Nissen Fundoplication, The Once And Future King of GERD

Neil Floch MD FACS
Fairfield County Bariatrics
Director of Bariatric Surgery Western Connecticut Healthcare System
Associate Clinical Professor of Surgery University of Vermont
Associate Clinical Professor of Surgery Quinnipiac School of Medicine
GERD

The condition in which stomach contents move up into the esophagus resulting in either symptoms or complications
Incidence of symptoms

- 20% [60 million] of the U.S. population has GERD
- Gallop poll

- 79% Nighttime symptoms
- 50% Nighttime reflux worse than daytime reflux
- 63% Ability to sleep affected
- 40% Daytime function affected
- 70% Nighttime discomfort moderate to severe
- 75% Can not fall asleep or wakes them up
- 45% Medication does not relieve all symptoms

Gallup Poll 2000 for AGA N = 1000
American Journal of Gastroenterology 2003; vol. 98 Shaker et al
GERD Facts

• Most GERD gets worse over time.

• Early correction prevents deterioration of natural barrier to reflux

• Esophageal cancer is 8X more likely with weekly heartburn or regurgitation

• 35-40% of patients continue symptoms while on PPI Medicine

• 62% saw a general practitioner

• But only 16% of patients saw a gastroenterologist

• 50,000 eventually receive surgical fundoplications
Typical symptoms

- Heartburn
- Regurgitation
- Reflux
- Abdominal Pain
- Bile taste
- Dysphagia
- Odynophagia
- Nausea and Vomiting
- Bloating
- Belching
- Diarrhea
- Flatulence
- Difficulty sleeping
- Bleeding
Atypical symptoms

**Pulmonary**
- Asthma
- Aspiration pneumonia
- Chronic bronchitis

**Other**
- Regurgitation
- Chest pain
- Dental erosion

**ENT**
- Hoarseness
- Laryngitis
- Sore throat
- Chronic cough
- Frequent swallowing
- Burning in the throat or mouth
Presenting Symptoms

- Heartburn
- Regurgitation
- Dysphagia
- Respiratory

Anatomy and physiology of LES

- No band typical of most sphincters
- Increase pressure diaphragm
- In cadavers have no muscle tone but no reflux
- Other factor prevents reflux
Anatomy and physiology of hiatal hernia

- Esophagus passes through hiatus
- Muscular fibers wrap around esophagus
- Stomach can “slide” through up into the chest
- Hiatal hernia creates a pressure differential
- Allows acid up into the esophagus
Antireflux barrier deteriorates

Extrinsic factors:
Deterioration of barrier to reflux; the antireflux Valve

Dysfunctional valve cannot close to prevent reflux of stomach contents

Dysfunctional valve Cannot close, loose to the scope
Endoscopic grading of the LES: Hill grades

Hill Grade I: 3-4cm, hug scope

Hill Grade II: open w/respiration

Hill Grade III: no fold, not tight

Hill Grade IV: large hernia

GERD is a Progressive Disease

Endoscopic grading of the LES: Hill grades
What causes GERD?

- Impaired resistance of esophageal lining
- LES dysfunction
- Delayed emptying of the stomach
- Esophageal Dysmotility
- Inadequate saliva production
Clinical Progression of GERD

Physiological Reflux → Symptomatic GERD → Esophagitis → Complicated Esophagitis

Complications
- Ulceration
- Hemorrhage
- Strictures
- Barrett’s
- Adenocarcinoma
Preoperative evaluation

- No consensus for optimal investigations
- Upper endoscopy – Barrett’s and malignancy
- Esophageal manometry - dysmotility
- 24 hour pH – dx reflux, medication responsive
- Barium esophagagram - esophageal length, herniation
- Gastric empty studies for bloating as delayed emptying may contribute to the reflux
Esophageal manometry

- Determines the presence of dysmotility
- Need for partial fundoplication
- Alternative diagnoses: scleroderma, achalasia,
- Modification of the surgery

