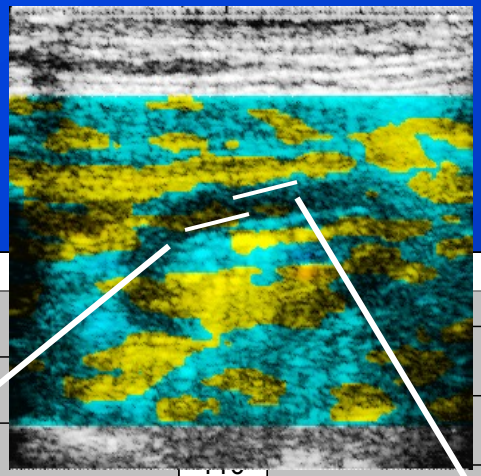
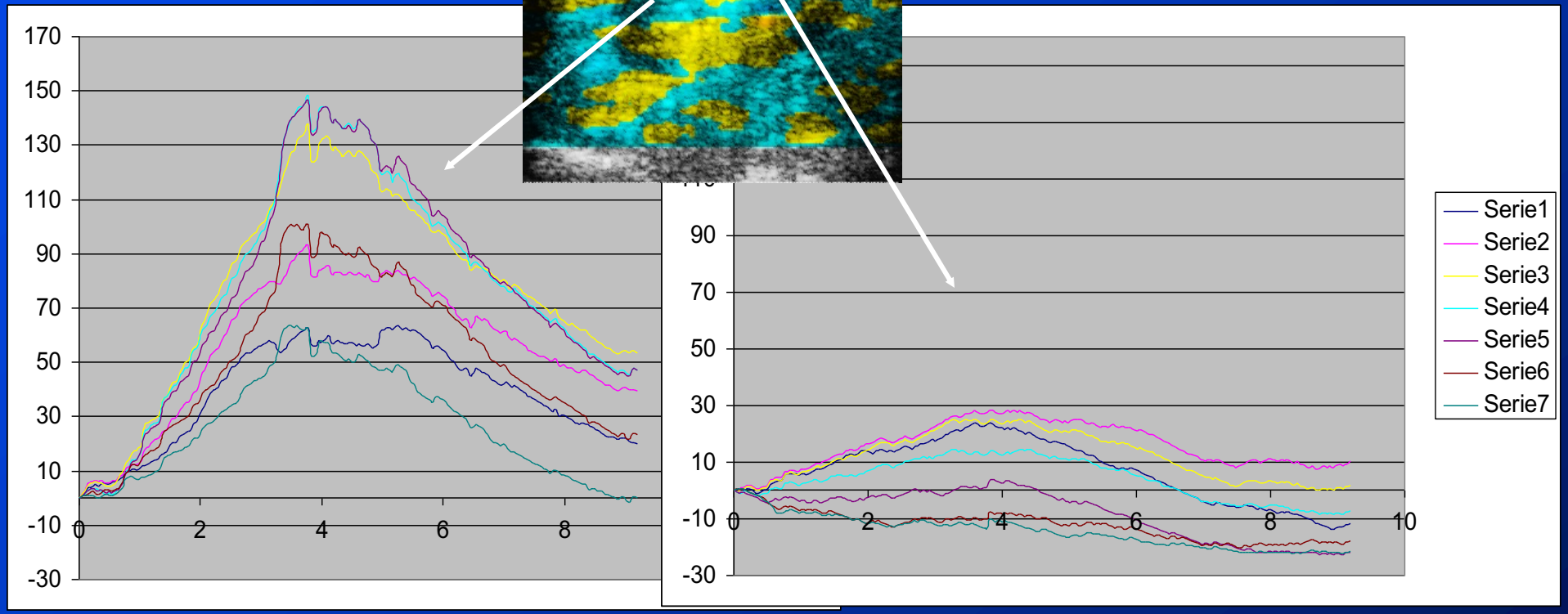
SRI can discriminate between Inner and Outer Muscle Layer of the Antrum



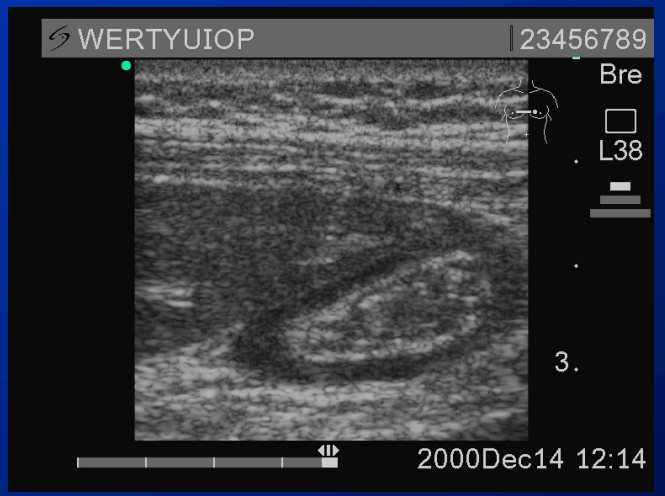


Circular muscle layer

Longitudinal muscle layer

The Ultrasound Meal Accommodation Test
A Clinical Stress Test

- Test Meal
  - 500 ml in 4 min
- Ultrasound scanning
  - Distal and proximal stomach
  - 2D and 3D ultrasound
- Morphometry
- Evaluation of Symptoms
- Psychological assessment



