Gastroesophageal Reflux Disease and Functional Heartburn

Dr. Patrick Nachipo

GIT fellow

Chris Hani Baragwanath Academic Hospital

Outline

- Introduction
- Epidemiology
- Risk factors
- Clinical features
- Diagnosis
- Treatment
- Functional heart burn

Introduction

- Gastroesophageal reflux is a physiologic process
  - Gastric contents move retrograde into the esophagus
  - Occurs multiple times during the day, no mucosal damage/clinical symptoms
  - Not a disease
- GERD
  - Montreal consensus defines it as: “reflux of stomach contents into the esophagus causing troublesome symptoms and/or complications
  - Spectrum of disease producing symptoms of heart burn and acid reflux
  - Failure of normal antireflux mechanism

Epidemiology

- A common reason for GIT consult
- Pooled prevalence of about 13%
  - Considerable geographic variation
  - Highest in South Asia, SE Europe (>25%)
  - Lowest in South East Asia, Canada, France: <10%
  - USA: 20%
  - No data for Africa
- Prevalence of complications: difficult to ascertain
  - Erosive oesophagitis: 15.5% in Sweden
  - Recurrent peptic strictures: 8% in 2000

Risk factors: Demographics

- Gender:
  - Not a factor in USA/Europe, but women in S.America and Middle East have 40% higher rates of symptoms vs men
  - Men have greater risk of oesophagitis and EAC > women
- Age:
  - Advanced age associated with complications
- Race:
  - In USA, similar prevalence of symptoms
  - Whites are at greater risk of erosive oesophagitis/BE/EAC

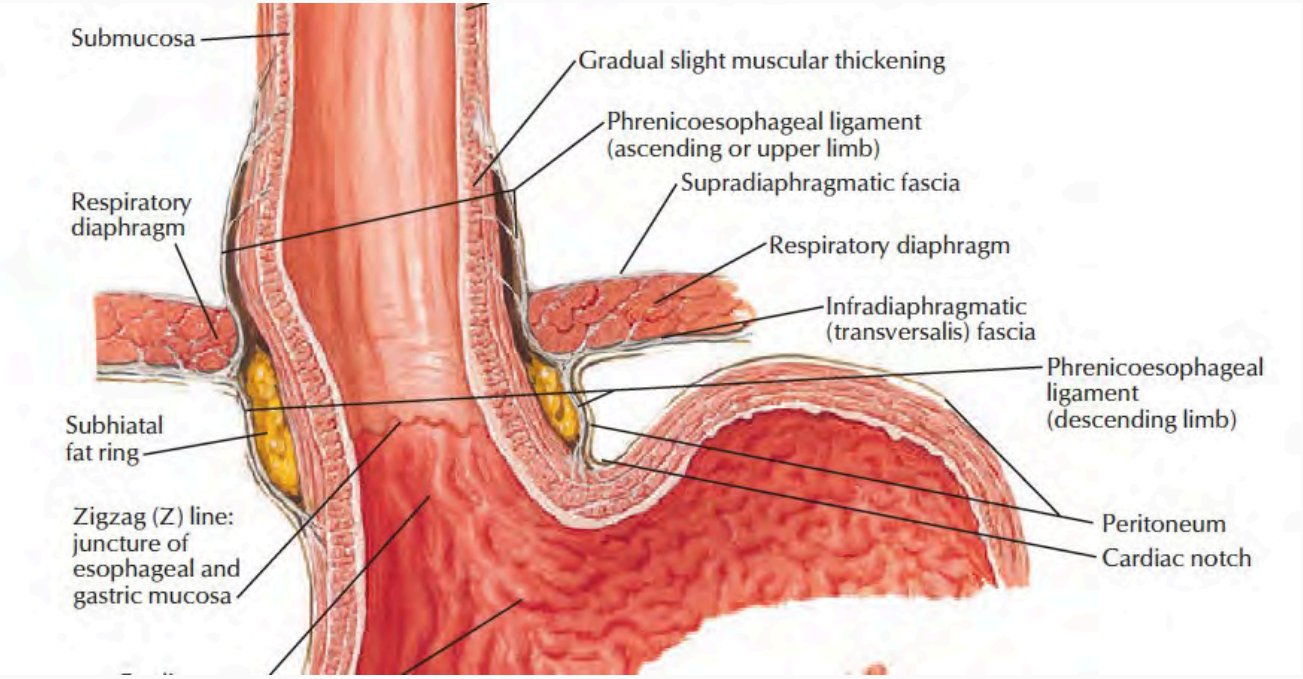
Environmental risk factors

- Obesity
  - OR for GORD symptoms: 1.73
  - OR for EAC 2.45
  - Central obesity may be more important than BMI
  - Proposed mechanisms
    - Increased intragastric pressure
    - Production of cytokines (IL 6, TNF-α) by visceral fat leads to LES moduration
- Falling prevalence of Hp gastritis
  - Gastric atrophy from Hpi seems to be inversely related to erosive oesophagitis, BE and EAC
- Others: association weak and unpredictable
  - Smoking, physical activities (cycling, weight lifting, swimming), alcohol (red wine)

Pathogenesis

- Imbalance of pro and anti-reflux factors
- Antireflux factors:
  - Anti-reflux barrier
  - Oesophageal acid clearance
  - Tissue resistance
- Pro-reflux aggressive factors
  - Gastric acidity
  - Gastric volume
  - Duodenal contents

GEJ



- LES involves the distal 3-4cm of the oesophagus
  - Proximal portion 2cm above SCJ
  - Distal 2cm is intra-abdominal
- Lies within the right crus
- Anchored by the phrenico-esophageal ligaments
- Oblique entrance into stomach creates a sharp angle: angle of His

Modulators of LES pressure

	Increase LES Pressure	Decrease LES Pressure
Hormones/ peptides	Gastrin	CCK
	Motilin	Secretin
	Substance P	Somatostatin
		Vasoactive intestinal peptide
Neural agents	α-Adrenergic agonists	α-Adrenergic antagonists
	β-Adrenergic antagonists	β-Adrenergic agonists
	Cholinergic agonists	Cholinergic antagonists
Foods and nutrients	Protein	Chocolate
		Fat
		Peppermint
Other factors	Antacids	Barbiturates
	Baclofen	Calcium channel blockers
	Cisapride	Diazepam
	Domperidone	Dopamine
	Histamine	Meperidine
	Metoclopramide	Morphine
	Prostaglandin $F_{2\alpha}$	Prostaglandins E_2 and I_2
		Serotonin
		Theophylline