Esophageal length

- Barium esophagram or upper gastrointestinal series
- Shortened esophagus or large hiatal hernia
- If present, may favor transthoracic approach

Multichannel intraluminal impedance (MII)

- A catheter-to detect intraluminal bolus movement
- With manometry: it provides the functional, bolus transit component
- With pH: it detects reflux independent of its pH, both acid and non-acid reflux
- Helpful to evaluate NERD and atypical GERD
Endoscopy reveals esophagitis
198 Patients Prior to Laparoscopic Nissen

Medical treatment of GERD: types of medications

• Antacids
  – Neutralize or buffer stomach acid

• H2 blockers (ranitidine, cimetidine)
  – Blocks the body’s signal to the stomach to produce acid

• Proton Pump Inhibitors (PPIs)
  – Blocks the secretion of acid into the stomach
“PPI is NOT a Permanent Solution”

Gary Falk, MD, The Cleveland Clinic

50-75% of patients experience relapse of symptoms and esophagitis after cessation of treatment.

ONLY 58% of PPI recipients totally satisfied with their medical therapy

Fass Drugs 2007;67:1521-30
Inadomi et al Am J Gastroenterol 2003; 98
PPI-Associated Complications

- Increased renal failure
- Increase of osteoporosis-associated fractures
- Increased risk of hip and other fractures
- 4x the risk of gastric polyps
- Increased risk of cardiovascular events independent of Plavix in post-MI
- Increased risk of acute coronary syndrome when used with Plavix
- Decreased gallbladder motility
- Increased bacterial gastroenteritis
- Increased risk of Clostridium difficile colitis
- Decreased innate immunity

References
Association of Proton Pump Inhibitors With Risk of Dementia
A Pharmacoepidemiological Claims Data Analysis

Results  A total of 73,679 participants 75 years of age or older and free of dementia at baseline were analyzed. The patients receiving regular PPI medication (n=2950; mean [SD] age, 83.8 [5.4] years; 77.9% female) had a significantly increased risk of incident dementia compared with the patients not receiving PPI medication (n=70,729; mean [SD] age, 83.0 [5.6] years; 73.6% female) (hazard ratio, 1.44 [95% CI, 1.36-1.52]; P<.001).

Conclusions and Relevance  The avoidance of PPI medication may prevent the development of dementia. This finding is supported by recent pharmacoepidemiological analyses on primary data and is in line with mouse models in which the use of PPIs increased the levels of β-amyloid in the brains of mice. Randomized, prospective clinical trials are needed to examine this connection in more detail.
Medical treatment of GERD: PPIs are not the solution for severe or chronic reflux

Does not stop
- Reflux
- Regurgitation

Anatomical changes need anatomical repairs
Indications for surgery

- Failed optimal medical management - most frequent indication
- Noncompliance with medical therapy
- High volume reflux
- Severe esophagitis by endoscopy
- Benign stricture
- Barrett's esophagus (without severe dysplasia or carcinoma)

Refractory GERD as the indication for surgery

• Controversial: lack of response to PPI qd vs bid
• Most common: 88% who have surgery have refractory GERD
• Regurgitation on PPI bid: do best for LARS
• Limited data for efficacy of LARS in refractory patients- 10-66% remain on meds

Sifrim D, Zerbib F. Diagnosis and management of patients with reflux symptoms refractory to proton pump inhibitors. Gut 2012; 61:1340.
Atypical indications for surgery

- Cough: most common
- 50% with GERD have upper respiratory symptoms
- 70% symptom improvement with surgery
- 30% remain on reduced medication
- Surgery outcomes: less favorable with respiratory symptoms and dysmotility
LARS choice: Nissen vs Toupet

• Lap-Nissen for normal esophageal length and motility

• Less postoperative dysphagia with Toupet but greater durability with Lap-Nissen