The Ultrasound Meal Accommodation Test in

Scandinavian Journal of Gastroenterology

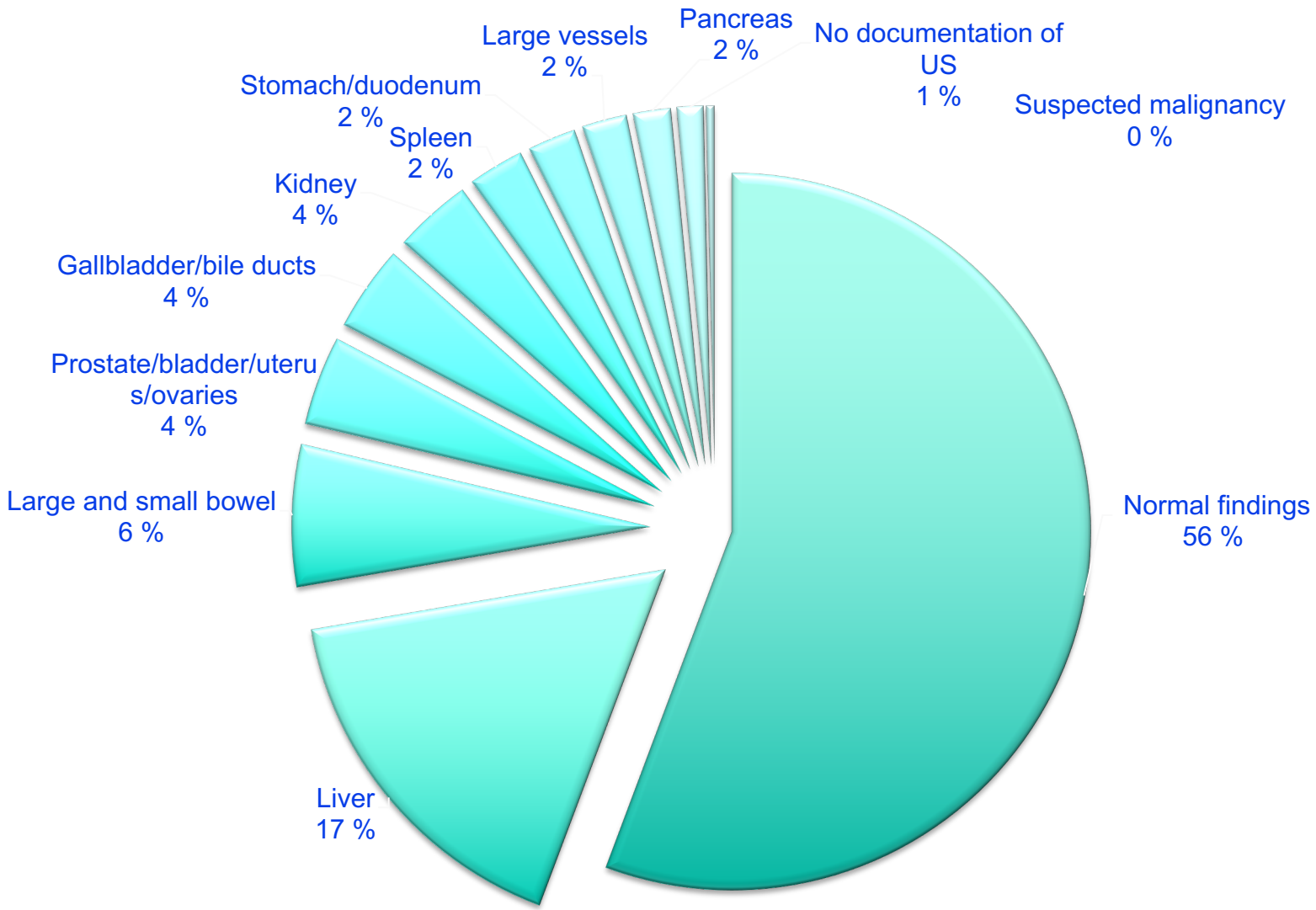
March 2016

ISSN: 0036-5521 (Print) 1502-7708 (Online) Journal homepage: http://www.tandfonline.com/loi/igas20

The ultrasound meal accommodation test in 509 patients with functional gastrointestinal disorders

Elisabeth K. Steinsvik, Trygve Hausken & Odd Helge Gilja

Ultrasound Findings at UMAT



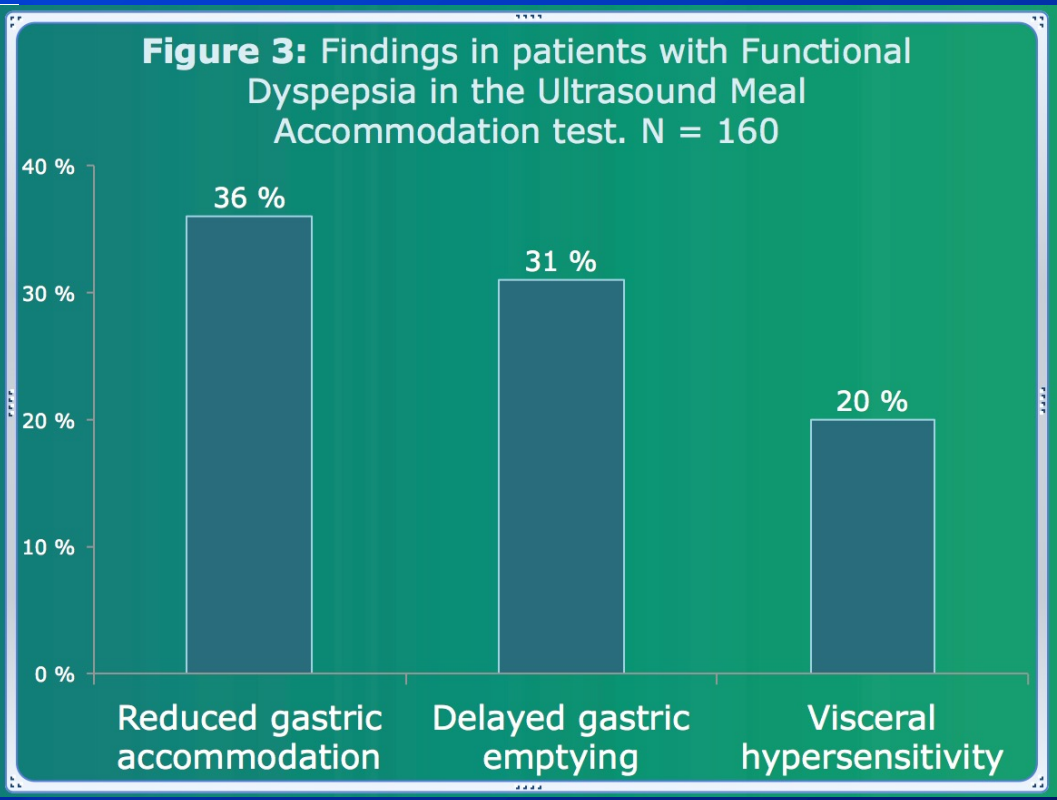
Steinsvik, Hausken, Gilja, Scand J Gastroenterol 2016

Findings in FD

160 patients (31%) were diagnosed with Functional Dyspepsia (FD). 94 patients (41%) with FD were diagnosed with co-existing Irritable Bowel Syndrome (IBS). In total, 154 patients (30%) were diagnosed with IBS.