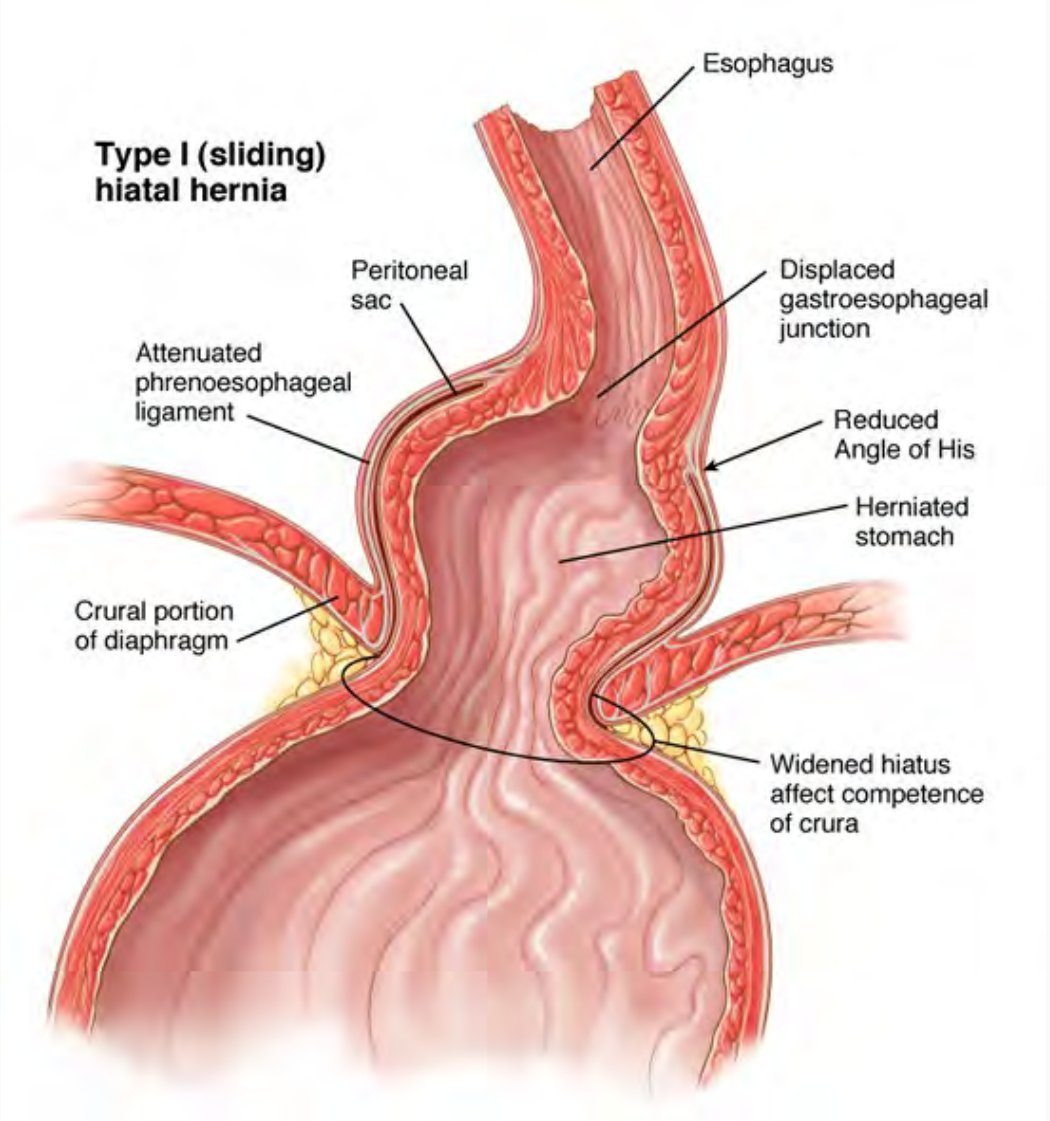
Mechanisms of reflux

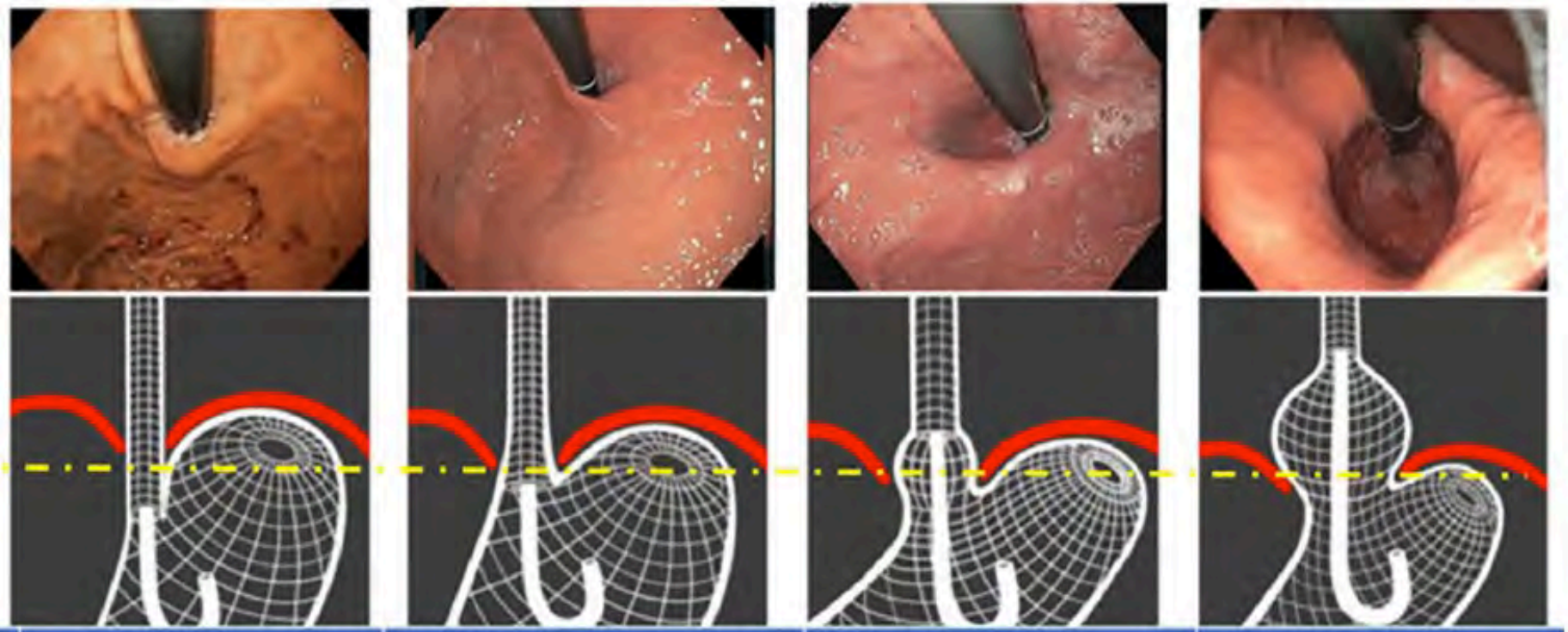
- Transient lower esophageal sphincter relaxations (tLESR)
  - Most frequent mechanism (up to 80% of episodes in GORD)
  - Occurs independent of swallowing
  - Lasts longer than 10 sec
  - Accompanied by crural diaphragm inhibition
  - Induced by distension of the proximal stomach
    - Activated mechanoreceptors

- Swallow induced LESR
  - 5-10% of reflux episodes
  - Associated with defective/incomplete peristalsis
  - More common if associated with a hiatal hernia
- Hypotensive LES pressure-strain induce/free reflux
  - Strain induced: relative hypotensive LES overcome by increase in intra-abdo pressure
    - Cough/straining/bending over
  - Free- reflux: Fall in LES pressure with no increase in intra-abdo pressure
    - LES pressure less than 5mm Hg
    - End-stage SSc, post myotomy in achalasia

Hiatal hernia

- Occurs in 54-94% of patients with reflux oesophagitis
- Proximal displacement of the LES from the crural diaphragm reduced basal LES pressure
- Eliminated increase in LES pressure during straining
- Increases the frequency of tLESR during gastric distention
- Creates the acid pocket
- Large, irreducible hernias more prone to reflux



AFS Hiatus Grade	Grade 1 Intact	Grade 2 Partial disruption	Grade 3 Moderate disruption	Grade 4 Complete disruption
				
AFS Hiatus Grade	1	2	3	4
Hiatal axial Length, cm (L)	None (0 cm)	None (0 cm)	0-2 cm	>2 cm
Hiatal aperture, cm (D)	Snug to scope 1 cm	Loose 1-2 cm	Open 2-3 cm	Wide open >3 cm
Flap valve (F)	Present, full lip with Omega shape (F+)	Absent, thinning & flattening valve lip (F-)	Absent (F-)	Absent (F-)

Oesophageal acid clearance

- Volume/bolus clearance
  - Done by oesophageal peristalsis in supine and upright positions
  - Primary vs secondary peristalsis
  - Peristaltic dysfunction increases the severity of oesophagitis
  - Gravity helps in upright position
- Acid clearance
  - Buffering action of saliva and oesophageal gland secretions
  - Xerostomia is associated with prolonged acid exposure and oesophagitis
  - Submucosal glands in the oesophagus release $HC0_3^-$ rich secretions in response to acid exposure in the lumen

Tissue resistance

- Pre-epithelial
  - Poorly developed
  - No well defined mucous layer
- Epithelial
  - 25-30 cell thick layer of non-keratinised squamous epithelium
  - Tight epithelium
  - Able to buffer and extrude hydrogen ions through transmembrane exchangers
- Post epithelial
  - Oesophageal blood supply, removing H^+ and CO_2

Gastric factors

- Gastric acid secretion
  - Acid and pepsin are key in producing oesophagitis
  - Role of Hpi: esp cagA+ virulent strains
    - Depends on location of infection
    - Antral predominant infection increase acid secretion and increases risk of GORD
    - Corpus predominant infection reduces acid secretion with reduced risk of GORD
- Duodenogastric reflux
  - Bile acid exposure to oesophagus leads to more severe oesophagitis
- Delayed gastric emptying
  - Importance of delayed gastric emptying on GORD is controversial

Clinical features

- Classic symptoms
  - Heart burn
    - Usually postprandial especially after a large meal/spicy foods/chocolate/citrus fruits
  - Regurgitation
    - Perception of flow of gastric contents into the mouth or pharynx
  - Oesophageal chest pain
- Other reported symptoms
  - Dysphagia
  - Water brash
  - Odynophagia
  - Burping
  - Hiccups
  - Nausea and vomiting

Extra-oesophageal manifestations

- Chest pain
  - May mimick angina
- Pulmonary manifestation
  - Asthma
  - Aspiration pneumonia
  - Fibrosis
  - Chronic bronchitis
  - Bronchiectasis
- ENT
  - Posterior laryngitis
    - Hoarse voice
    - Globus sensation
    - Frequent throat clearing
    - Recurrent sore throat
- Sleep disorders
  - Nocturnal GORD leads to sleep disturbance
  - Association found between OSA and nocturnal GORD

Differential diagnosis

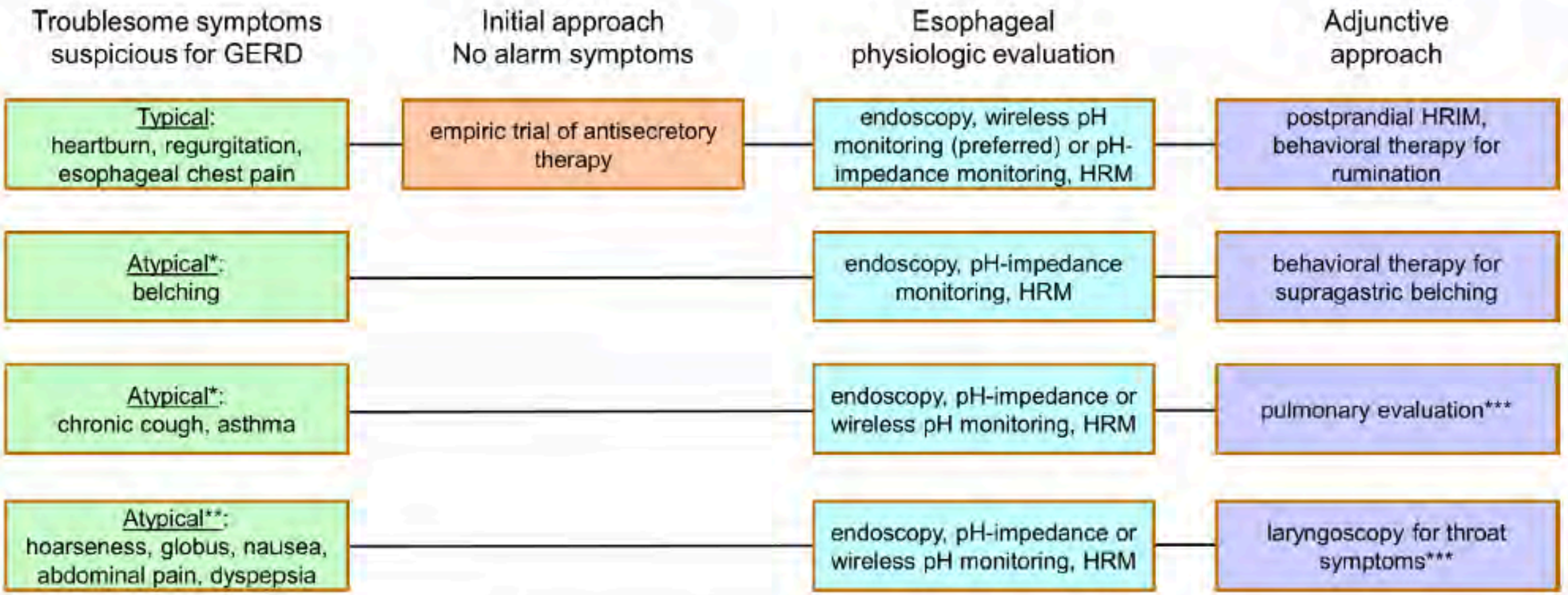
- Achalasia
- EoE
- Zenker’s diverticulum
- Gastroparesis
- Gallstones
- PUD
- Functional dyspepsia
- Angina pectoris