• "tailored approach" to antireflux surgery

• Lap-Nissen for most with uncomplicated disease

LARS choice: Decreased motility

• Lap-Nissen can improve esophageal contraction amplitude in all but the poorest 20% of motility
• For decreased motility, Toupet, Hill or Belsey recommended
• Full wrap increases the (LES) pressure, too high and may lead to obstructive symptoms

LARS choice: Shortened esophagus

- Collis-gastroplasty with fundoplication for inability to mobilize chronically inflamed, shortened esophagus
- Lengthens esophagus allows wrap placement in abdomen
- Opinions vary regarding what constitutes adequate esophageal mobilization
- Trans-thoracic approaches for concurrent pulmonary disease, prior abdominal surgery, lengthening

LARS choice: Shortened esophagus

- Collis-gastroplasty with fundoplication for inability to mobilize chronically inflamed, shortened esophagus
- Lengthens esophagus allows fundoplication in abdomen

- Opinions vary regarding what constitutes adequate esophageal mobilization
- Trans-thoracic approaches for concurrent pulmonary disease, prior abdominal surgery, lengthening

LARS: mechanism of function

- 360 or 270 degree fundoplication
- Increase LES resting pressure
- Increase intrabdominal LES length
- Accentuate angle of His
- Distensible stomach squeezes esophagus when stomach fills
- Speed rate of gastric emptying
Technique: Lap-Nissen

- Total of: (2) 1.2cm and (3) 0.5cm incisions
- Divide gastrohepatic ligament: right crura
- Reduce sac then hernia
- Repair crura: no mesh vs mesh
- Divide short gastric vessels
- Create 2-3 cm fundoplication; 3 sutures
- 56 french bougie
- Check with upper endoscopy

1. Crural repair steps

1. Start right crura
2. Disect sac
3. Window and nerves
4. Mobilize esophagus
5. Clean crura
6. Close crura
2. Fundoplication steps

1. Short gastric, under, stay
2. Shoeshine & kiss
3. Bougie, suture
4. Endoscopic, check tight
5. Possible redo, looser
6. Finish
Pearls of technique: Avoiding Nissen complications

- The LES and fundus normally undergo vagally-mediated relaxation with swallowing.
- Only use fundus to create wrap.
- Wrap placed around esophagus, not upper stomach.
- Avoid vagal nerve injury.

Early Results and complications of Nissen fundoplication

- Mortality 0.2%
- Conversions 5.8%
- Early dysphagia 20%
- Late dysphagia 5.5%
- Dilationation 4.0%
- Recurrent reflux 3.4%
- Satisfaction 87-100%

Hunter JG, et al. Surgical Endoscopy 2001: 1,000 cases study

• Average hospital stay 1.2 days
• Resolution of symptoms at 1 year: 94%
• Major complications: 2%
• Long term complications: 2-62%
  – Gas bloat
  – Difficulty swallowing
Technique: alternative fundoplications

- Rosetti-Nissen - short gastrics intact
- Toupet - partial 270 degree posterior (LPF)
- Dor - partial 180 degree anterior wrap (LAF)
- Belsey Mark IV—a partial fundoplication, transthoracic
- Hill gastropexy—imbrication of the ant/pos lesser curve around esophagus, tether to median arcuate ligament, Intraoperative manometry, recreate angle of His


Technique: Toupet

- Nissen technique
- 270 wrap
- 3 sutures of esophagus to stomach x 2 sides
- Suture to crus
Technique: all types of LARS

• Nissen fundoplication, Belsey Mark IV, and Hill repair:
• 85% success in relieving symptoms and healing esophagitis
• Long-term mortality is low
• Surgeries all restore physiologic equivalent to LES
• Manometry of (LES) shows postop reflux is correlated with a lower mean LES pressure, shorter mean intra-abdominal LES length, and shorter overall sphincter length