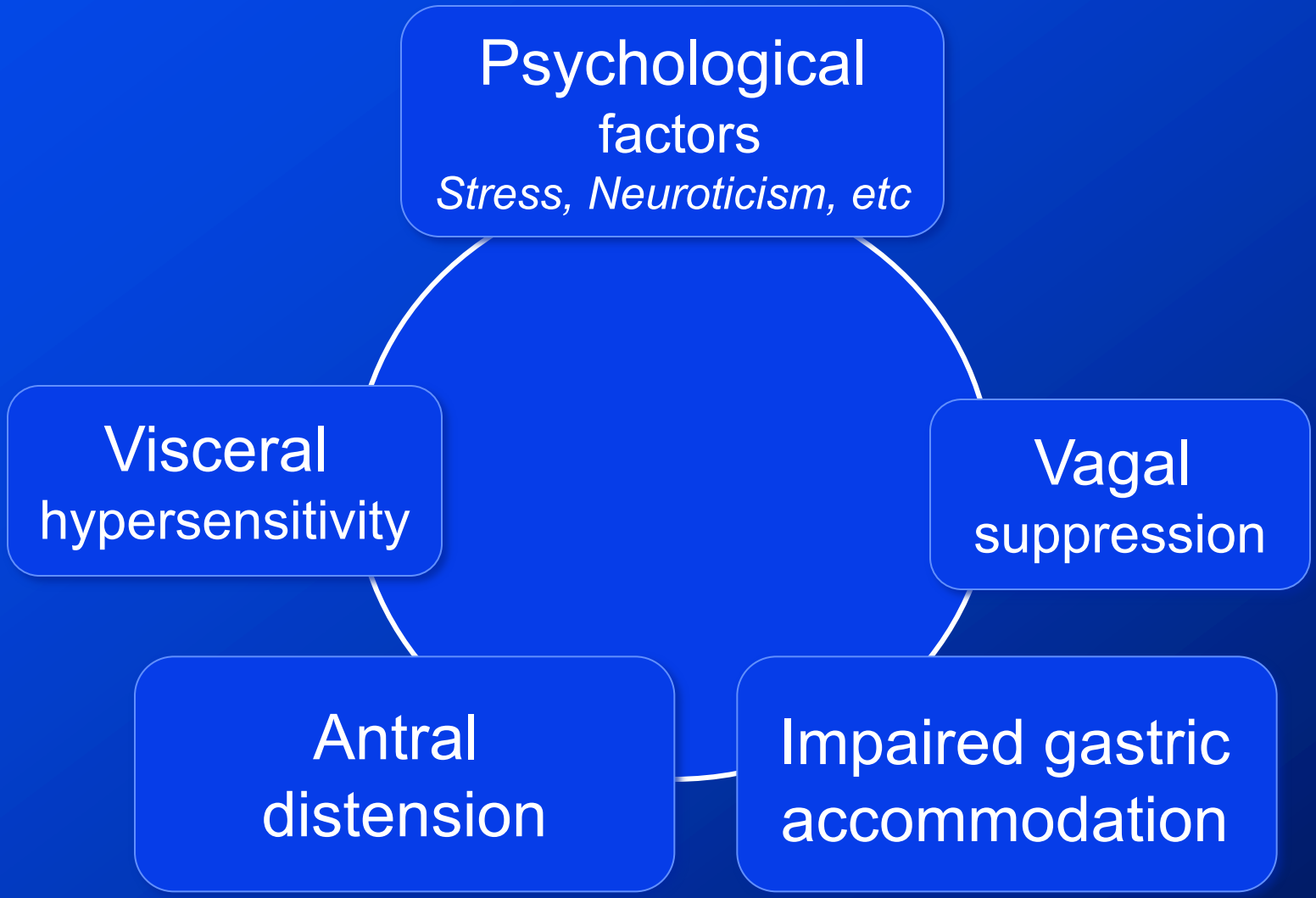
- 29 (6%) patients were diagnosed with gastroparesis
- 29 (6%) patients were diagnosed with psychogenic dyspepsia

48% received a final diagnosis with no need for further investigations



Steinsvik, Hausken, Gilja, Scand J Gastroenterol 2016

Vicious Cycle in Functional Dyspepsia



GIUS – EFSUMB guidelines on Gastro-Intestinal Ultrasound

- Task Force Group of over 20 experts from Europe
- Started at UEG Week October 2014
- 7 guideline/position papers are published / in progress:
  - 1. Methodology and examination technique (published EJU 2016)
  - 2. IBD (Published – EJU 2018)
  - 3. Perineal and transrectal US (Published- UIO - 2019)
  - 4. Acute appendicitis and diverticulitis (Published EJU 2019)
  - 5. Misch./ Coeliac / Upper GI (Published Med Ultrason -2019)
  - 6. Intestinal Emergencies (Published EJU 2020)
  - 7. Functional Disorders (Recommendations voted on, ready for submission)

No 7: GIUS of functional disorders

EFSUMB recommendations on GIUS (part 7):

Ultrasound in Functional Disorders of the Gastrointestinal Tract

Giovanni Maconi [1], Trygve Hausken [2], Christoph F Dietrich [3], Nadia Pallotta [4], Ioan Sporea [5], Dieter Nurnberg [6], Laura Romanini [7], Carla Serra [8], Barbara Braden [9], Zeno Sparchez [10], Odd Helge Gilja [11]

1) Gastroenterology Unit, Department of Biomedical and Clinical Sciences, "L.Sacco" University Hospital, Milan, Italy.
2) Department of Clinical Medicine, University of Bergen, and Department of Medicine, Haukeland University Hospital, Bergen, Norway.

