Anatomic Treatment of GERD/PEH

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Yakima, WA March 11 2022

Management of GERD/PEH

Anatomy and Pathophysiology ✓

Endoscopic Management

Open and Minimally Invasive Surgery

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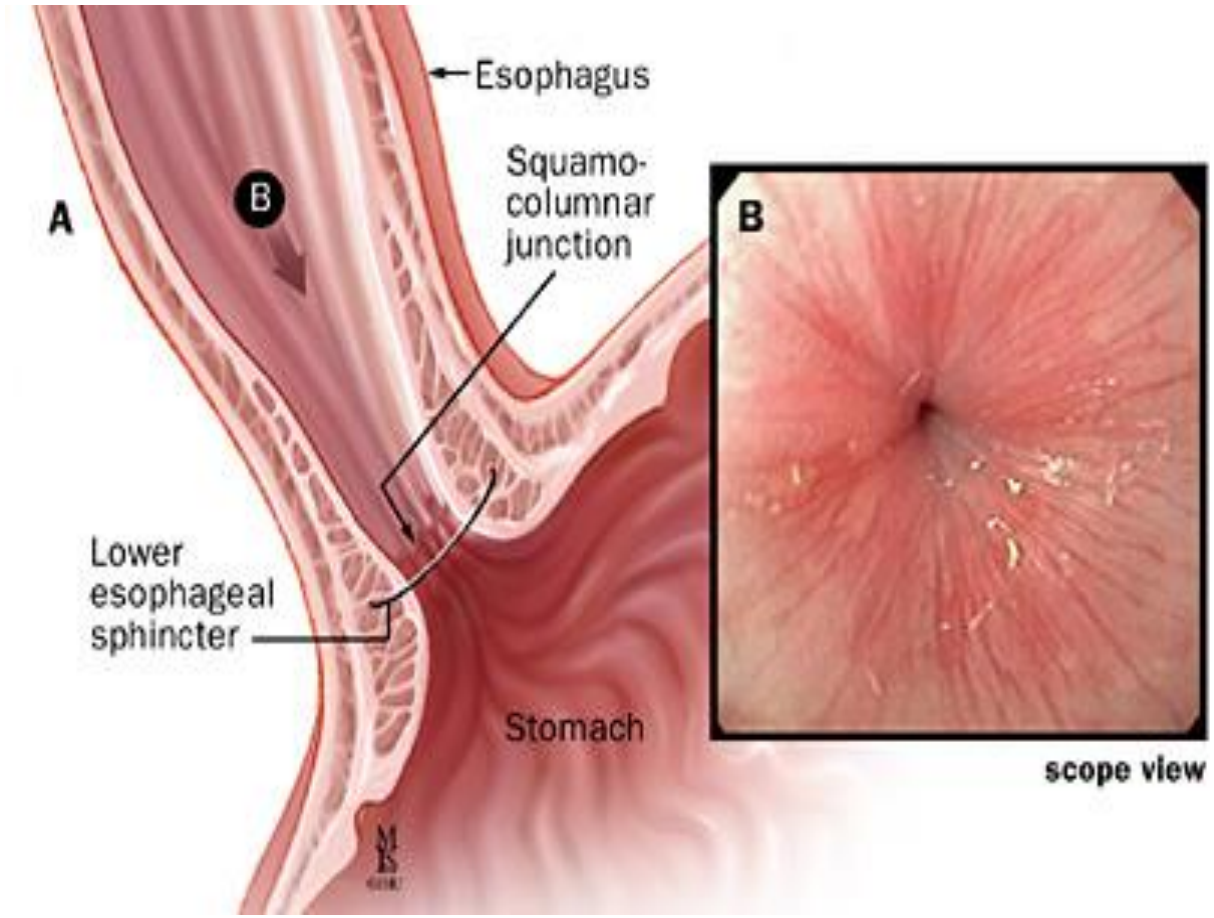
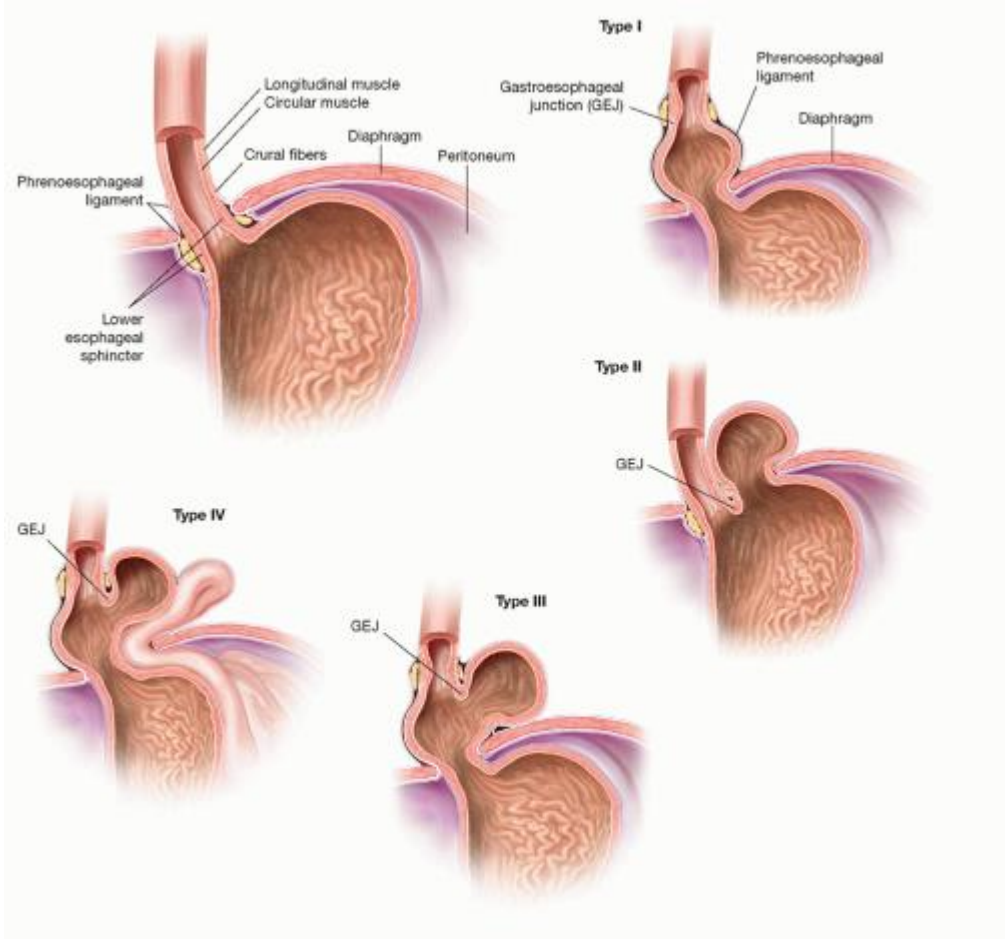
GERD/Anatomy of the EG Junction