Technique: Gastric bypass for GERD

- Gastric bypass — procedure of choice for GERD and morbid obesity
- Several small series have reported a decrease in reflux symptoms in about 75%
- Also complete or partial regression of Barrett's esophagus in morbidly obese patients with RYGB

EsophyX

- Internally reconstructs antireflux valve
- 45 - 60 minute procedure
- Overnight stay (general anesthesia)
- Post-op discomfort minimal
- Rapid recovery – Most patients are back to work and most activities in a couple of days
Esophyx technique
Esophyx results

- Minimal risk of adverse events
- Excellent QOL improvement 73%
- Elimination of PPI use 85%
- Esophagitis resolution 59%
- Hiatal hernia reduction 71%
- pH normalization 49%
  (Hill grade one)
Technique: Stretta

- Most widely studied endoscopy procedure
- The specialized catheter is placed with endoscopic assistance over guidewire
- Using monopolar energy, a series of 56 treatments delivered is delivered across 5 levels
- Stretta- indicated with an LES of 8 mmHg and hiatal hernia less than 3 cm

LINX®: Refractory GERD

- Laparoscopic sphincter augmentation with band of magnetized beads
- Placed around the LES to keep a weak LES closed
- Beads separate when swallowing a food or liquid bolus

LINX®: Design and Engineering

CLOSED to Reflux

Normal Peristaltic Pressures
35-80 mm Hg

LINX® System
20-25 mm Hg

Gastric Pressures
5-10 mm Hg

OPEN to Swallowing
Linx results 2 years postoperative

- Daily PPI Dependence: Baseline 100%, Post-LINX 8%
- Reflux Affecting Food Tolerance: Baseline 76%, Post-LINX 2%
- Acid Reflux Affecting Daily Sleep: Baseline 70%, Post-LINX 2%
- Moderate or Severe Regurgitation: Baseline 57%, Post-LINX 1%
- Severe Heartburn: Baseline 55%, Post-LINX 1%
- Extra Esophageal Symptoms: Baseline 51%, Post-LINX 12%
- Esophagitis: Baseline 40%, Post-LINX 11%

Source: LINX IDE Pivotal Trial
Torax Medical’s LINX®

• In 2013 NEJM study: majority reduced or resolved reflux and eliminated medications
• Severe regurgitation eliminated in 100%
• 93% had a significant decrease in medication
• 94% satisfied with their overall condition after LINX compared to 13% before treatment while taking medication
Postoperative management: Dysphagia

- Most patients have some degree - require modified dietary intake: liquids to puree food from 2-6 weeks, counsel preoperative
- "sticking” in lower or mid chest may be attributed to recurrent (GERD)
- May resume antisecretory medications but unlikely to have functional LARS and GERD

Postoperative management: Dysphagia treatment

• Barium esophagram to determine if fundoplication is “too loose” or “too tight”

• Dysphagia for more than 12 weeks requires a barium swallow, a 13 mm barium tablet

• If 13 mm barium tablet passes slowly through the esophagus and who had normal motility preoperatively should be considered candidates for dilation after 12 weeks - 6-12% of patients

• No consensus on the optimal dilation technique (ie, bougie versus guidewire dilation versus pneumatic dilations).

• If dysphagia persists convert Nissen to Toupet
Postoperative management: Gas bloat

- A sensation of intestinal gas with inability to belch seen more often with longer/tighter fundoplications
- May be due to dysfunction in gastric emptying, aerophagia or vagal dysfunction
- Symptoms lessen over time in most
- Treat with simethicone, Charcoal tablets, metoclopramide, Domperidone, or Erythromycin
- With documented gastroparesis, pyloroplasty, pyloric botox, and pneumatic pyloric dilatation are options
- Studies show decreased incidence of gas bloat with partial fundoplication
- Conversion from a full to a partial fundoplication is rarely required.