13 statements on US in FGID

”Waschmaschinen-phenomen”

Typically seen in
Coeliac disease

Familial GUCY2c Diarrhoea Syndrome

Snow-globe phenomenon

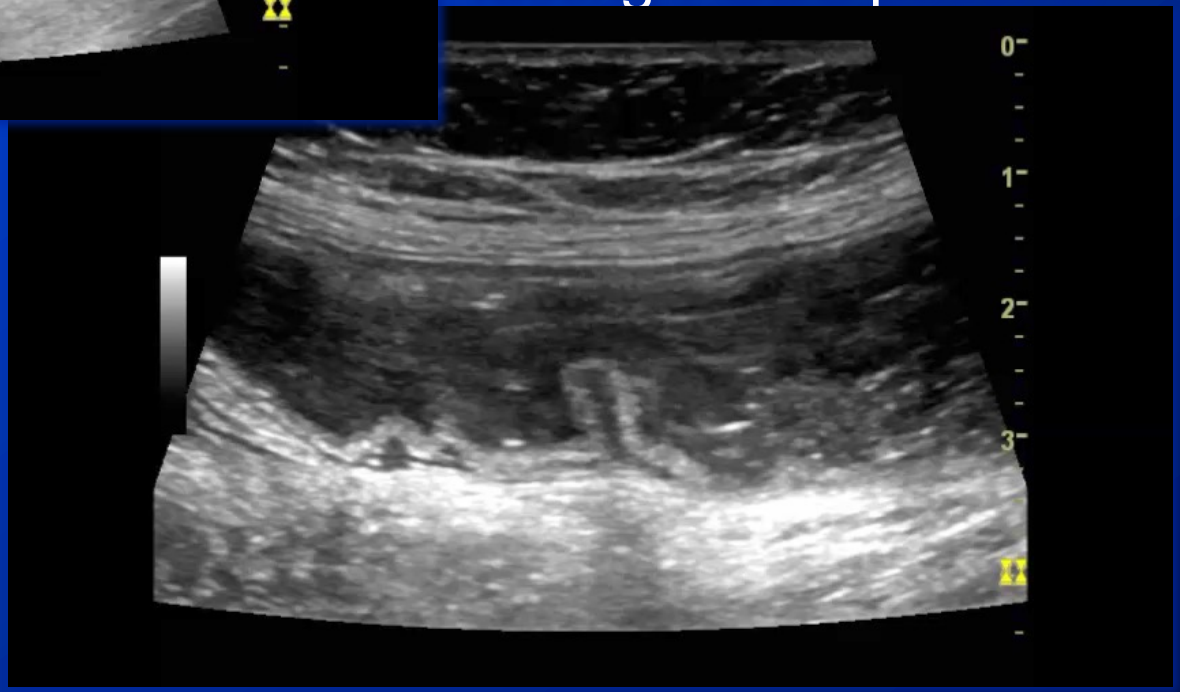
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Familial Diarrhea Syndrome Caused by an Activating *GUCY2C* Mutation

N Engl J Med 2012;366:1586-95

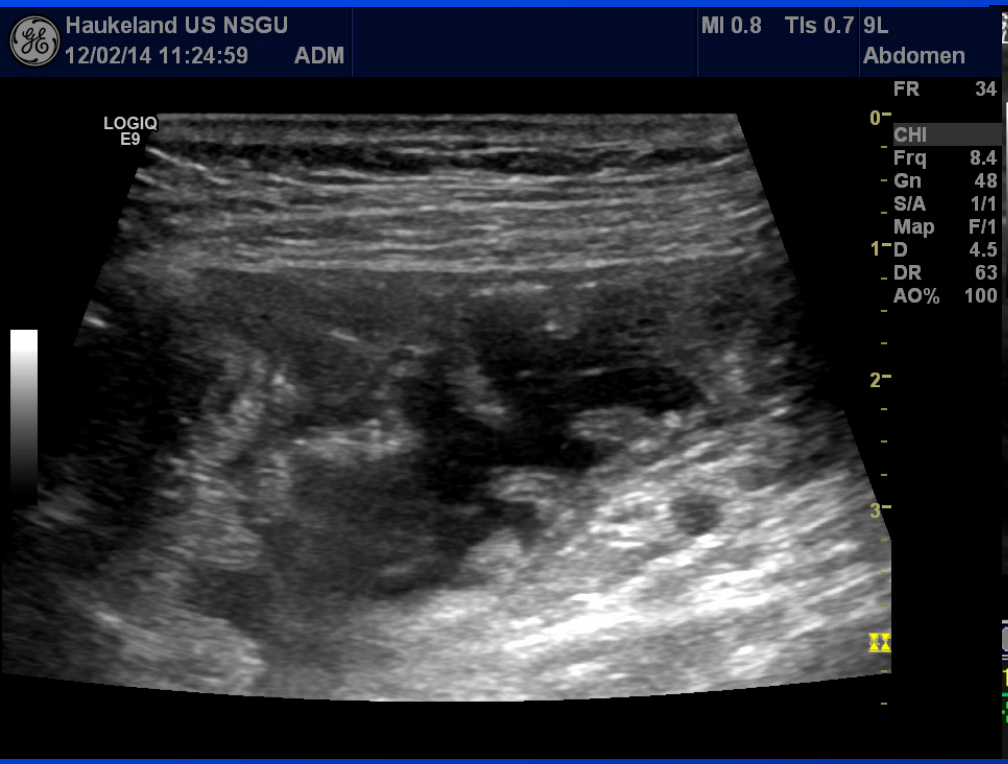
Small intestine in fasting FGDS patients