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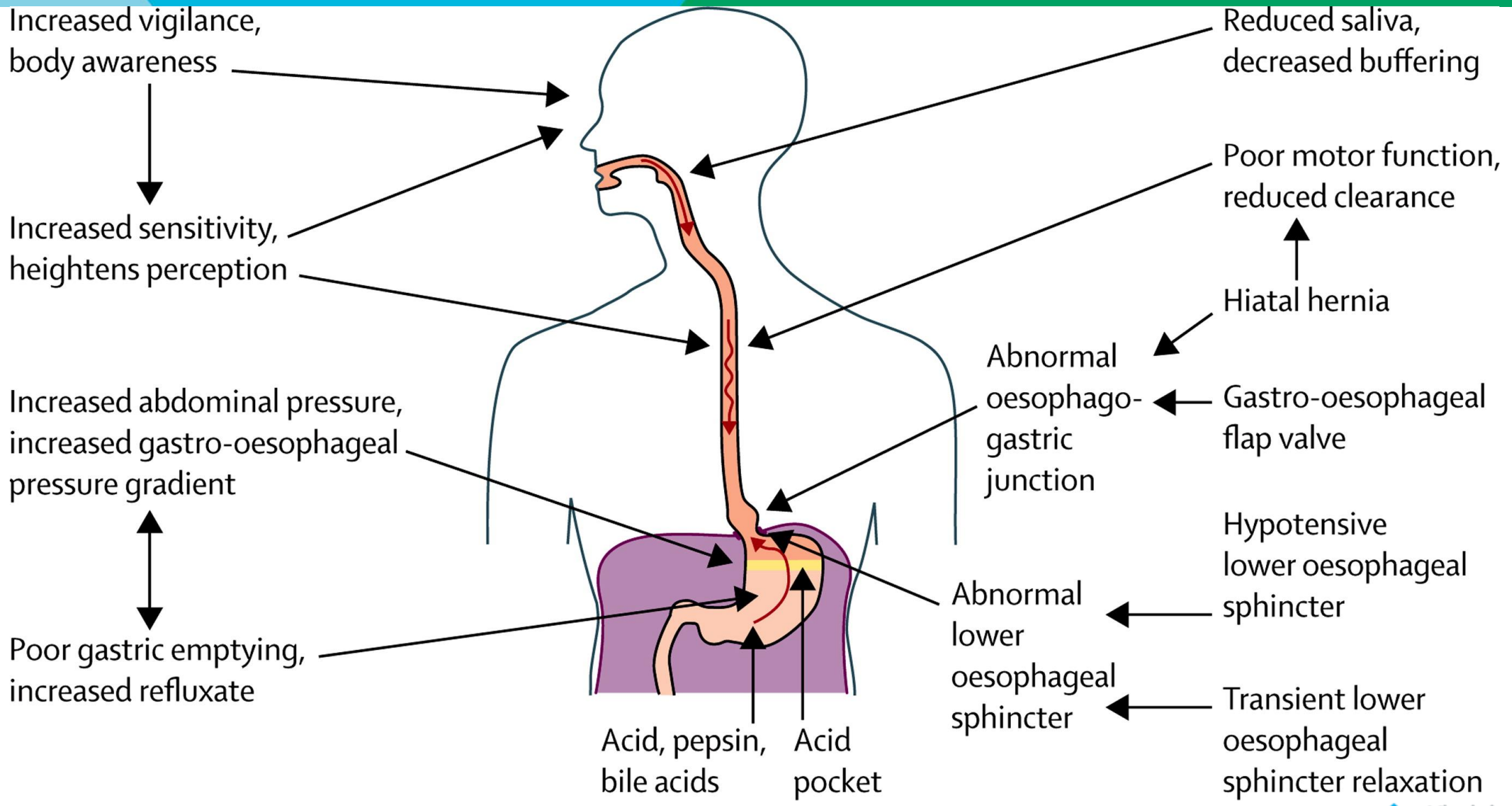
Anatomic Considerations

- "a condition which develops when the reflux of stomach contents causes troublesome symptoms and/or complications." (Montreal consensus)
- failure of the antireflux barrier, allowing abnormal reflux of gastric contents into the esophagus
- GERD = mechanical disorder
  - Esophagus
  - LES
  - the diaphragmatic crura
  - the phrenoesophageal ligament
  - the stomach

The Montreal definition and classification of gastroesophageal reflux disease: a global evidence-based consensus. *Am J Gastroenterol.* 2006; 101: 1900-1920

Functional Considerations



Bredenoord, Lancet, Volume 381, ISSUE 9881, P1933-1942, June 01, 2013)

What are the symptoms of GERD?