Associated conditions

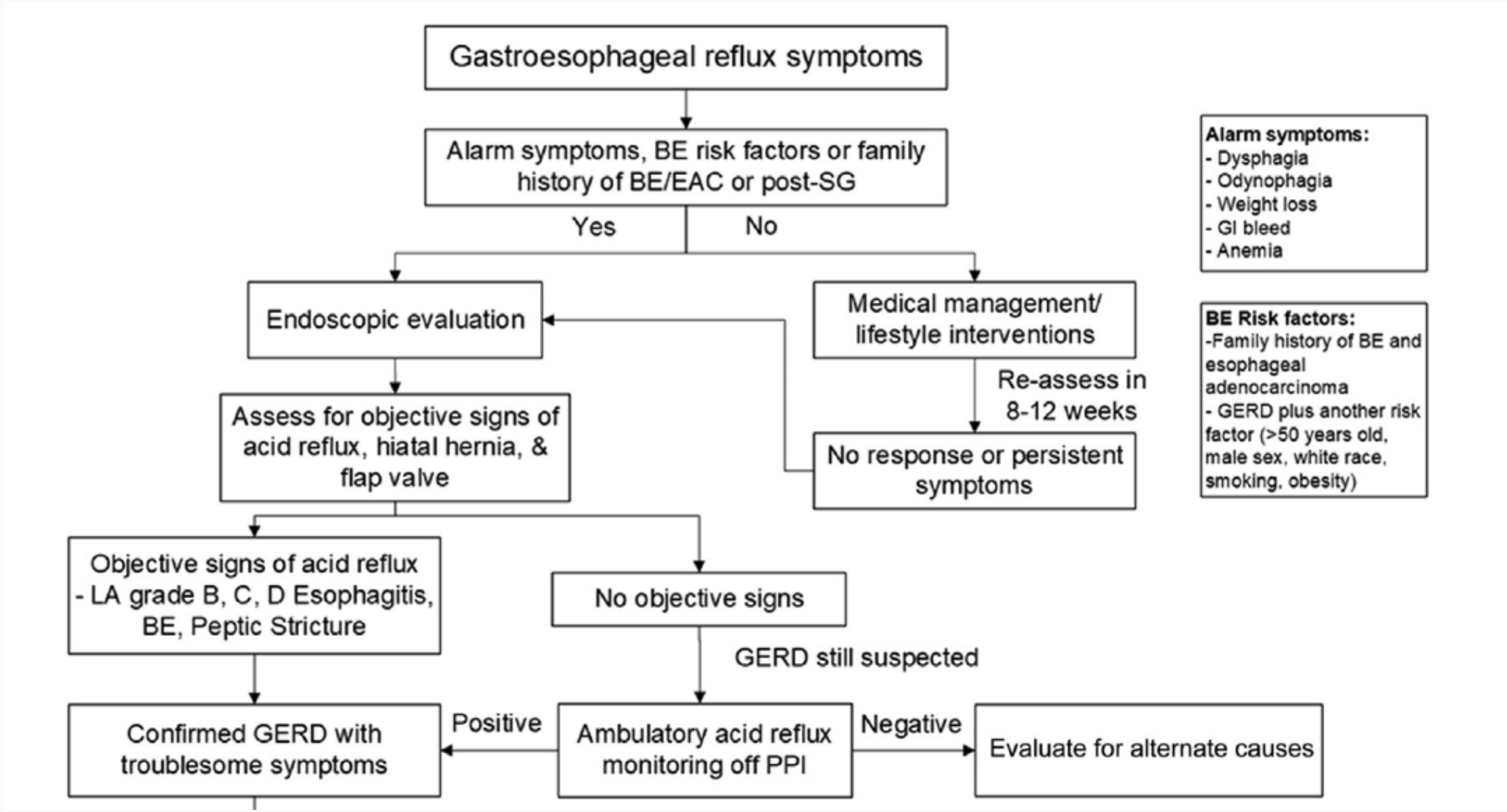
- Pregnancy
  - 30-80% of women complain of heart burn
  - Worse in 1st trimester
  - Reduced LES pressures by oestrogens and progesterones
  - Oesophagitis is uncommon, even with severe symptoms
- Scleroderma
  - Up to 90% of patients
- ZES:
  - Due to acid hypersecretion
- Post myotomy for achalasia: hellers/POEM
- Post bariatric surgery
- Prolonged NG intubation

Diagnosis

- Based on Lyon consensus 2.0 (2023)
- Cell damage
  - Oesophagitis (LA B,C,D)
  - Barretts oesophagus
  - Peptic stricture
- Symptoms without cell damage (NERD)
  - Evidence of pathologic reflux with pH monitoring +/- impedence



* likelihood of GERD is lower than with typical symptoms, testing is performed to identify or rule out a reflux basis for symptoms
** likelihood of GERD is very low, upfront testing is typically not recommended except to rule out a reflux basis for symptoms
***adjunctive approaches may precede esophageal evaluation to rule out primary pulmonary and laryngeal disorders


Gastroesophageal reflux symptoms
Alarm symptoms, BE risk factors or family history of BE/EAC or post-SG
Yes
No
Endoscopic evaluation
Medical management/ lifestyle interventions
Re-assess in 8-12 weeks
No response or persistent symptoms
Assess for objective signs of acid reflux, hiatal hernia, & flap valve
Objective signs of acid reflux - LA grade B, C, D Esophagitis, BE, Peptic Stricture
No objective signs
GERD still suspected
Confirmed GERD with troublesome symptoms
Positive
Ambulatory acid reflux monitoring off PPI
Negative
Evaluate for alternate causes
Alarm symptoms:
- Dysphagia
- Odynophagia
- Weight loss
- GI bleed
- Anemia
BE Risk factors:
-Family history of BE and esophageal adenocarcinoma
- GERD plus another risk factor (>50 years old, male sex, white race, smoking, obesity)

Reflux monitoring

- Prolonged (96hrs) wireless pH monitoring off antisecretory therapy is the preferred diagnostic too when available
- Ambulatory pH impedance off PPI has diagnostic value when
  - Associated exessive belching
  - Rumination is suspected
  - Evaluating pulmonary symptoms in association with GORD
- Ambulatory pH impedance monitoring on PPI is valuable when proven GORD has persisting symptoms

Metrics and thresholds in reflux monitoring

- Acid exposure time (AET)
  - Total time the oesophagus is exposed to pH less than 4
- Number of reflux episodes
- Symptom association
  - Symptom index (SI): % of symptom episodes associated with reflux
  - Symptom sensitivity index (SSI): % of reflux episodes that cause symptoms
  - Symptom association probability (SAP): statistical probability that the symptom/reflux link is not due to chance
- Baseline impedance

Acid exposure time

- AET <4% with negative reflux-symptom association excludes GORD
- AET >6%(≥2 days) is diagnostic of GORD

- AET <4% with positive reflux-symptom association is diagnostic of reflux hypersensitivity

- AET between 4 and 6%: need more test data and clinical context to determine if need for GORD treatment
  - Other conditions might be contributing to the patient's symptoms

Number of reflux episodes

- Total reflux episodes <40/day is adjunctive evidence for absence of pathological GORD
- Total reflux episodes >80/day is adjunctive evidence for objective GORD
- Total reflux episodes 40-80/day is inconclusive for GORD as a stand alone metric

Symptom association

- Positive symptom association:
  - Symptom association probability of >95%,

  AND/OR
  - Symptom index of >50%

- AET <4% with positive symptom association: **Reflux hypersensitivity**

- AET <4% with poor symptom association: **Functional heartburn**

Baseline impedence

- Impedance reflects the integrity of the oesophageal mucosa
- Reflects mucosal permeability
- Surrogate of reflux related epithelial damage
  - Intact epithelium has high impedance
  - Inflammed epithelium with dilated intercellular spaces: lower impedance

- Baseline impedance <1500 Ω is adjunctive evidence for GORD
- Baseline impedance of >2500 Ω is evidence against pathological GORD

LYON consensus 2.0 summary

	UNPROVEN GERD ENDOSCOPY, WIRELESS pH STUDY, 24 HOUR pH OR pH IMPEDANCE, HRM *off therapy*			PROVEN GERD ENDOSCOPY, 24 HOUR pH IMPEDANCE *on therapy*
	ENDOSCOPY	pH or pH-IMPEDANCE	HRM	ENDOSCOPY pH-IMPEDANCE
CONCLUSIVE EVIDENCE FOR PATHOLOGIC REFLUX	LA grades B, C&D esophagitis Biopsy proven Barrett's mucosa Peptic esophageal stricture	AET>6% on 24 hour studies AET>6% on ≥2 days on wireless studies		LA grades B, C&D esophagitis Peptic esophageal stricture AET>4%, reflux episodes>80
BORDERLINE OR INCONCLUSIVE EVIDENCE	LA grade A esophagitis	AET 4-6% on 24 hour studies AET 4-6% on ≥2 days on wireless studies Total reflux episodes 40-80/day		LA grade A esophagitis AET 1-4% Total reflux episodes 40-80/day MNBI 1500-2500 Ω
ADJUNCTIVE OR SUPPORTIVE EVIDENCE*	Hiatus hernia Histopathologic scoring systems Electron microscopy of biopsies	Reflux-symptom association Total reflux episodes >80/day MNBI<1500 Ω	Hypotensive EGJ Hiatus hernia IEM/absent contractility	Hiatus hernia MNBI <1500 Ω Reflux symptom association
EVIDENCE AGAINST PATHOLOGIC REFLUX		AET<4% each day of study** Total reflux episodes<40/day MNBI>2500 Ω		AET<1% Total reflux episodes <40/day MNBI>2500 Ω

In short:

Tests that prove GORD	Tests that DO NOT prove GORD
Endoscopy (LA B/C/D, Barrets, Peptic)	**Biopsies: “reflux oesophagitis”**
pH/Impedance (AET >6%)	**Trial of PPI**
	Barium swallow: “reflux was observed”
	Reflux questionnaires
	Manometry