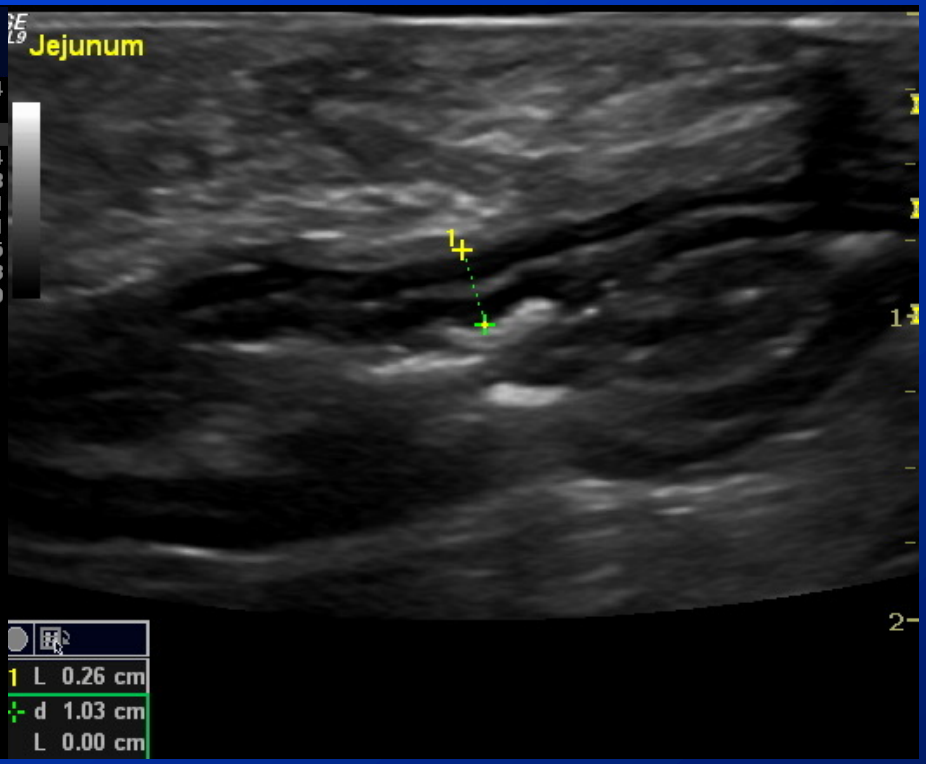
Volkmann von HL, Nylund K, Tronstad RR, Hovdenak N, Hausken T, Fiskerstrand T, Gilja OH. Scand J Gastroenterol. 2016 Jun 24:1-8.

IBS or IBD?

In jejunum



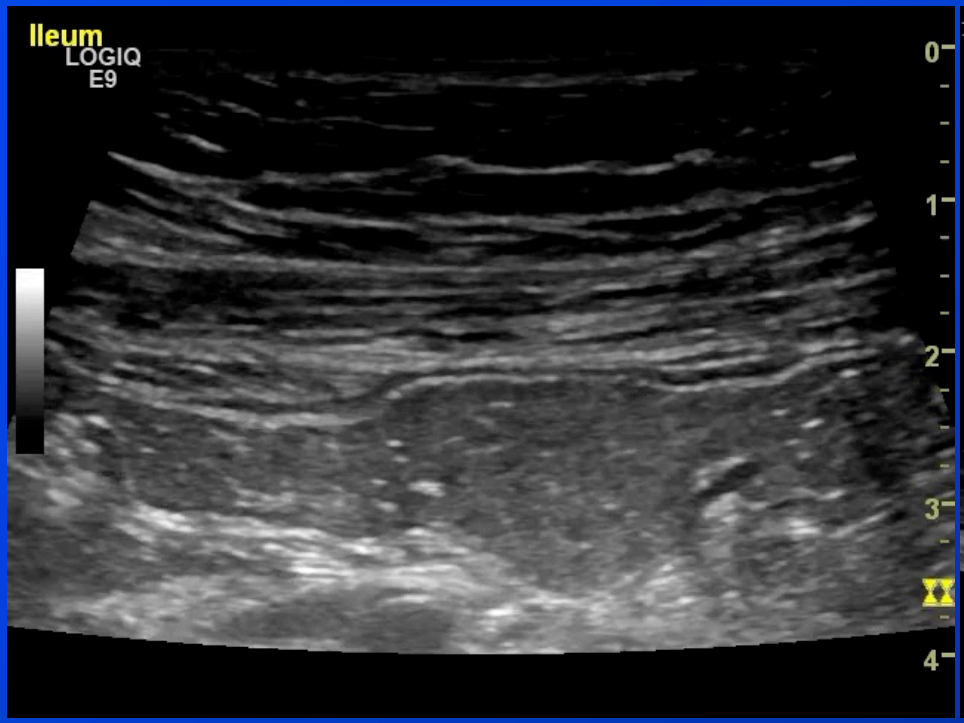
Normal wall
Note valvula conniventes



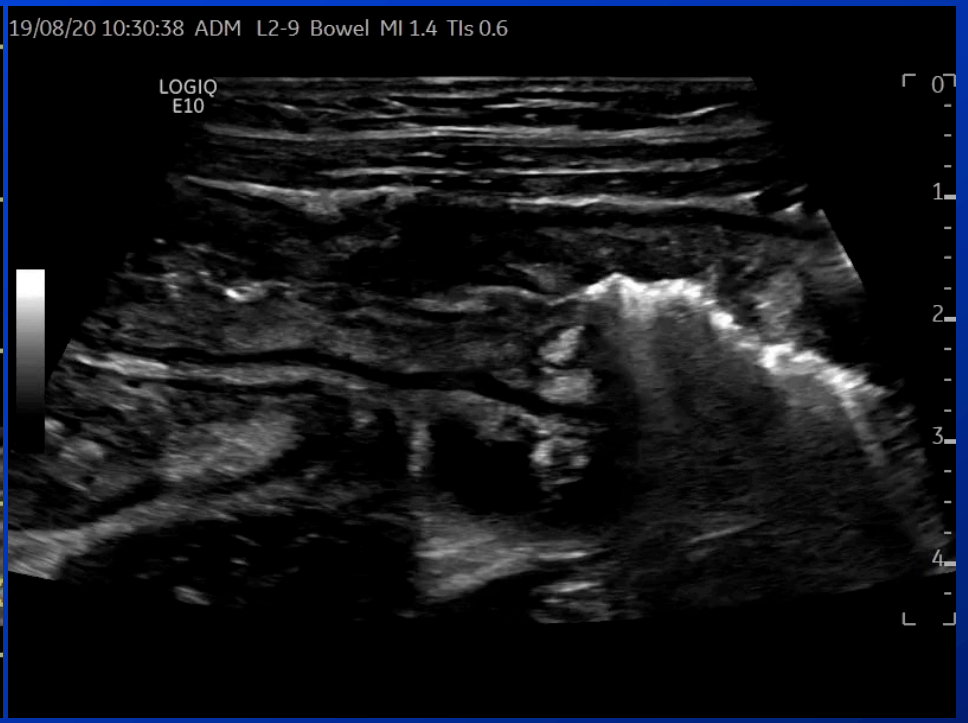
Note thickened wall, no valvula, and irregular luminal contour

IBS or IBD?