Typical Symptoms

- Heartburn
- Acid regurgitation

Atypical Symptoms

- Chest pain
- Laryngitis
- Chronic cough
- Aspiration pneumonia

Indications for Surgery

- **failed medical management** (inadequate symptom control, severe regurgitation not controlled with acid suppression, or medication side effects)
- **opt for surgery despite successful medical management** (due to quality of life considerations, lifelong need for medication intake, expense of medications, etc.)
- **complications of GERD** (e.g., Barrett's esophagus, peptic stricture)
- **extra-esophageal manifestations** (asthma, hoarseness, cough, chest pain, aspiration)

https://www.sages.org/publications/guidelines/guidelines-for-surgical-treatment-of-gastroesophageal-reflux-disease-gerd/

PREOPERATIVE EVALUATION

Upper endoscopy
CT Chest Abdomen
Esophagram
Esophageal manometry
24hr pH or Bravo
Gastric Emptying
Pulmonary Function Tests
Cardiology Evaluation

Function ← → Anatomy

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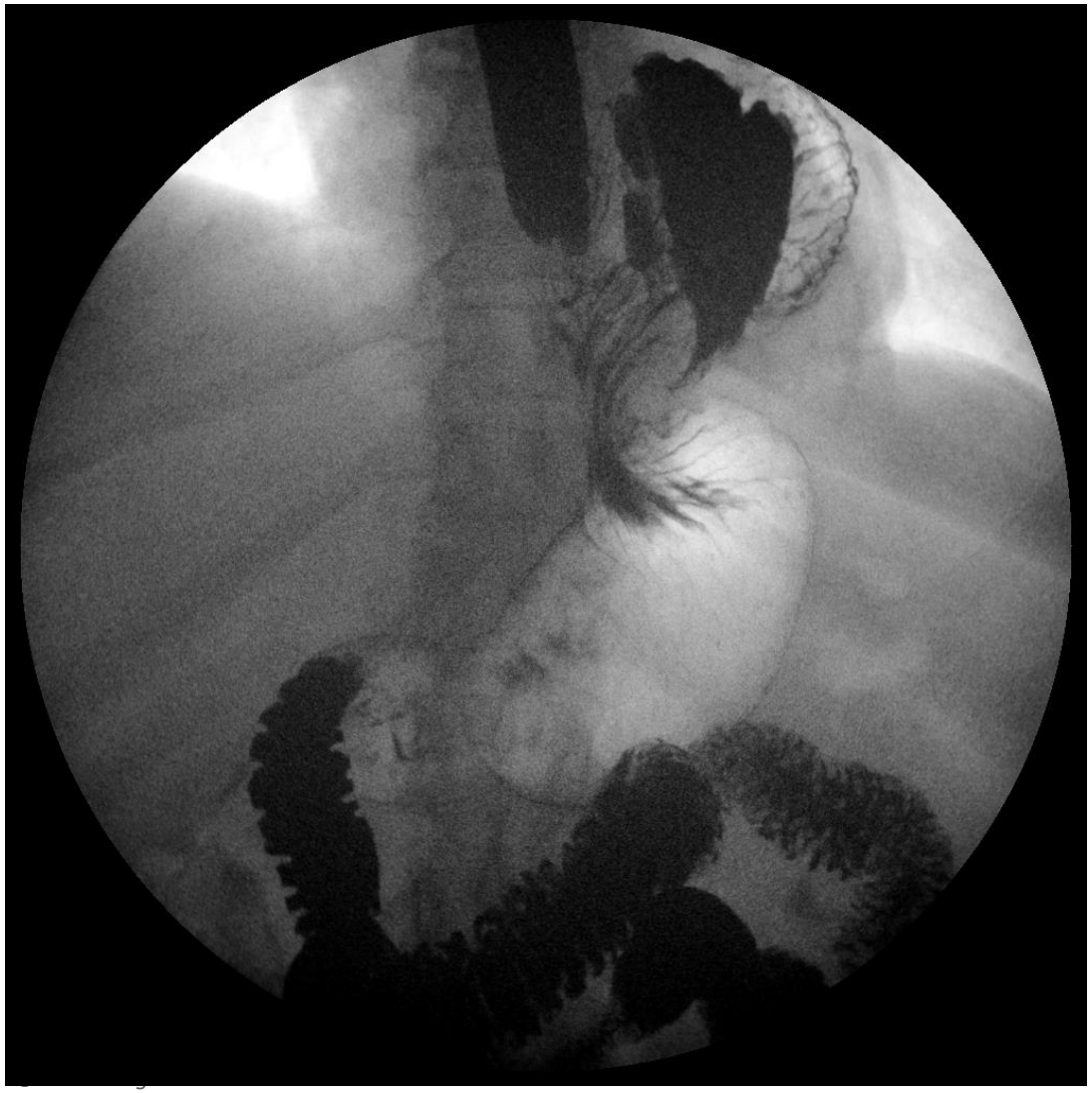
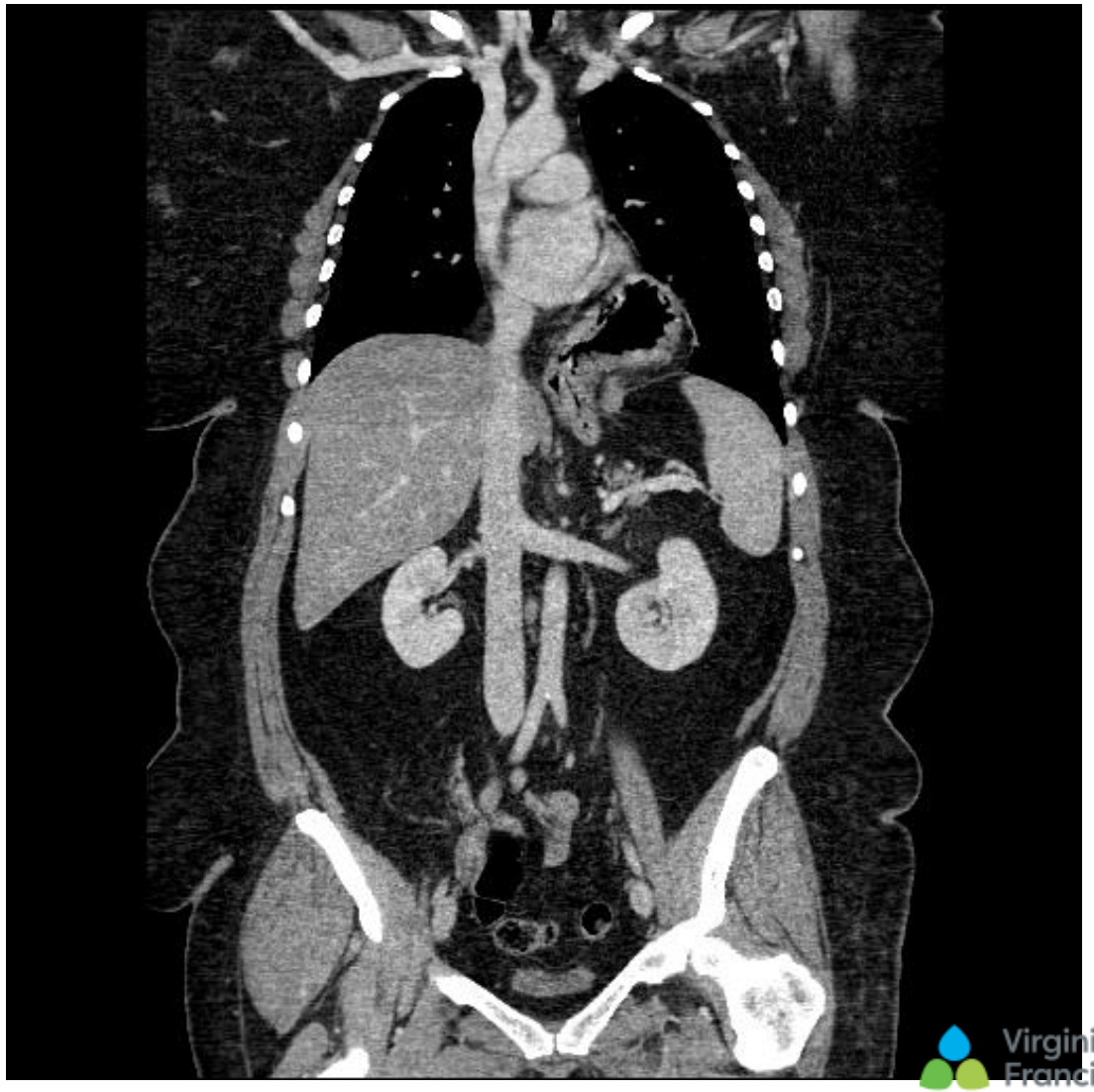
Paraesophageal Hernia Evaluation