De Vault K. Gas bloat syndrome: a pre- or postoperative dysmotility syndrome? Am J Gastroenterol 1995; 90:1536
Postoperative management: Failure to relieve symptoms

- Cause may be anatomic, functional, or psychological
- pH impedance to diagnose surgical failure
- Attempt medical therapy for treating esophageal spasm
- Symptoms could be caused by fundoplication, slippage +/- into the chest may result from inadequate esophageal mobilization or short esophagus
- With dysphagia or reflux should undergo barium esophagram, manometry, pH testing, and endoscopy


Postoperative management: revisional surgery

- 5-10% need revisional surgery after LARS
- Most commonly for recurrent heartburn and dysphagia
- Most common predictor of postoperative dysphagia is preoperative dysphagia
- Most common reasons for failure are disruption of the fundoplication and excessive cephalad migration with unrecognized shortened esophagus
- The success rate lower: 10% complain of reflux or dysphagia postoperative

Types of hiatal hernia

- **Type I** sliding: GEj migrates above the diaphragm, longitudinal
- **Type II** pure paraesophageal: GEJ normal position, fundus herniates adjacent to esophagus
- **Type III** combination of I and II, GEJ junction and fundus herniate
- **Type IV** structure other than stomach: omentum, colon or small bowel
Type 3 accounts for 85% of paraesophageal hernias and is treated differently.
Indications for repair: paraesophageal hernia

• When medical treatment fails to control:
• GERD
• Dysphagia
• Regurgitation
• Anemia
• Dyspnea
• Epigastric or abdominal pain
• Bleeding, obstruction, or gastric volvulus

Indications for repair: Paraesophageal hernia

• Should be symptomatic to have repair as there is a 1.4% mortality
• Probability of developing acute symptoms requiring emergency surgery is 1.1%
• The lifetime risk of developing acute symptoms requiring emergency surgery decreases exponentially with age >65
• But when questioned, most have symptoms

Secondary gastric volvulus: PEH

- Pathological gastric rotation, common with PEH, in chest or abdomen, often elderly
- Mesenteroaxial rotation about short axis bisecting lesser and greater curves
- Organoaxial: most common, rotation along long axis between GEJ and pylorus
- Acutely presents with progressive chest pain, vomiting, and distention
- Borchardt’s triad (obstruction), epigastric pain, retching, and nasogastric tube will not pass

Cardile AP, Heppner DS (2011) Gastric volvulus, Borchardt’s Triad, and Endoscopy: A Rare Twist. Hawaii Med J 70:80-82
Preoperative evaluation: Paraesophageal hernia

• Upper endoscopy:
  - other esophageal or gastric pathology
  - retroflexion of hernia
  - If organoaxial rotation: cant pass into duodenum

• A barium swallow: anatomy, length, and presence of organoaxial rotation

• Manometry and pH are unreliable and difficult to perform with a PEH

• CT scan- great anatomy
Compare: LPEHR vs transthoracic

- Currently, LPEHR is most common
- Lower mortality and morbidity with LPEHR
- Hospital stay 7.8 days transthoracic vs 4.5 LPEHR 4.5 days
- Mechanical ventilation: 5.6% transthoracic vs LPEHR 2.3%
- LPEHR has higher risk of radiographic recurrence
- Reoperation rates are similar
- 2 largest studies of 94 and 240: mortality 2.1% and 1.7%

Emergency open transabdominal PEHR

- Retrospective study ≥80 years: open transabdominal PEHR – 8.2% mortality
- Emergency repair 43%: 15.7% mortality vs elective repair 2.4%
- Emergency sole predictor of mortality in multivariate analysis (odds ratio [OR] 7.1, 95% CI 1.9-26.3)

PEHR: crural closure

- Mesh is used: weak crural fibers, large defect, tension
- Crural closure if fibers are intact after dissection, small defect, and tension-free
- Close with 3-4 non-absorbable sutures
PEHR crural closure: Mesh