In ileum



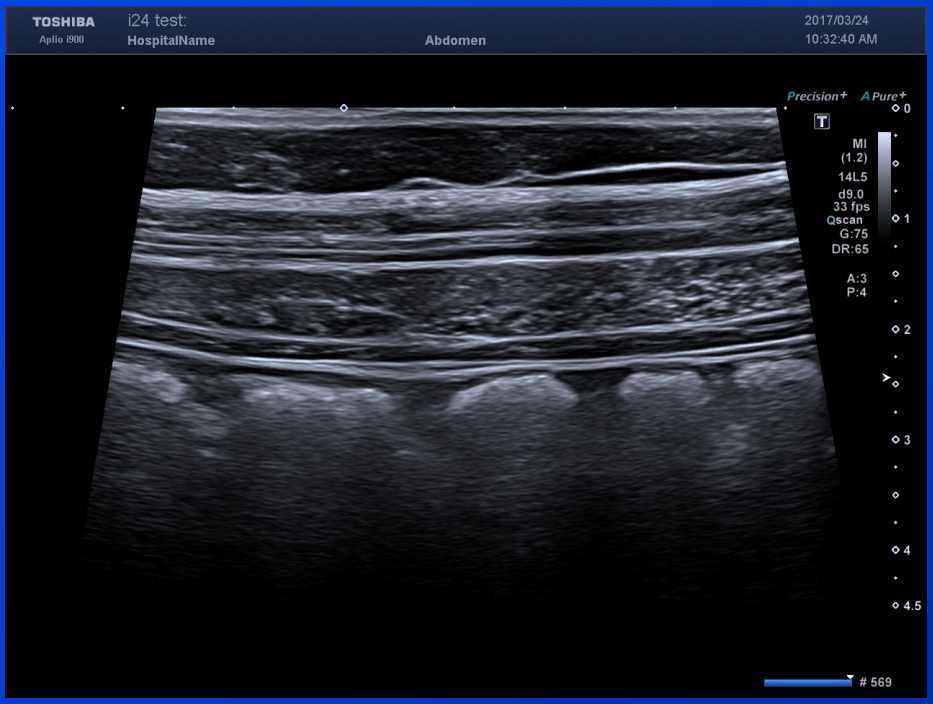
Normal ileum motility
Note thin wall



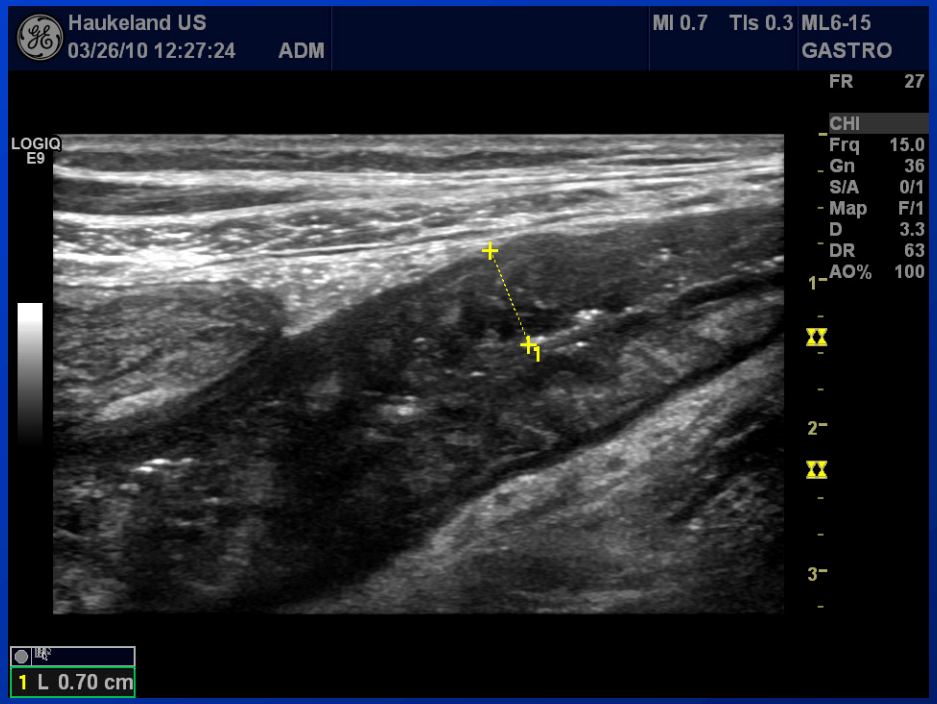
Dysmotility and thickened wall
In Crohn´s disease

IBS or IBD?