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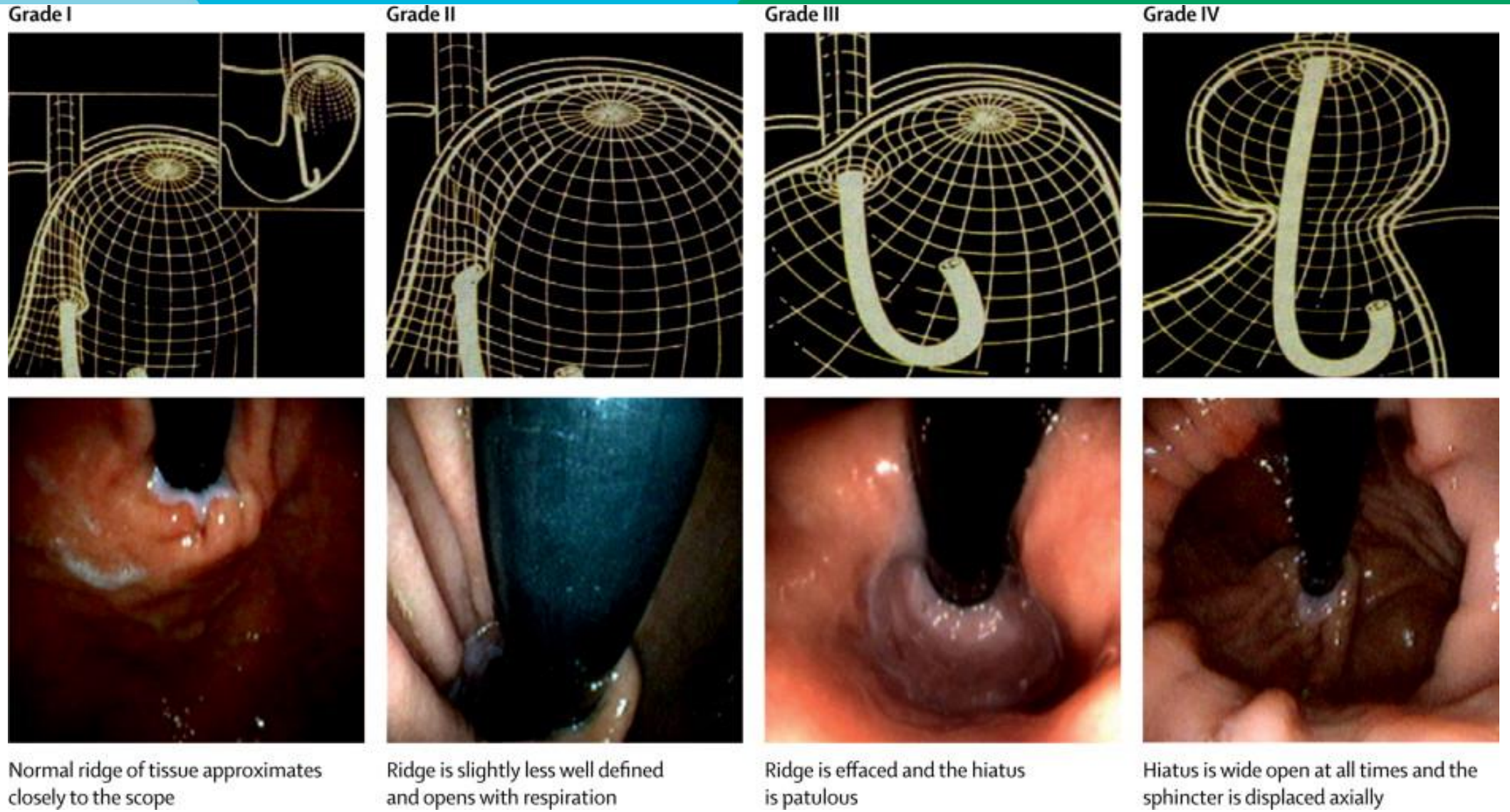
Hill endoscopic classification of EGJ valve