Dr M. Scriba: Gastrofoundation 2025

Clinical course

Non-erosive disease

- Up to 70% of patients
- More likely to be female, younger, with no HH

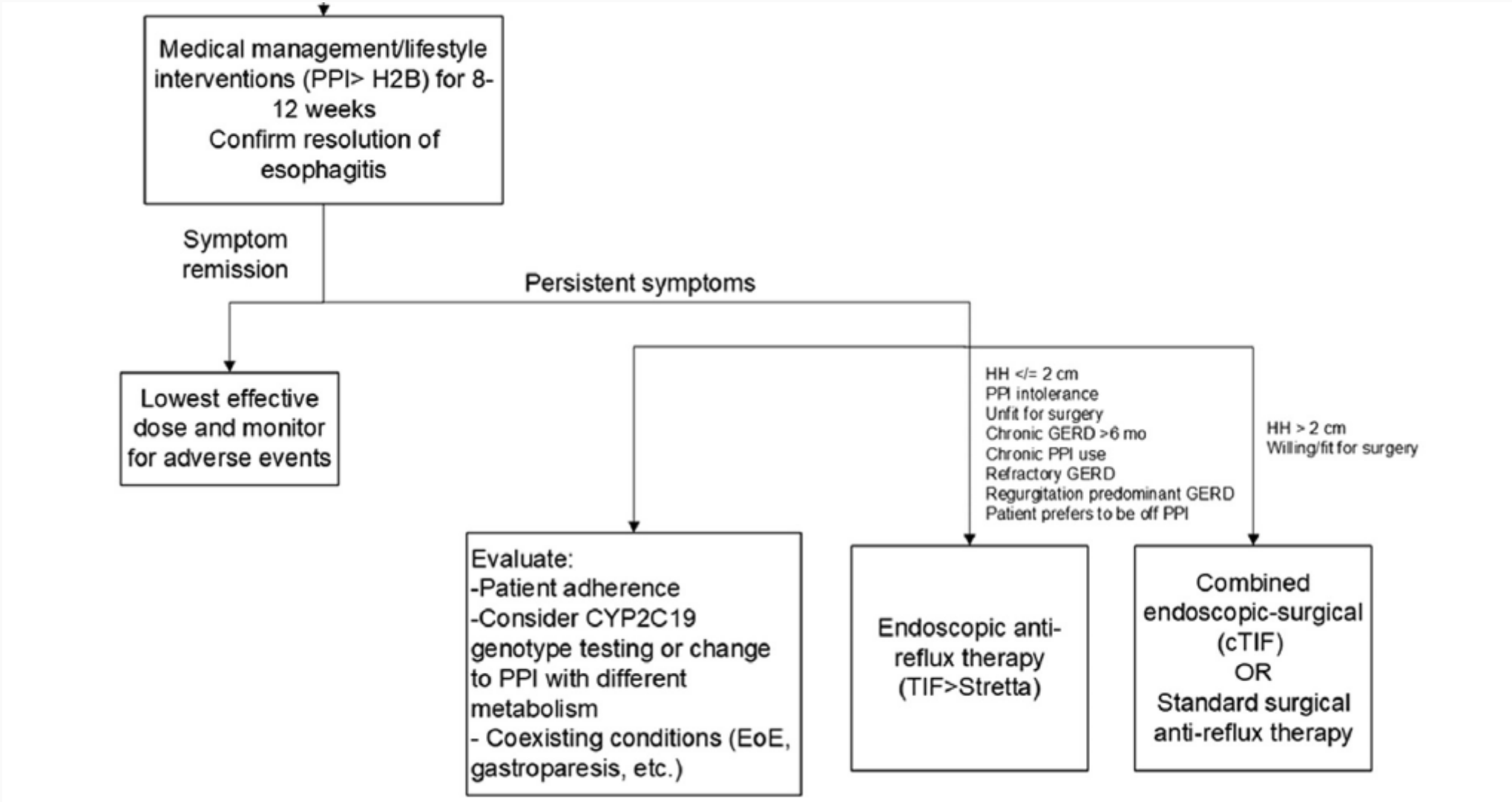
Erosive disease

- Patients tend to be male, older, overweight
- Tend to relapse off PPI
- Prone to complications

Complications

- Haemorrhage, ulcers, perforations
  - GORD related non cancer deaths are rare
  - Most common fatal causes are these
- Peptic strictures
  - Occur in 7-23% of untreated oesophagitis
  - Present with progressive dysphagia, with intact appetite, little weight loss
  - Smooth walled, circumferencial narrowing in distal oesophagus
  - Usually less than a cm, but can be as long as 8cm
- Barrett’s oesophagus

Treatment


Medical management/lifestyle interventions (PPI> H2B) for 8-12 weeks
Confirm resolution of esophagitis
Symptom remission
Persistent symptoms
Lowest effective dose and monitor for adverse events
Evaluate:
-Patient adherence
-Consider CYP2C19 genotype testing or change to PPI with different metabolism
- Coexisting conditions (EoE, gastroparesis, etc.)
HH </= 2 cm
PPI intolerance
Unfit for surgery
Chronic GERD >6 mo
Chronic PPI use
Refractory GERD
Regurgitation predominant GERD
Patient prefers to be off PPI
Endoscopic anti-reflux therapy (TIF>Stretta)
HH > 2 cm
Willing/fit for surgery
Combined endoscopic-surgical (cTIF)
OR
Standard surgical anti-reflux therapy

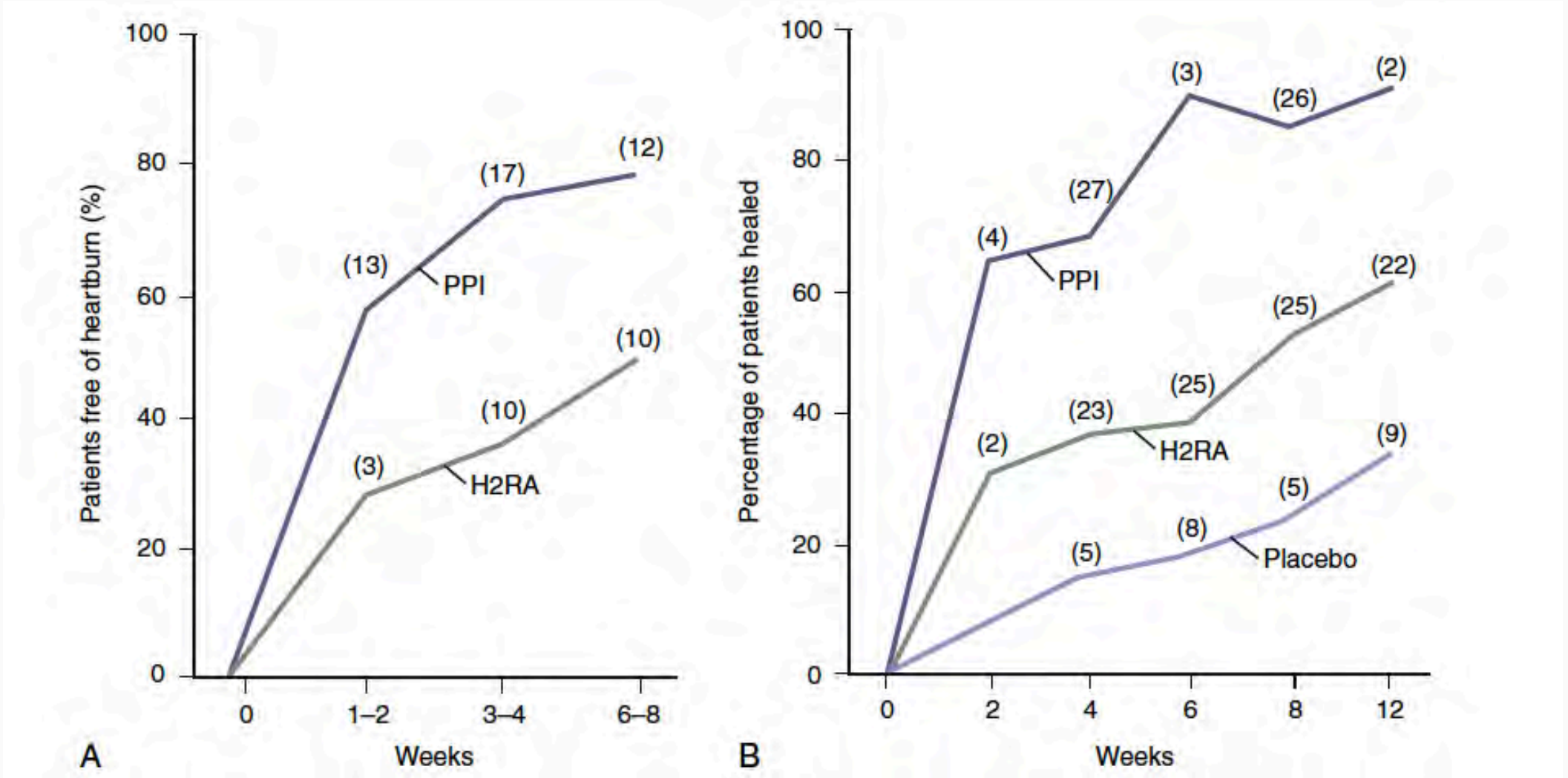
Life style modifications

- Weight loss if overweight
  - Population based studies have shown linear relationship between BMI and GORD symptoms
- Smoking cessation
- Elevation of head of bed
- Avoiding meals within 3 hrs of bedtime
- Specific food avoidance: No conclusive evidence to make a recommendation (ASGE 2025)
  - Avoid specific food triggers in particular patients (*Sleisenger)*

Over the counter medications

- For infrequent heartburn symptoms
- Antacids:
  - Work by buffering gastric acid
  - Short period of relief, might need more frequent dosing
  - Vs placebo: absolute benefit of 8% with NNT of 13 (Gaviscon was better, 26% absolute benefit, NNT 4)
  - Do not heal oesophagitis, symptomatic relief in only 20% of patients
- OTC H_2RAs:
  - Superior to placebo, but not as effective as PPI