- Randomized trials: both permanent and biologic mesh prevent recurrence
- 2016 meta-analysis 4 randomized trials: Mesh vs. suture:
  - Mesh reduced reoperation: 2% vs 9% (stat significant) and recurrence: 16% vs 27% but not complication: 10% vs 10%
- Mesh complications: erosions, stenosis, fibrosis
- Need for reoperations: esophagectomy, gastrectomy and stents
- Complication rate is independent of mesh type or configuration

Antireflux and PEHR: Nissen and PEHR

- First choice: perform a Nissen with PEHR
- Fundoplication restores LES
- An antireflux procedure reduces risk of new onset of GERD caused by extensive crural dissection
- Preoperative dysphagia, perform a partial fundoplication to minimize postoperative dysphagia

Antireflux and PEHR: Nissen vs cardiopexy

• Randomized trial of 40: LPHR combined with either: suture of cardia to diaphragm or Nissen as a part of their PEHR
• Nissen had less postoperative GERD symptoms at 1 year and significantly lower postoperative esophagitis: 17% Nissen vs 53% cardiopexy
• Postoperative complications of dysphagia and gas bloating same in both groups

Antireflux and PEHR: Crural repair with gastropexy

- Anterior gastropexy (AG) performed at end of PEHR
- Prospective study 28 pts: LPEHR with anterior gastropexy, all normal postop esophagram at 1 year, asymptomatic, and no recurrences at 2 years
- AG with PEG tubes if too high risk for PEHR: endoscopic or lap-hernia reduction, with AG using 2 PEG tubes, prevents volvulus
- Can be used in an emergency setting
- 2 years follow-up: only 1 of 11 pts had recurrence of PEH

LPEHR outcomes

- Retrospective reviews of 662 and 354 pts: Nonemergency LPEHR -30-day mortality rate of 1.7% and 0.8% respectively
- Major complications: pneumonia 4%, pulmonary embolism 3.4%, heart failure 2.6%, and postoperative leak 2.5%
- M/M higher in ≥70 years and emergency surgery, one or more comorbid illnesses
- Pts≥70 years much higher mortality 2.4% vs 0%, morbidity 24.4% vs 10.1% compared with <70 years of age
- Emergency repair: mortality 7.5% vs 0.5% elective

Radiology for recurrence: Paraesophageal hernia repair

- Radiographic recurrence by barium esophagram is higher than clinical recurrence
- Most patients are asymptomatic
- Recurrence symptoms such as heartburn can be controlled with PPI
- Small fraction will require a re-repair for complications or intractable symptoms
- LPEHR has more radiographic recurrences but most do not require reoperation.
Radiographic recurrence rates: LPEHR

- A meta-analysis of 13 retrospective studies: clinical recurrence 10.2% (range 3-33%) radiographic recurrence 25%
- Collis gastroplasty has a lower recurrence rate
- LPEHR review of 31 patients: 32% recurrence at 10 years
- Open repair: clinical recurrence 0 to 44% and prospective study of 72: patients radiographic recurrence in 11%
- 8 recurrences <2 cm were type 1 HH; none required reoperation
- Transthoracic repair 2 studies, 94 and 240 patients- 2.1% and 1.7% clinical recurrences requiring reoperation

Reoperation for recurrent Paraesophageal hernia

- Reoperation for symptomatic patients
- Difficult adhesions if mesh has been placed
- Should be performed by highly experienced surgeons
- Low threshold to convert to an open procedure in the presence of perforation, ischemia, or significant blood loss
- If complex, a transthoracic approach can provide an undissected plane for repair
What are the results of antireflux surgery?
Long-term results LARS: defining success or failure

- Long-term 90-95% satisfied
- No consensus on definition of success/failure
- Currently use of anti-acids represents failure, but no studies show % of patients on anti-acids with objective evidence of reflux
- Some on anti-acids after surgery have high QOL compared with preoperative patients