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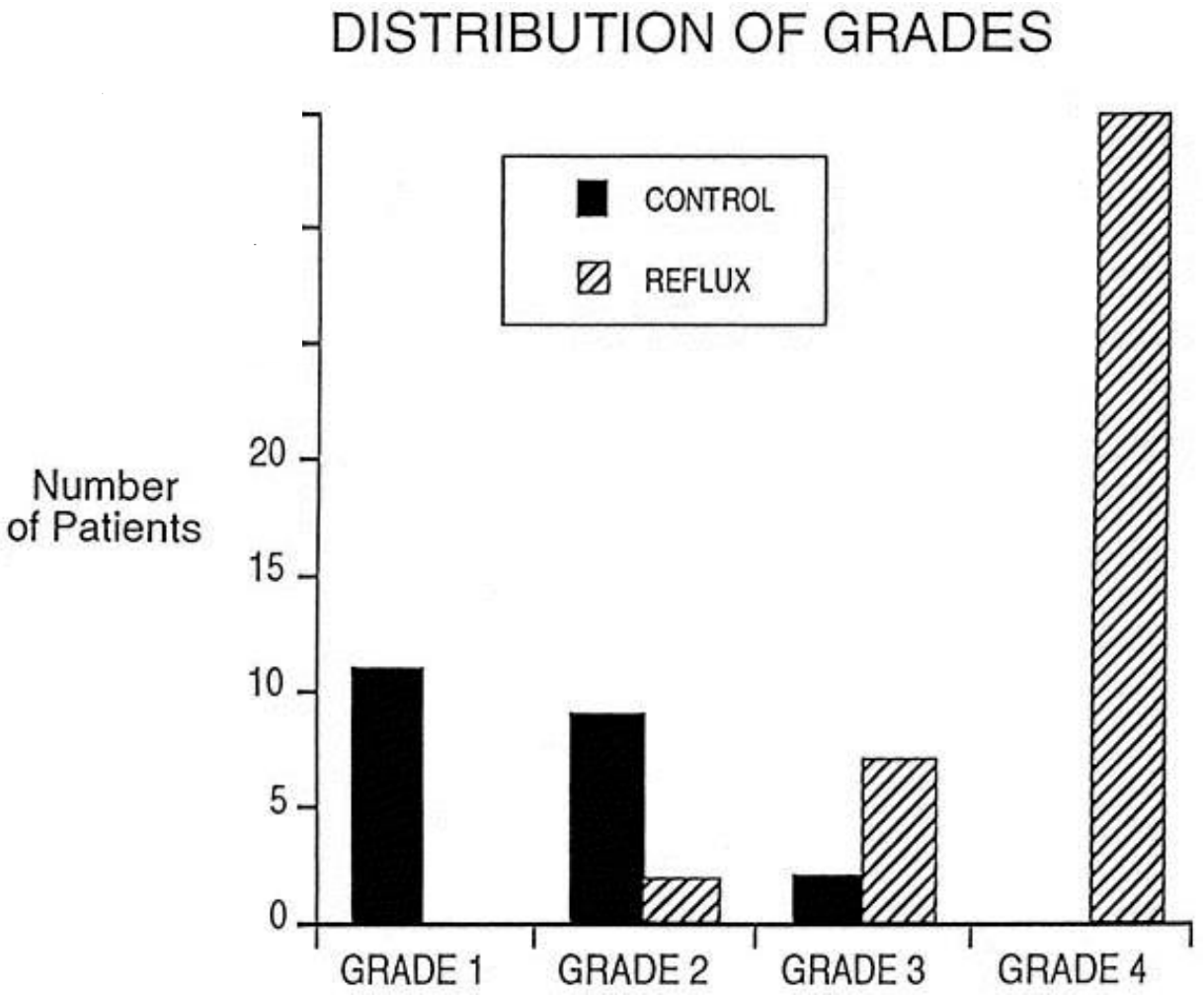
Understanding the mechanism of GERD!

0016-5107/96/4405-0547$5.00 + 0
GASTROINTESTINAL ENDOSCOPY

The gastroesophageal flap valve: in vitro and in vivo observations

Lucius D. Hill, MD, Richard A. Kozarek, MD, Stefan J.M. Kraemer, MD, Ralph W. Aye, MD
C. Dale Mercer, MD, Donald E. Low, MD, Charles E. Pope II, MD
Seattle, Washington



Paraesophageal hernia/GERD Functional Evaluation

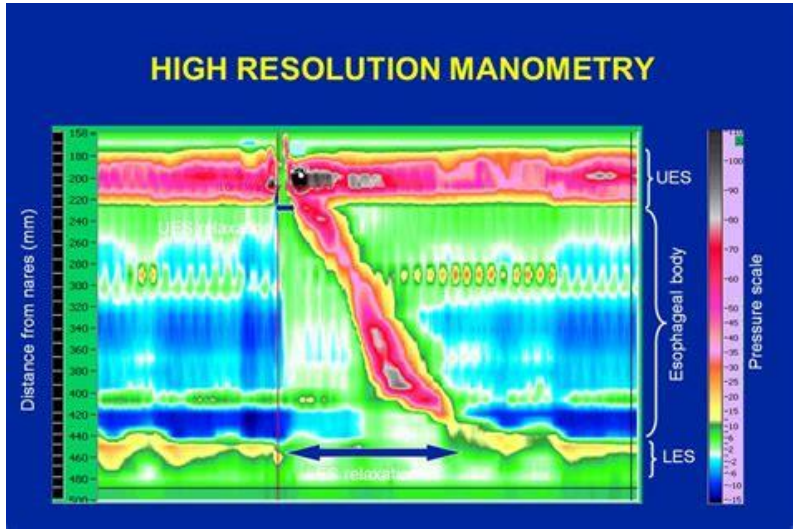
REFLUX MEDICATIONS:
_ Yes Medication/dose: _
x No

ESOPHAGEAL pH SENSOR
Fraction Time pH <4: **21.6** % (NL < 4.5)
Upright Position: **20** % (NL <8.4)
Supine Position: **22.8** % (NL < 3.5)
Reflux Episodes > 5 minutes: **10** (NL <5)
Longest Reflux Episode: **45** minutes

GASTRIC pH SENSOR
Fraction Time pH <4: **97.4** %

DeMeester Score: 79.1 (NL <14.72)

SYMPTOM CORRELATION
Patient reported 5 episodes of chest pain, all of the episodes were related to acid reflux (SI 100%, SAP 98.6%).