PPI vs H2RA


100
80
60
40
20
0
Patients free of heartburn (%)
(13)
(17)
(12)
PPI
(3)
(10)
(10)
H2RA
0
1–2
3–4
6–8
Weeks
A
100
80
60
40
20
0
Percentage of patients healed
(4)
(27)
(3)
(26)
(2)
PPI
(2)
(23)
(25)
(25)
(22)
H2RA
(5)
(8)
(5)
(9)
Placebo
0
2
4
6
8
12
Weeks
B

Prescription medications: Prokinetics

- Increase LES pressure
- Increase acid clearance
- Improve gastric emptying
- Do not alter tLESRs
- Modest benefit, esp in delayed gastric emptying
- Use limited by SE

- Metoclopramide, domperidone, Bethanechol
- No mention of these by ASGE

tLESR inhibitors

- Attractive target for GORD treatment
- Baclofen: only medication available
  - $GABA_B$ agonist
  - Improves symptoms in GORD patients
  - Problems with tolerability
  - Causes drowsness, dizziness , N&V
- No mention of these by ASGE

Histamine-2 Receptor Antagonists (H2RA)

- Cimetidine, ranitidine, famotidine
- More effective for nocturnal than meal stimulated acid secretion
- Suggested new indication in PPI era: night time break through reflux symptoms while on PPI
- Tolerance develops with long term use (weeks to months)
- ASGE: *"… the panel agreed on the use of H2 receptor blockers as an adjunct, as-needed therapy and when faster onset of action might be required on a case-by-case basis."*

PPIs

- Inhibit meal time and nocturnal acid secretions better than H2RAs
- Taken before the first meal of the day (30min-1hr)
- Complete healing in 80% of oesophagitis patients within 8 weeks
- Head to head: esomeprazole is superior to omeprazole and lansoprazole, esp with LA C and D oesophagitis

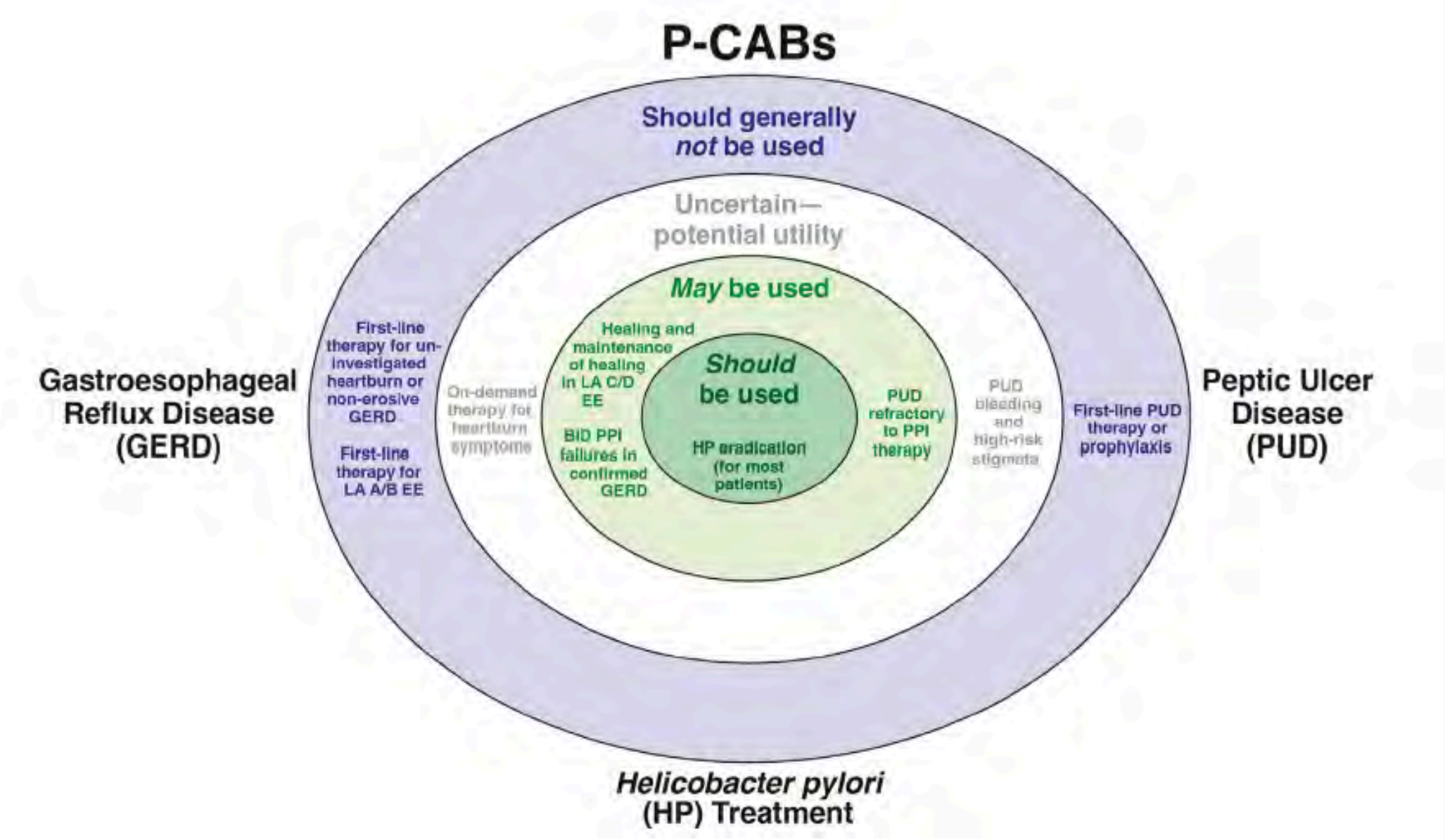
Safety of PPIs

- Generally safe as a class
- Associated with Fundic gland polyps
- Increased risk of CAP and enteric infections including c.diff
- Chronic use affects absorption of calcium, B12, Mg, Fe?
- Acute interstitial nephritis
- Drug-drug interaction: metabolism through CYP2C19 isoenzyme
  - Omeprazole, esomeprazole and lansoprazole
  - FDA warning with clopidogrel in 2009, data no longer supportive of this

Potassium Competitive Acid blockers

Variable	P-CAB	PPI
Effect of gastric acid	Acid-stable	Acid-labile (note enteric coating)
Prodrug	No	Yes (converted to sulfonamide compounds in acidic environment)
Binding to proton pump	Ionic (reversible) binding (blocks access of K^+ to potassium-binding site of pump)	Binds covalently (irreversible) to cysteines on active pumps (blocks exchange of H^+ and K^+)
Half-life estimates, *h*[5–7]	6–9	1–2
Timing of administration	Independent of mealtimes (not restricted, given longer half-life)	30–60 min before meals (so presence in secretory canaliculus coincides with postprandial peak in active pumps)
Dosing range, *d*, for maximal acid suppression[5,7,8]	1	3–5
Examples	Revaprazan, vonoprazan, tegoprazan, fexuprazan, linaprazan, zastaprazan, and keverprazan	Dexlansoprazole, esomeprazole, lansoprazole, omeprazole, pantoprazole, and rabeprazole

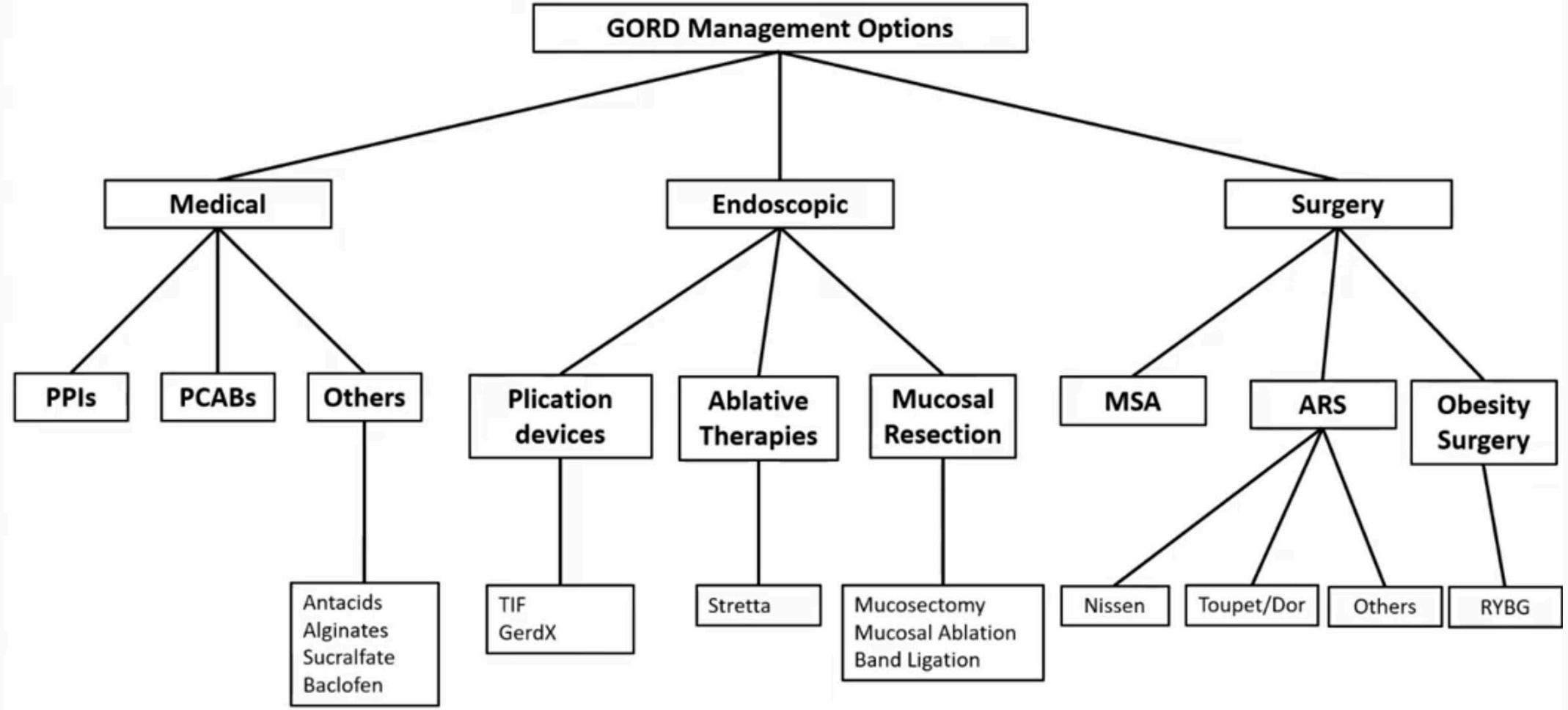
AGA position statement



In short

- **When to use P-CABs**
  - In eradication regimens for most patients with *H. pylori* infection.
  - For patients with more severe erosive esophagitis (Los Angeles grade C/D) and patients with documented GERD who fail twice-daily PPI therapy.
- **When not to use P-CABs**
  - As first-line therapy for patients with uninvestigated heartburn symptoms, nonerosive reflux disease, milder erosive esophagitis (Los Angeles grade A/B), or peptic ulcer disease.
- **When P-CABs may have potential utility:**
  - For on-demand treatment of reflux-associated heartburn symptoms.
  - For patients with bleeding gastroduodenal ulcers and high-risk stigmata of hemorrhage.