Long-term results: Toupet vs Nissen

- Randomized trial **Toupet vs. Nissen** after 18 years:
  - Control of symptoms of heartburn **80%** vs. **87%**; Acid regurgitation **82%** vs. **90%**
- Similar rates of long-term side effects such as bloating, flatulence, and dysphagia scores
- Rate of flatulence, decreased over time
- Meta-analysis of 5 randomized trials in 458 patients: **Toupet vs Nissen**: similar heartburn score, dilatation rate, PPI use, and satisfaction score


Long-term results: Dor vs Nissen

- 5 year outcomes for results for 180° laparoscopic anterior fundoplication (LAF) are similar to those for a laparoscopic Nissen fundoplication (LNF)
- 1 year, LAF had less gas bloating: 11% vs. 18%, flatulence: 14% vs. 25%, bloating 34% vs. 44%
- LAF results in less dysphagia but greater esophageal acid exposure, esophagitis, and re-operation
- Note: No Nissen patients had mobilization of short gastrics, and were performed over smaller caliber bougies

Long-term results: Toupet vs Dor

• The (LAF)(Dor) (90 to 180° wrap) compared to (LPF)(Toupet) (180 to 270° wrap) found higher recurrent reflux

• A meta-analysis of 7 randomized trials: 338 patients by Toupet had acid exposure time (0.8 vs 3.3%), heartburn (8 vs 21%), and reoperation rate (4% vs 8%) compared with 345 Dor

• No significant short-term differences for esophagitis, regurgitation, belching, LES pressure, or satisfaction

• The long-term outcomes for Toupet: lower heartburn (14% vs 31%) and lower reoperation rate (5% vs 10%)

• No differences in dysphagia, inability to belch, gas bloating, or satisfaction


Long-term results: Barrett’s esophagus

- LARS: not shown to halt progression from intestinal metaplasia (Barrett’s esophagus) to dysplasia
- Controversial: presence of Barrett’s is not an indication for LARS
- One trial, endoscopic findings of Barrett’s were present in 11.1% and 10.5% in LARS and PPI treated groups
- Prevalences at 5 years remained stable in both groups: 13.6% LARS; 9.3% PPI (esomeprazole)

How do surgery results compare to medication?

Scalpel vs. The Pill
LARS significantly worse than PPI with dysphagia and flatulence, but with better control of heartburn and regurgitation.
Long-term results: LARS vs. medication

- Optimized medication of (esomeprazole, 20 to 40 mg/day) to LARS have similar 5-year remission rates for controlling GERD symptoms
- In a randomized trial, LARS had lower 5 year remission rate: 85% vs. 92% medically
- Dysphagia, bloating, and flatulence were more common in LARS: 11% vs 5%, 40% vs. 28%, 57% vs. 40%, but acid regurgitation was less common in LARS: 2% vs. 13%
- LARS had lower residual 24-hour acid exposure than medicine: 0.7% vs. 1.9% at 5 years

Long-term results: LARS vs. medication

A multicenter, randomized trial of 357 with >12 mo of GERD on PPI: showed better control of GERD at 5 years following LARS

Trial of 246 patients, 5 year F/U: concluded Nissen or Toupet (pts= 127), patients required PPI at 5-years postop compared to medicine: 82% vs 44%

Study permitted cross-over after randomization: a fundoplication underwent procedure, 13% randomized to a fundoplication underwent fundoplication

LARS is performed by qualified surgeons is at least as good as PPI and likely better at 5 years

Grant AM, Cotton SC, Boachie C, et al. Minimal access surgery compared with medical management for gastro-oesophageal reflux disease: five year follow-up of a randomised controlled trial (REFLUX). BMJ 2013; 346:f1908
Conclusions

• PPIs have significant long term side effects
• Paraesophageal hernias should be repaired if symptomatic
• Use mesh only if needed
• LARS surgery is superior to PPI in control
• The Nissen fundoplication is the procedure of choice