Lower Esophageal Sphincter
Mid LES (from nares) (cm): 44
Resting pressure minimum (NL 4.8-32.0 mm Hg): 0
Resting pressure mean (NL 13-43 mmHg): 9
Integrated relaxation pressure (NL < 15 mmHg): 3
Hiatal Hernia: x yes, 2.5 size (cm)
_ no

Esophageal Motility
Number of swallows evaluated: 10
Distal contractile integral mean (NL 500-8000 mmHg-cm-s): 1776
Distal contractile integral Max (mmHg-cm-s): 2577
Distal latency mean (NL > 4.5 s): 5.8
Peristaltic contractions 100 %
Weak peristalsis (DCI < 450 mmHg-cm-s) 10 %
Large breaks 0 %
Failed 0 %
Multiple swallows: intact x yes _no

Upper Esophageal Sphincter
Relaxation pressure (NL < 12 mmHg): 0

Impression:
- Hypotensive LES pressure with normal relaxation
- Normal peristalsis
- Normal UES relaxation
- Hiatus hernia

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Esophageal Manometry

Abnormal High-Resolution Manometry Findings and Outcomes After Paraesophageal Hernia Repair

Wirsching, Zhang, McCormick, Hubka, Low

Journal of the American College of Surgeons, 2018-08-01, Volume 227, Issue 2, Pages 181-188.e2

- Abnormal motility in 106 (53%) patients.
- Abnormal motility was associated with older age (72 vs 69 years)
- Postoperative improvement:
  - Retrosternal pain in AM vs NM patients went from 79% to 5% vs 75% to 2%,
  - Regurgitation from 52% to 2% vs 59% to 0%
  - Dysphagia from 56% to 7% vs 67% to 7%.
  - Postoperative reflux in AM vs NM went from 54% to 21% vs 57% to 16%

Management of GERD/PEH

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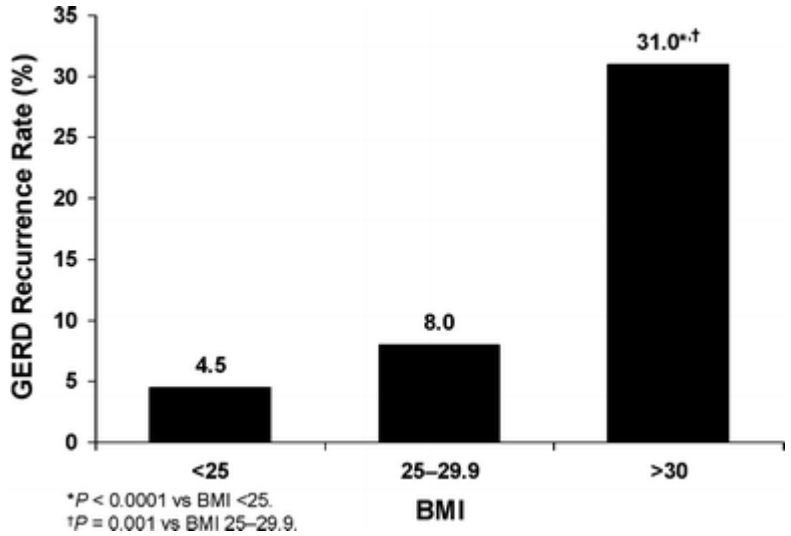
Special Consideration/GERD in the obese BMI >35 kg/m2

Dig Dis Sci (2008) 53:2318–2329
DOI 10.1007/s10620-008-0415-7

ORIGINAL ARTICLE

Surgical Management of Gastroesophageal Reflux Disease in Obesity

Sayeed Ikramuddin



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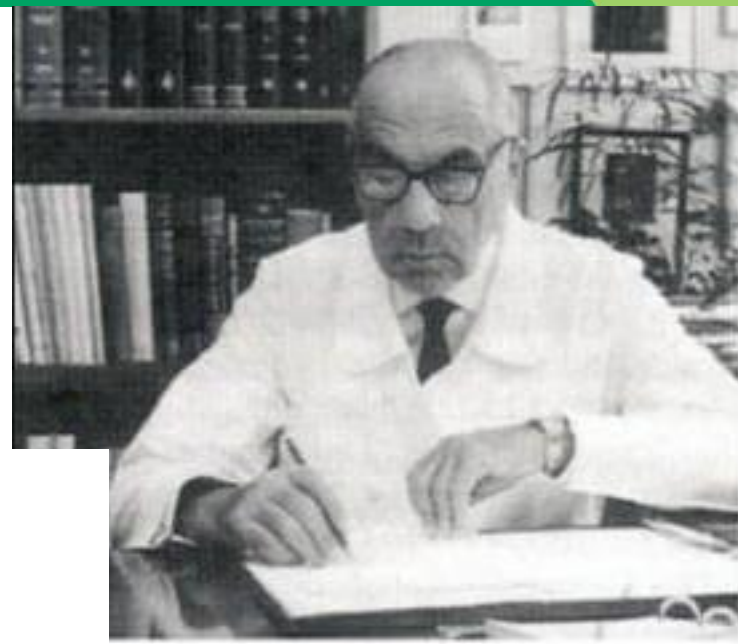
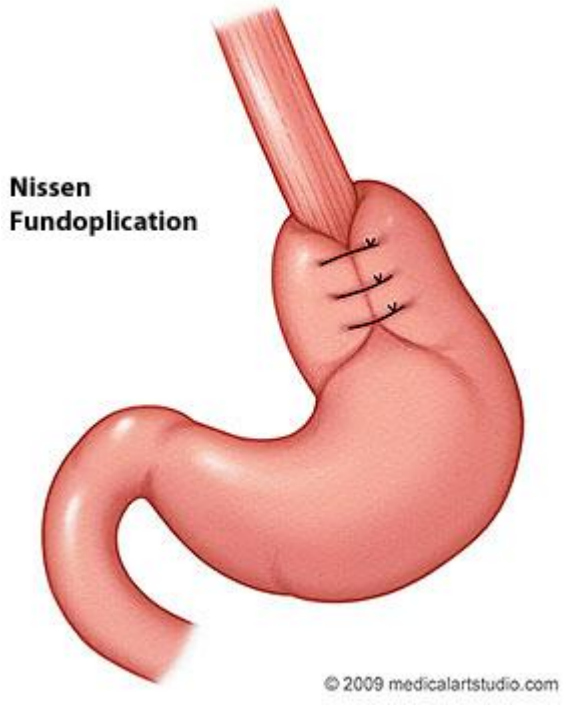
Rudolph Nissen