In colon



Normal descending colon



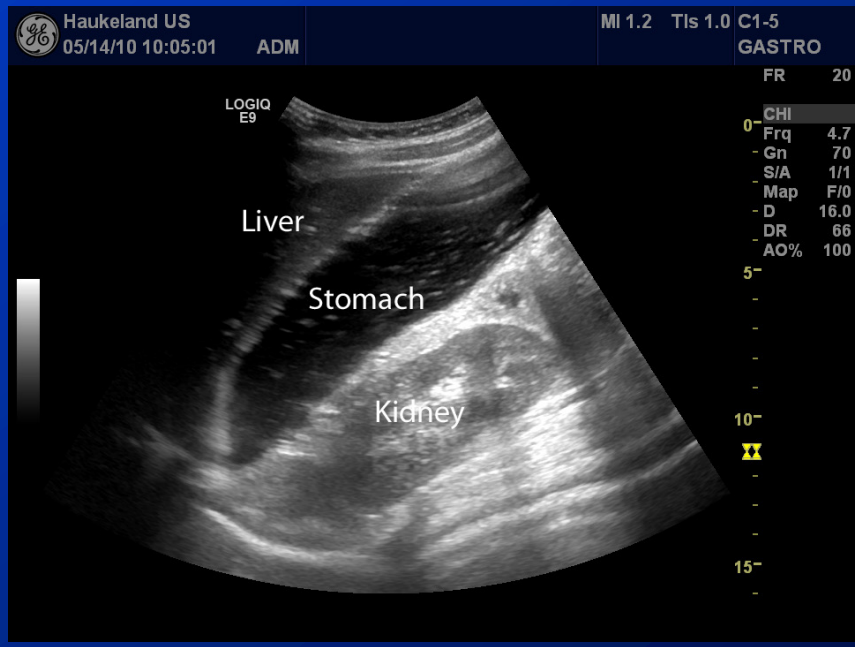
Thickened GI wall, loss of haustration, and dearranged wall layers in ulcerative colitis

Kasuistikk: Kvinne 17 år

- Magesmerter i 6 år
- Tidlig metthet, slutter å spise pga smerter i epigastriet
- Litt kvalme og oppfylthet
- Plager med nakke-

  myalgier
- Normal gastro-

  og koloskopi



Suppetest

- Hun drikker 350 ml på 4 min og stopper pga kvalme, - gråter
- Symptomer (VAS 0-100)
  - Smerter 35 – 47
  - Kvalme 3 – 51
  - Oppfylthet 2 – 3

Psykometri

- GHG-28
  - 22/28: mer enn vanlig av angst og depressive symptomer
- EPQ-N: 8/12
- HAD: Angst 14/21 (>8 patologisk)

Diagnose

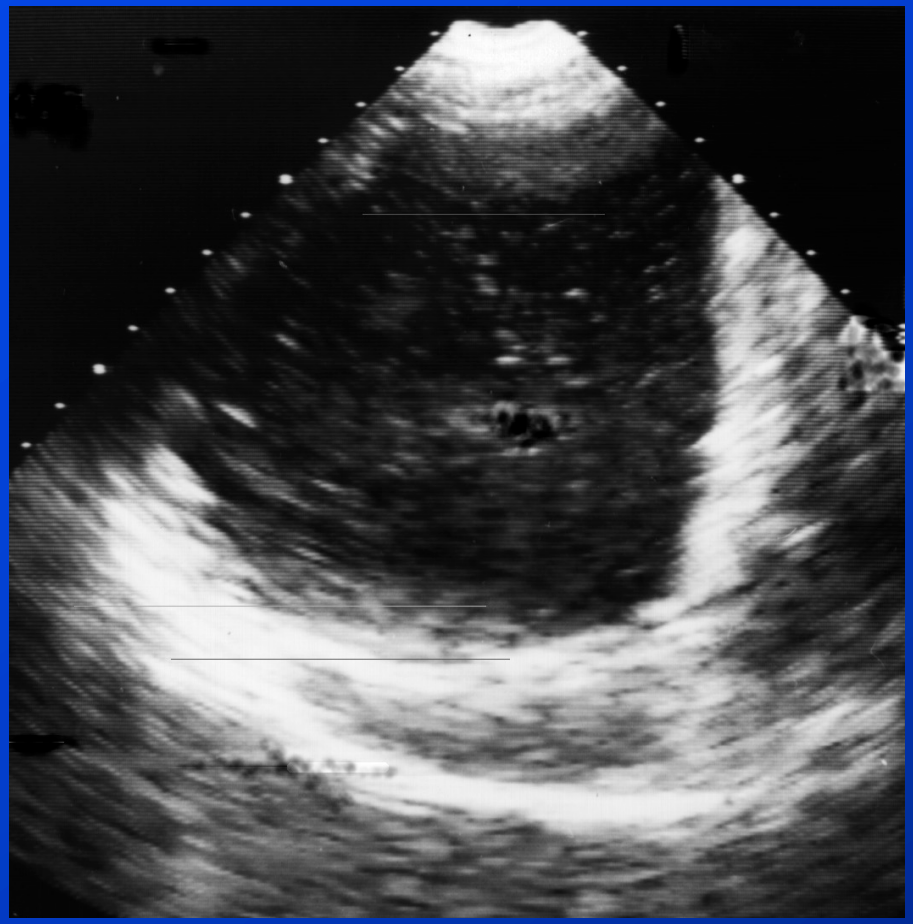
F45.3 Psykogen dyspepsi

- I samarbeid med fastlegen la vi et opplegg for antidepressiv behandling
- Henvise til psykosomatisk team