Surgical/endoscopic management



Anti-reflux Surgery

- **General Principles:**
  - Surgery is still the most effective treatment for true GORD
  - You need to confirm true GORD before operating!
  - Operating the OG junction results in permanent changes

- **Ideal Candidate:**
  - Confirmed GORD
  - Typical symptoms and/or positive symptom association:
    - Heartburn, regurgitation, chest pain
  - At least partial response to PPI
  - Lack of concomitant functional symptoms/psychological concerns (DGBI)
  - Surgically fit, willing patient

Contraindications to ARS

- Oesophageal motility disorders
  - Aperistalsis
  - Achalasia
  - IEM (relative?)
- Diagnostic uncertainities
  - Functional heart burn/reflux hypersensitivity
- Inability to tolerate anaesthesia

Surgical therapy

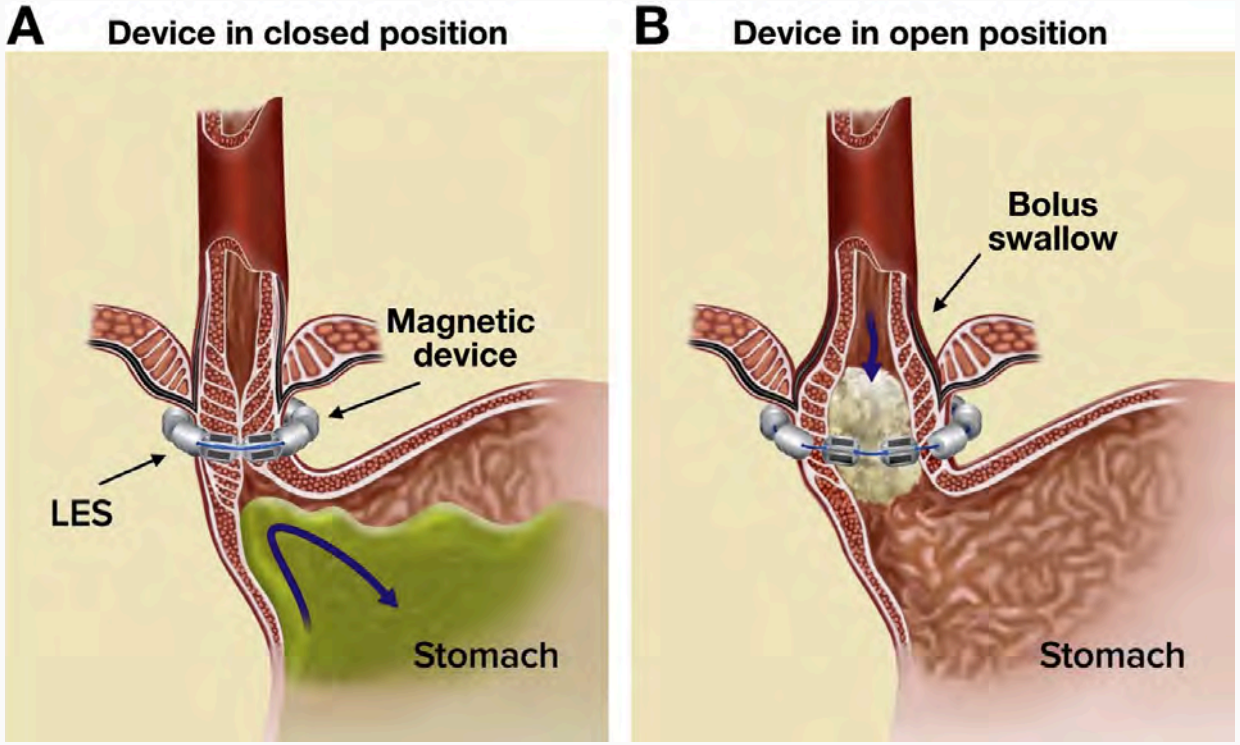
ARS

- Nissen and Toupet procedures
- Reduces acid and non-acid reflux episodes
  - Decreases tLESRs
  - Increases basal LES pressure
  - Inhibits complete LES relaxation
- Relieve symptoms in >90% of pts
- BE progression unchanged
- Not superior to PPI

Complications

- Dysphagia
- Gas bloating
- Fundoplication failure with re-interventions
- Post-op obstructive symptom

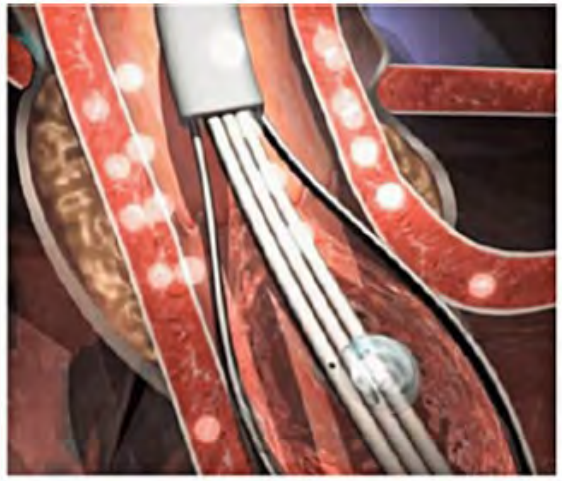
Magnetic sphincter augumentation

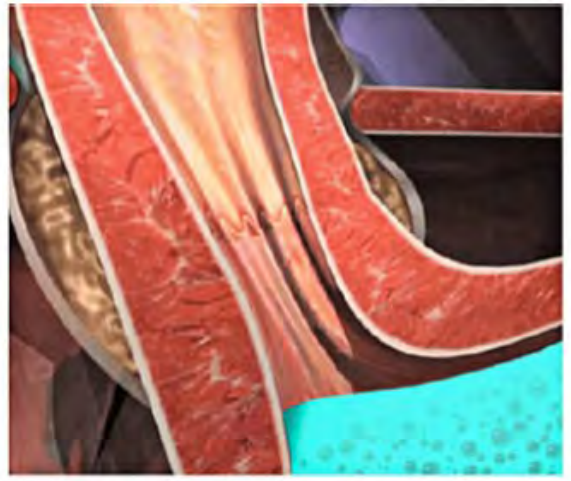


- Bracelet of magnets encased in titanium, around the LES
- 58% of patients normalize the AET within a year
- 90% halve the PPI use
- Patients with regurgitation predominant symptoms are favourable
- Complications:
  - Dysphagia
  - Device erosion
  - Device explantation
  - Aperistalsis/gastroparesis

Endoscopic treatment options: Radiofrequency energy treatment (STRETTA)

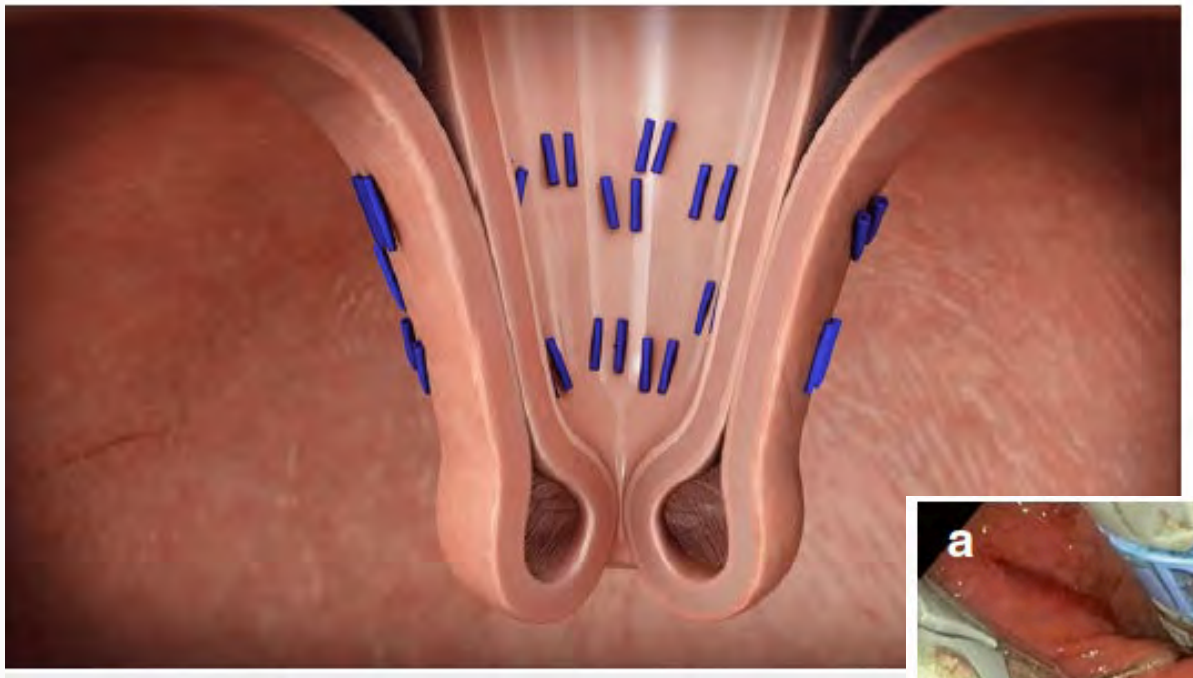
- Delivery of RF energy into the muscle layer at different levels in the LES and cardia
- Exact MOA not clear, but thickens LES by fibrosis and muscle hyperT
- 2017 meta-analysis:
  - 51% stopped PPI
  - 36% healing of oesophagitis
- Complications:
  - Erosions
  - Mucosal lacerations
- Sustained long term results
  - Positive outcomes up to 10yrs post procedure