- 1931- first pneumonectomy by a Western Surgeon
- 1936 – Nissen fundoplication (after partial resection of esophageal ulcer)
- 1948 – Albert Einstein AAA repair



Dr. Nissen 1896-1981



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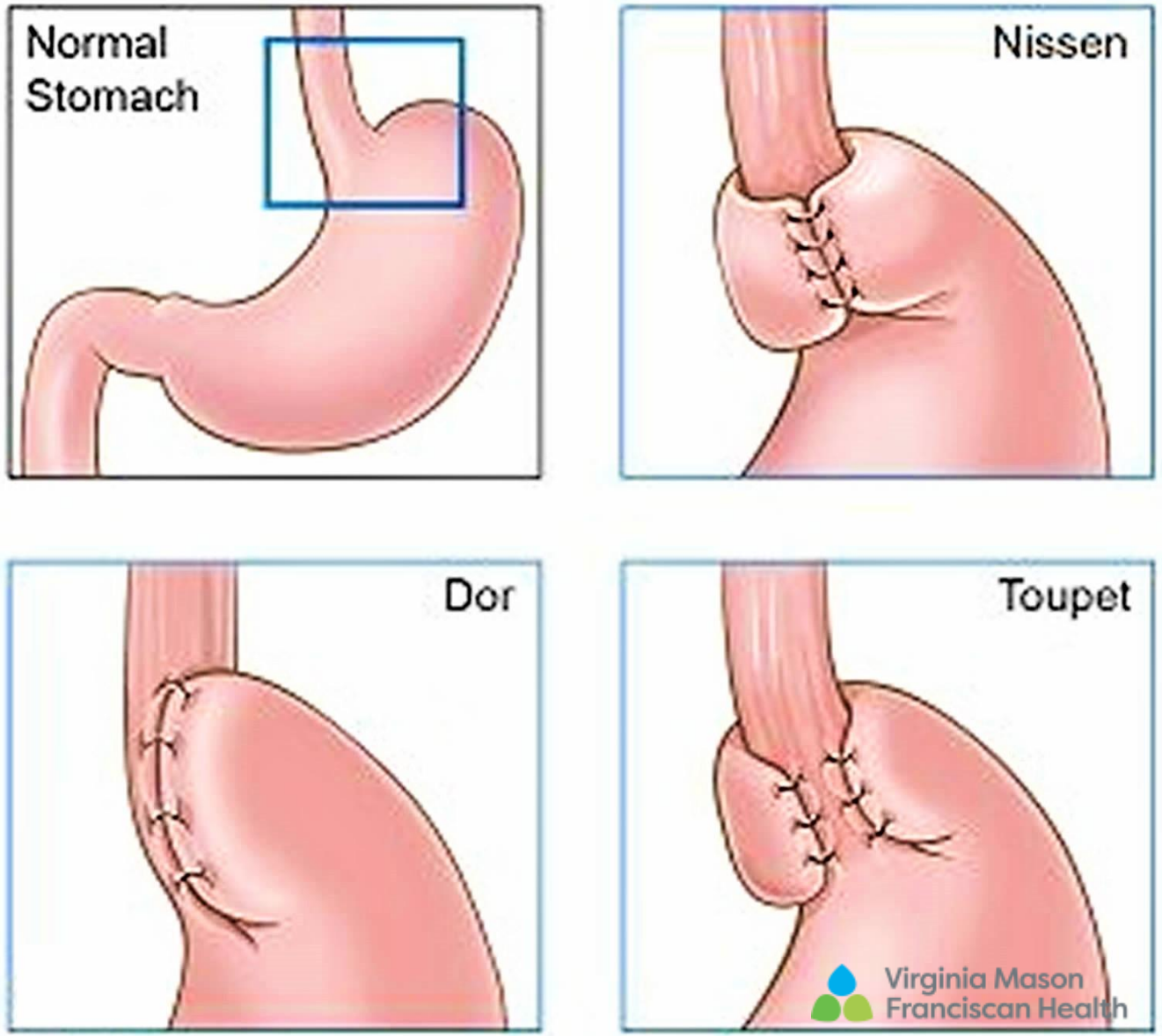
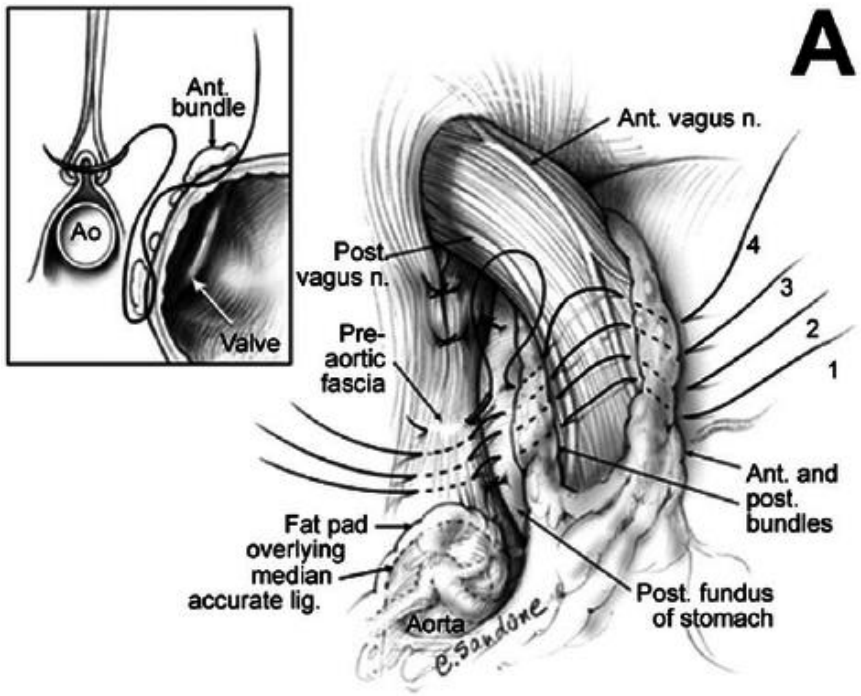
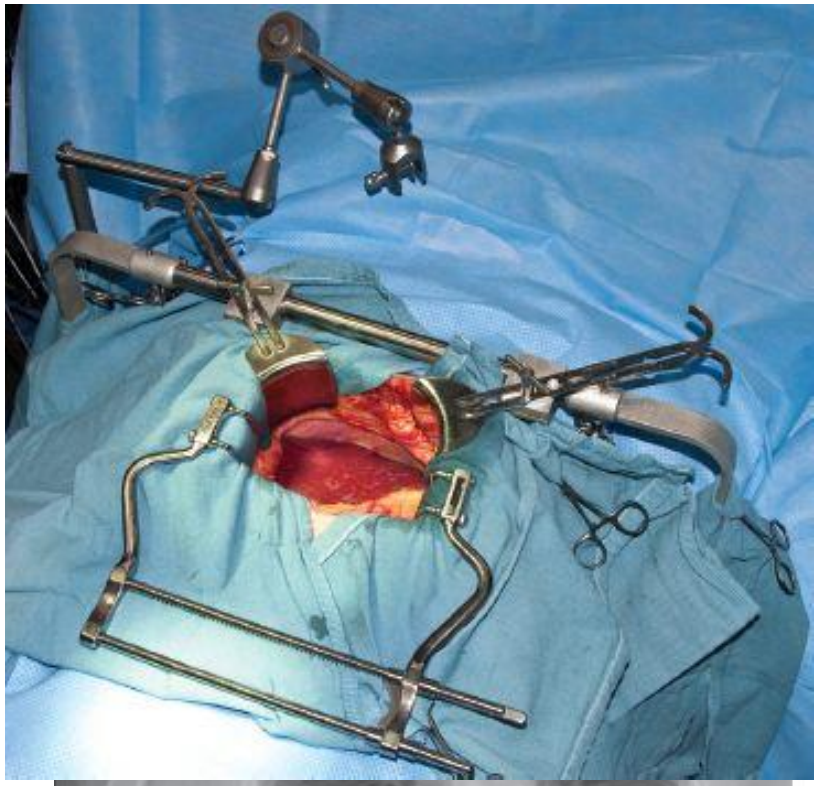
Repair of PEH +/- correction of GERD