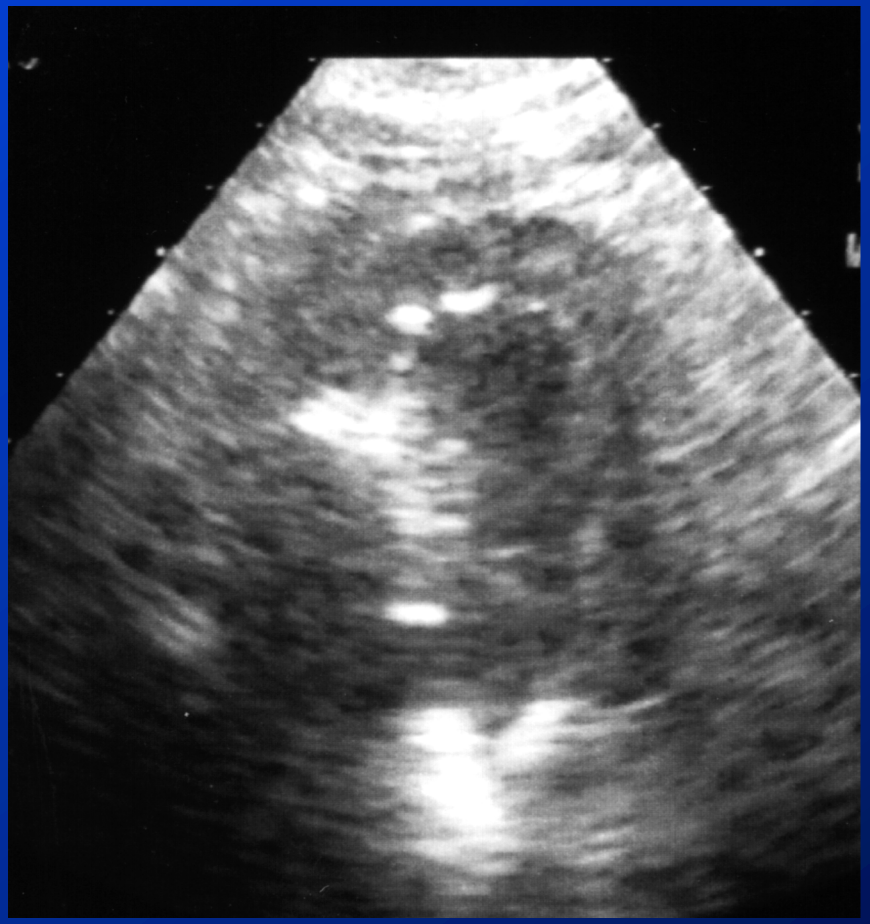
Case: A 50-year old woman with dyspepsia and weight loss

- Upper endoscopy & duodenal biopsies: normal
- Us: Gallbladder stones: Cholecystectomy of no help
- Work-up:
  - Abdominal ultrasonography
  - Plain abdominal X-ray
  - Barium follow-through
  - Colonic barium enema with double contrast
  - A CT-scan of the abdomen
  - Exercise ECG test
  - 24 hrs pH-metry
  - Stationary manometry
  - Another upper endoscopy
  - Small bowel enema with intubation
  - Duplex-Doppler examination of the mesenteric arteries

Transabdominal ultrasonography
UMAT - 500 ml meat soup

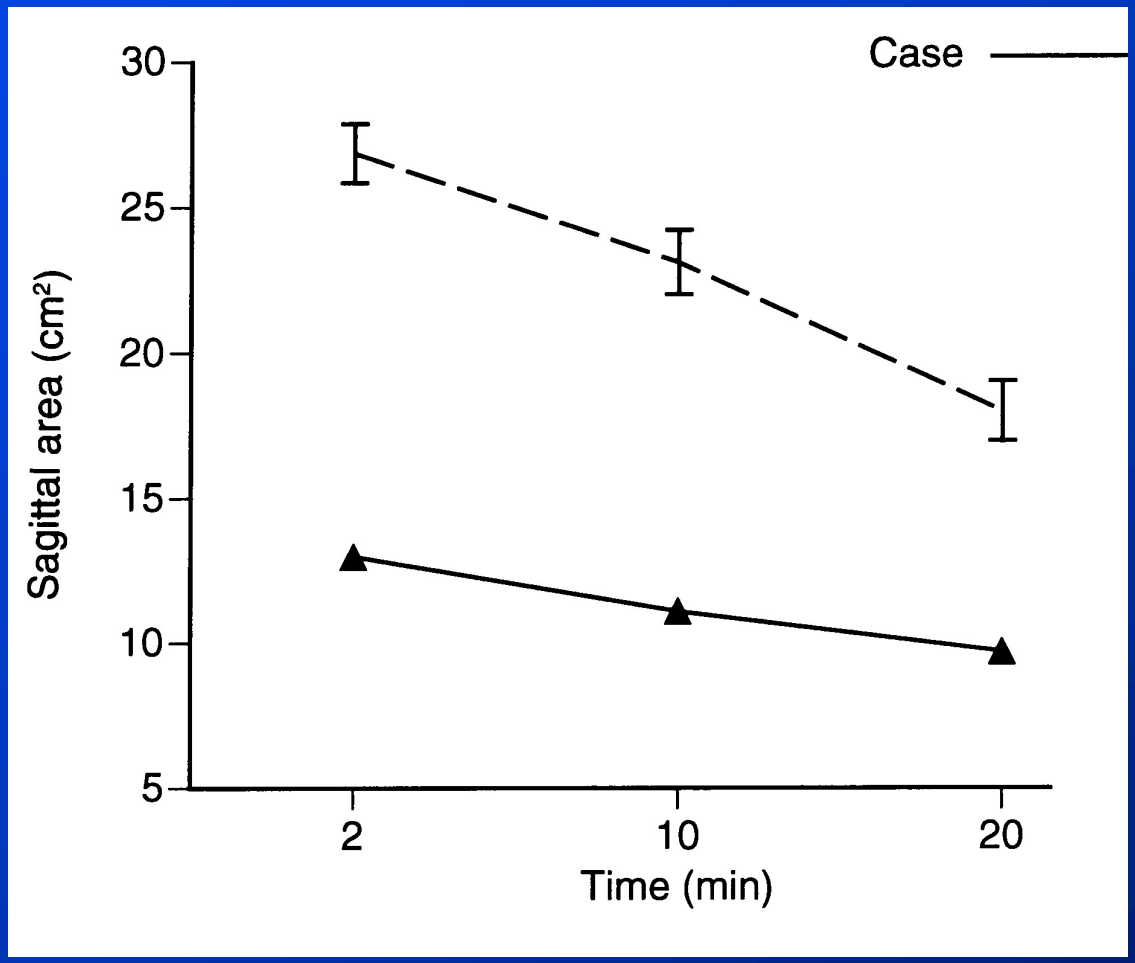


Normal view



Patient with dyspepsia

Sagittal area measurement



Bars denote 95% C.I.

Conclusions

- Ultrasound can contribute in the management of patients with FGID
- Ultrasonography can be used to:
  - Visualize contractions
  - Study gastric emptying
  - Measure transpyloric flow
  - Evaluate meal accommodation
  - Assess intragastric distribution of meals
  - Estimate strain in the gastric wall
- Meal provocation testing is valuable in a clinical setting
- Intestinal dysmotility can also be evaluated by US