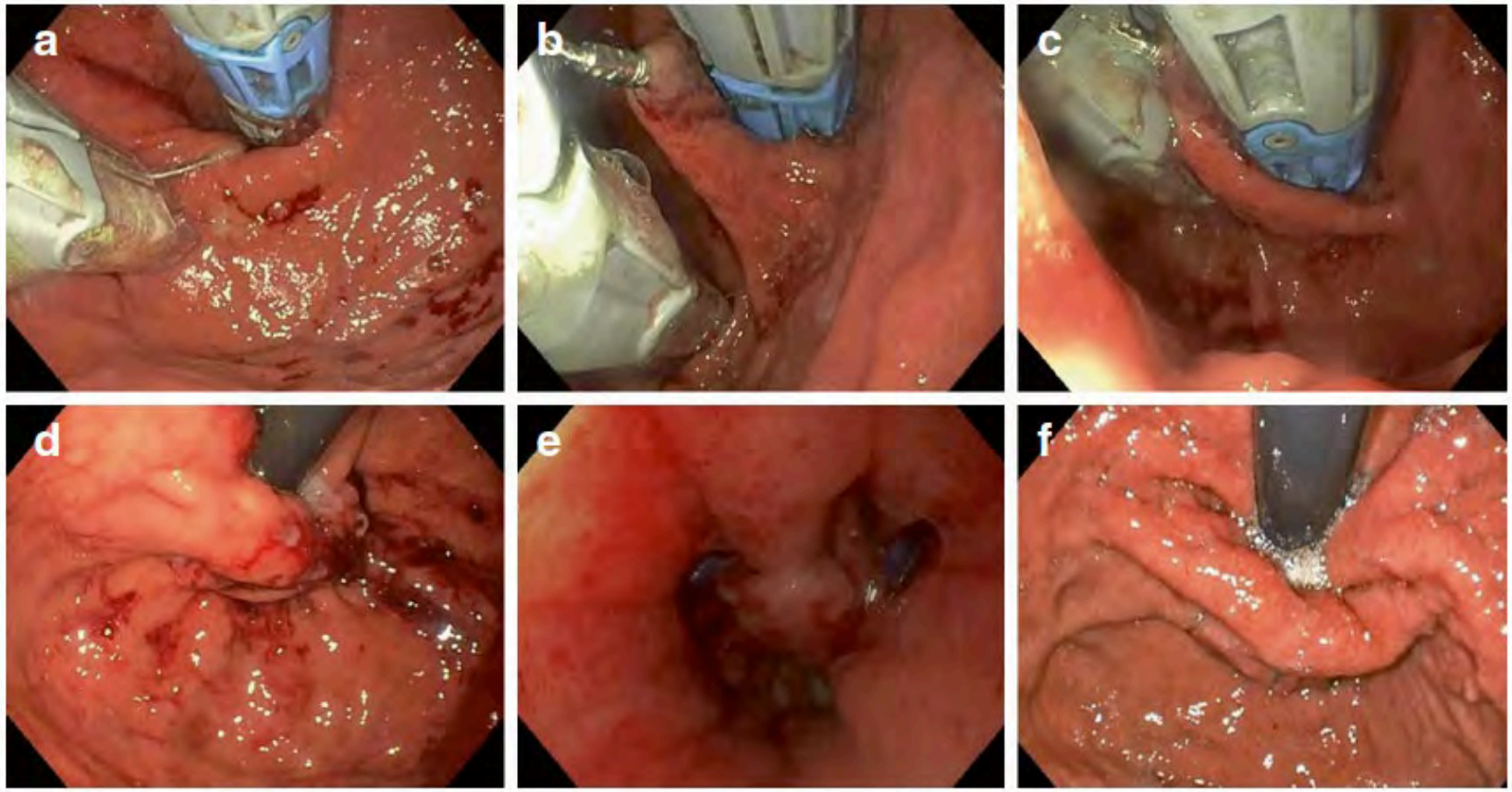


Transoral incisionless fundoplication (TIF)

- Uses EsophyX™ device
- Gastric fundus wrapped around the LOS without need of external incisions
- Creates a valve of 2-4cm, 270-300 degrees in circumference
- Efficacy:
  - Discontinuation of PPI in >90%
- 1-2% rate of adverse events



TIF



Antireflux mucosectomy (ARMS)

- hemicircumferential endoscopic mucosal resection of the gastric cardia
  - Mucosal defect healing by scarring would narrow the cardia
  - 65% PPI discontinuation rate
  - 17.2% AE rate: dysphagia and stricture

Refractory GORD

- **Refractory GORD**: persistent symptoms and objective evidence of GORD despite OMT
- **Refractory GORD symptoms**: persistent symptoms in patients with prior objective evidence of GORD, despite OMT
- **Refractory reflux like symptoms**: persistent symptoms on OMT without prior objective GORD dx
- **Optimal acid suppression Rx**: stable BD PPI or maximum PCAB dose for atleast 8 weeks

Causes of Refractory GORD symptoms

Persistent reflux

- Poor PPI adherence
- Rapid PPI metabolism
- Residual acid reflux
- Bile reflux

Anatomic/motor abnormalities Of UGT

- gastroparesis
- Achalasia/IEM/absent motility
- Large HH
- Post POEM

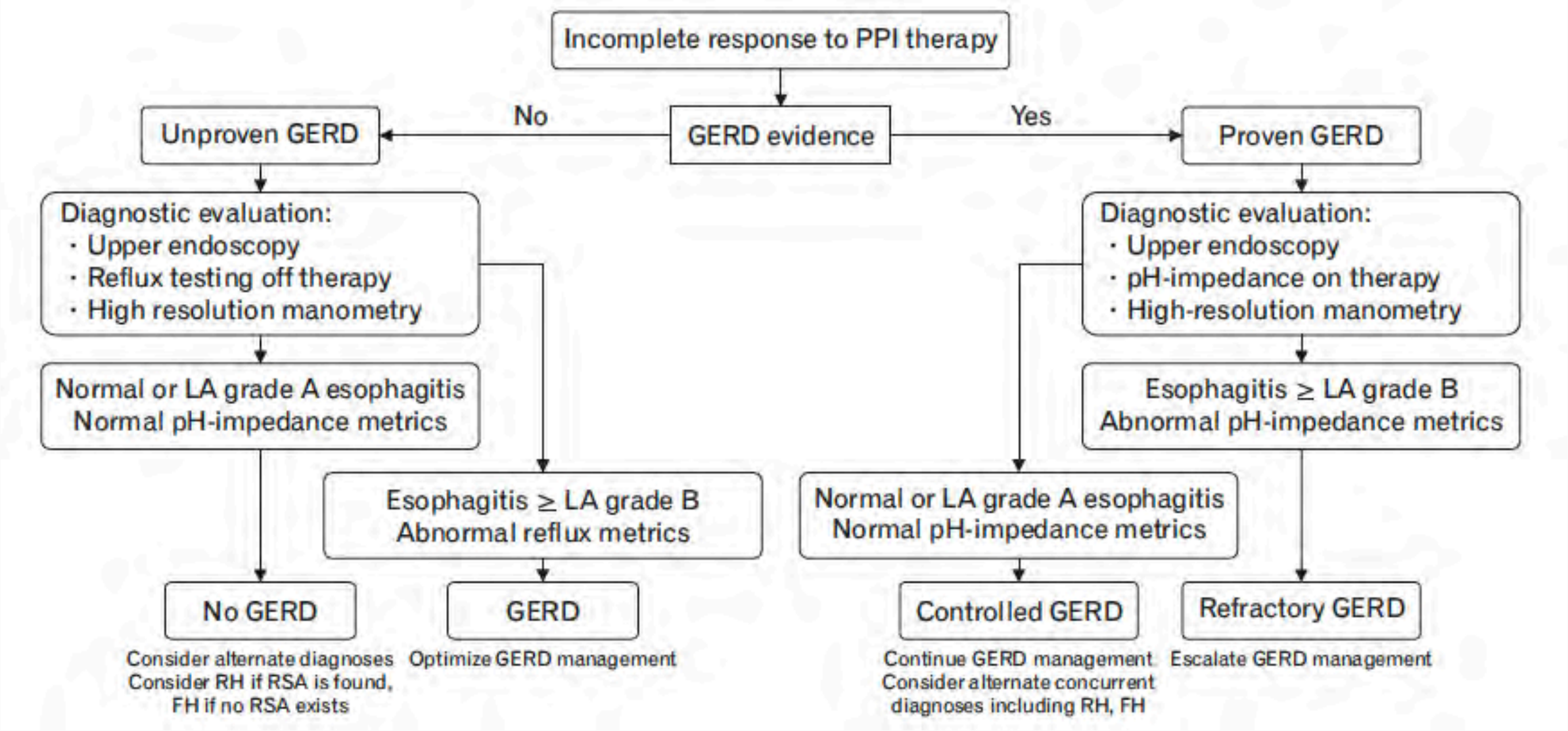
Overlap with DGBI

- Reflux hypersensitivity
- Functional heart burn
- Functional dyspepsia

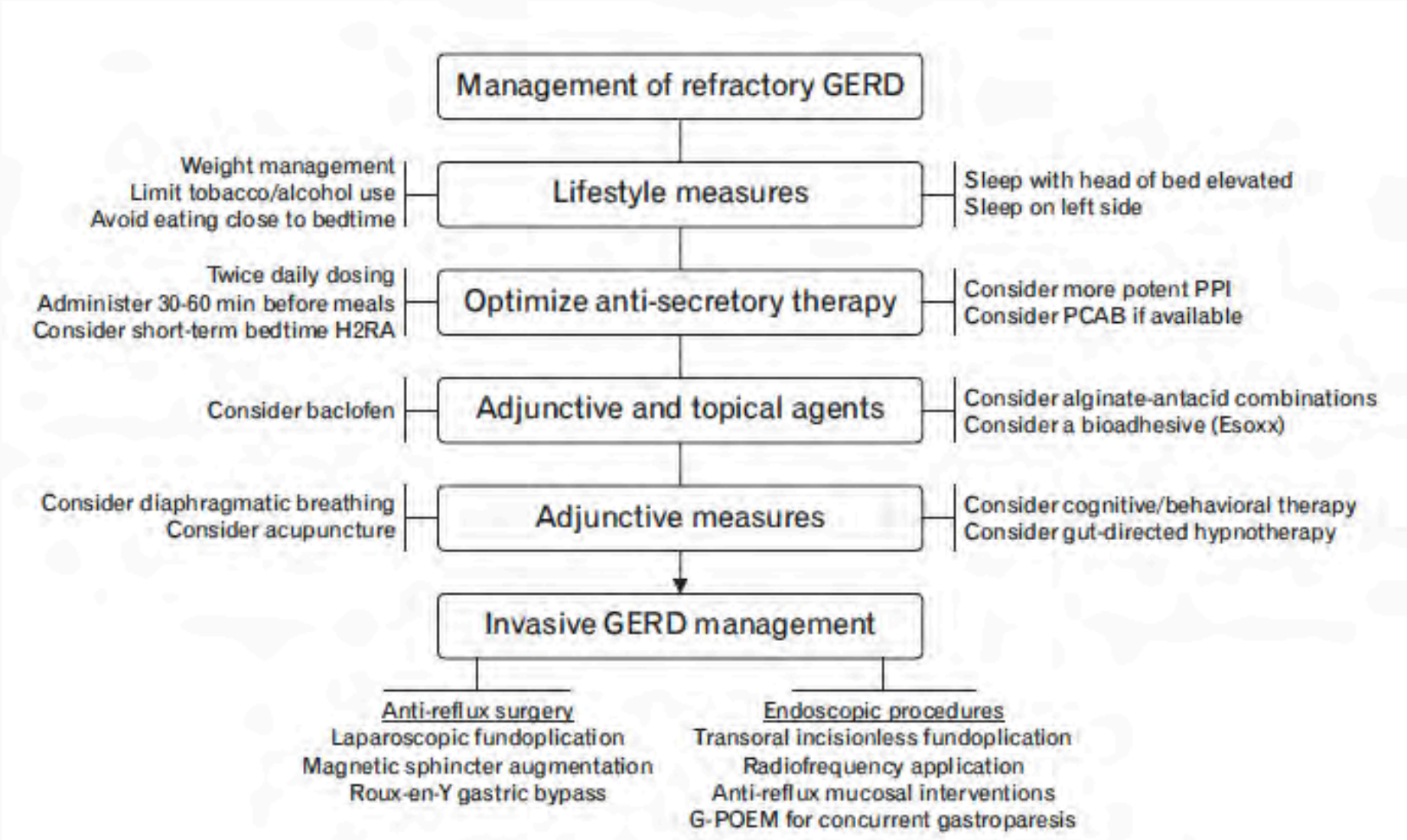
Oesophageal mucosal disorders

- EoE
- Other causes of oesophagitis
  - Lymphocytic
  - Infectious
  - Pill-induced

Evaluation of persistent reflux symptoms



Management of refractory GORD



Role of CYP2C19 testing in refractory GORD

- PPI metabolism is affected by genotypical variability of 2C19
  - Rapid and ultrarapid metabolizers would reduce availability
- There is lack of robust evidence on 2C19 though testing
- ASGE: "… *Therefore, the panel agreed to a best practice advice suggesting assessment of CYP2C19 genotype and tailoring PPI therapy accordingly in patients with persistent and confirmed GERD who have failed to respond to standard medical therapy*"

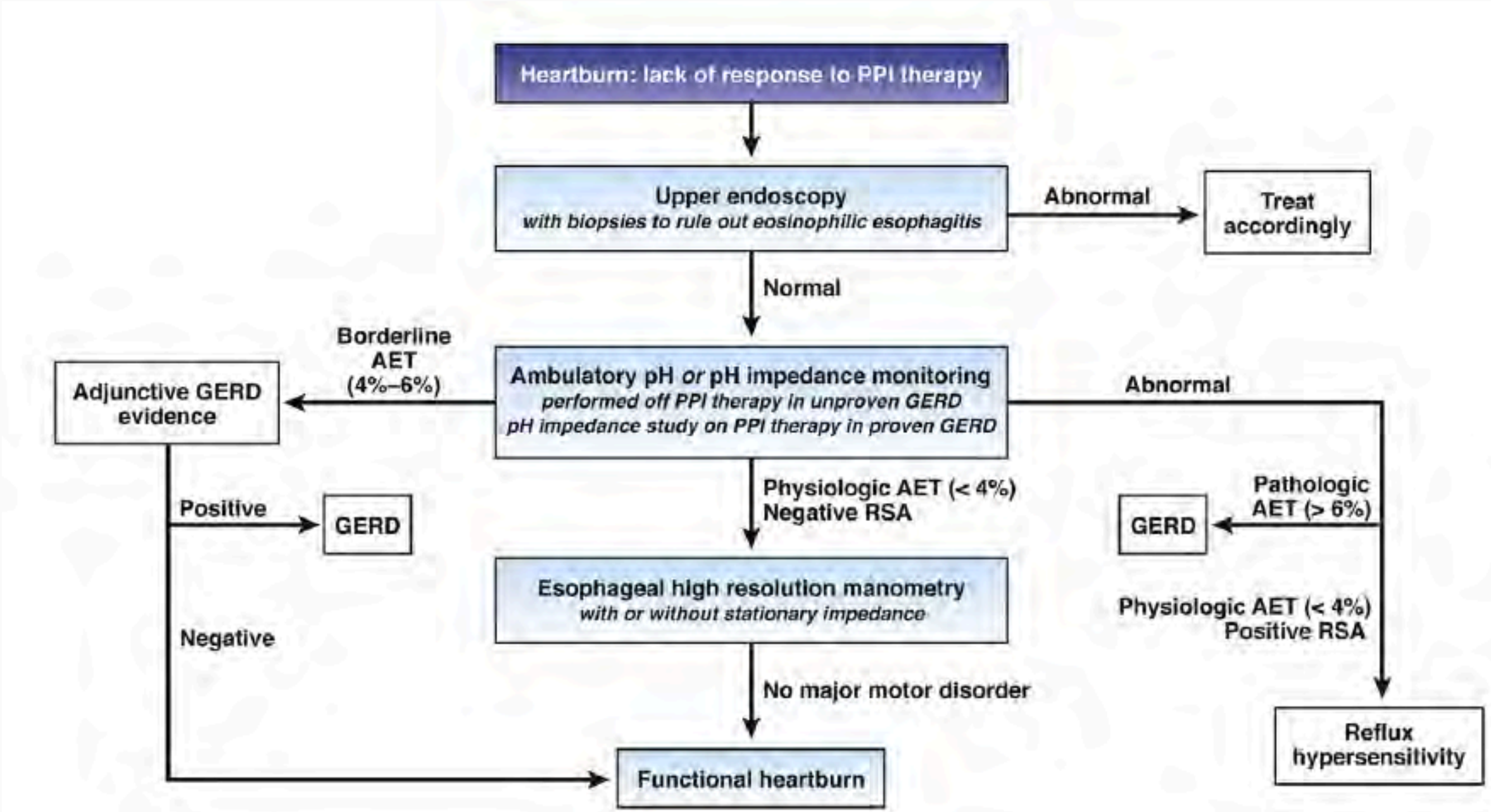
Functional Heartburn

- Retrosternal burning like in GORD without evidence of abnormal oesophageal acid exposure, oesophageal motility disorders or oesophageal mucosal pathology
- 21-39% with heart burn refractory to PPI have functional heartburn
- Important to recognize to avoid unnecessary acid suppression
- ARS and other invasive modalities of treatment should be avoided

Diagnosis: Rome IV

- Must include all of the following:
  1. Burning retrosternal discomfort or pain
  2. No symptom relief despite optimal antisecretory therapy
  3. Absence of evidence that gastroesophageal reflux or eosinophilic oesophagitis is the cause of the symptom
  4. Absence of major oesophageal motor disorders

- Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis with a frequency of at least twice a week


Heartburn: lack of response to PPI therapy
Upper endoscopy
with biopsies to rule out eosinophilic esophagitis
Abnormal
Treat accordingly
Normal
Borderline AET (4%–6%)
Adjunctive GERD evidence
Ambulatory pH or pH impedance monitoring
performed off PPI therapy in unproven GERD
pH impedance study on PPI therapy in proven GERD
Abnormal
Positive
GERD
Physiologic AET (< 4%)
Negative RSA
Pathologic AET (> 6%)
GERD
Esophageal high resolution manometry
with or without stationary impedance
Physiologic AET (< 4%)
Positive RSA
Negative
No major motor disorder
Reflux hypersensitivity
Functional heartburn

Treatment

Treatment goals

- Symptom improvement
- Symptom resolution
- Prevention of symptom recurrence

Treatent options

Lifestyle modifications
Improved sleep experience
Pharmacotherapy
Tricyclic antidepressants
Selective serotonin reuptake inhibitors
Tegaserod
Histamine 2 receptor antagonists
Melatonin
Alternative/complementary medicine
Acupuncture
Psychological intervention
Hypnotherapy

References

- Feldman, M., Friedman, L. S., & Brandt, L. J. (2020). *Sleisenger and Fordtran's Gastrointestinal and Liver Disease E-Book: Pathophysiology, Diagnosis, Management*. Elsevier Health Sciences
- Desai M et al. ASGE guideline on the diagnosis and management of GERD: summary and recommendations. Gastrointestinal endoscopy 2025;101 (2)
- Gyawali CP et al. Updates to the modern diagnosis of GERD: Lyon consensus 2.0. Gut 2024; 73:361-71
- Fass R et al. AGA clinical practice update on functional heart burn: Expert review. Gastroenterology 2020; 158:2286-2293
- Scriba M. "When reflux is not reflux". Gastro Foundation presentation 2025. https://www.youtube.com/watch?v=nT28QGfbAOQ&t=1119s

- The end

- Thank you