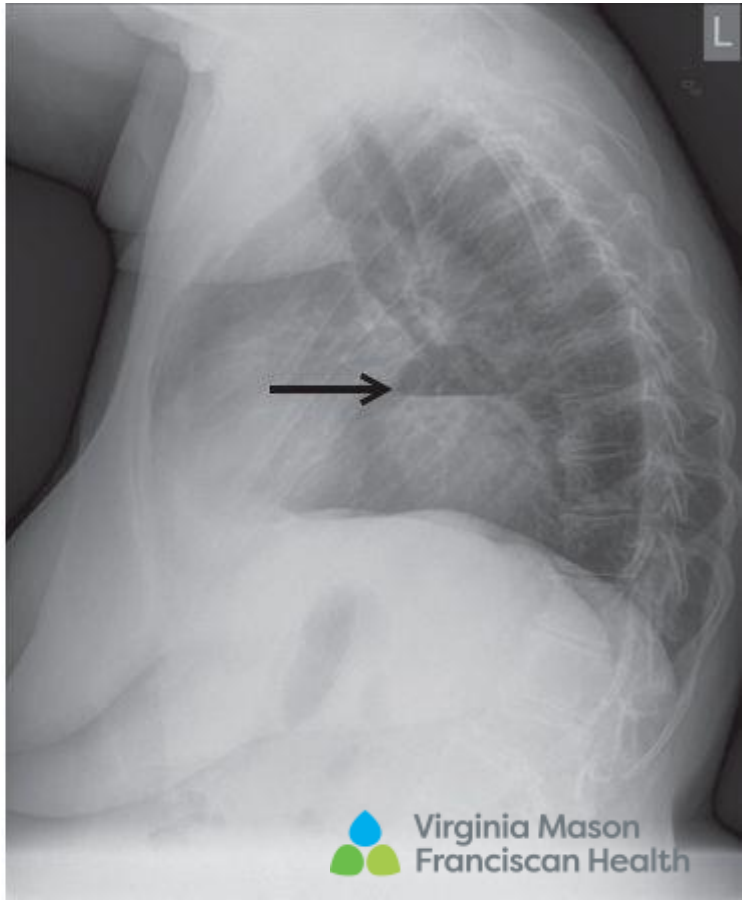
1. Mobilization, reduction and resection of hernia sac
2. Dissection of both crura
3. Transhiatal mobilization to allow at least 3 cm of intraabdominal esophagus
4. Preservation of anterior and posterior vagus nerves
5. Tension-free crural closure with nonabsorbable sutures,
6. Creation of a tailored fundoplication



Virginia Mason Hill repair



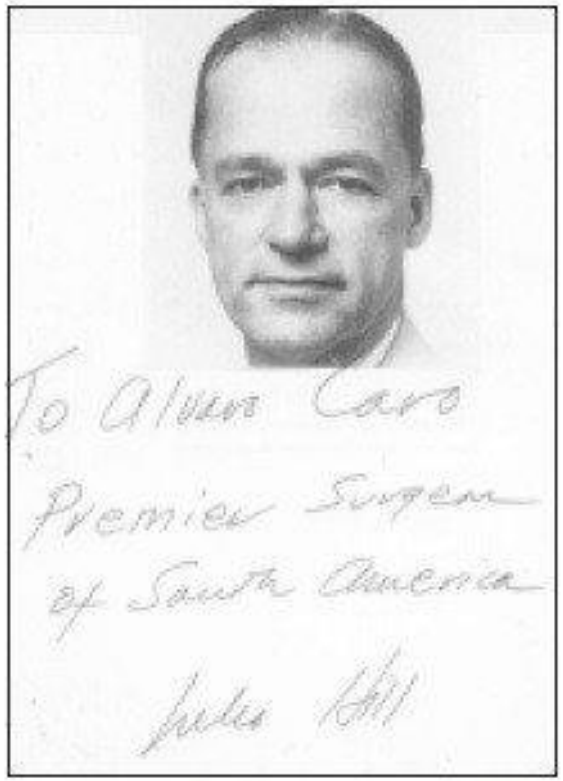




An Effective Operation for Hiatal Hernia:
An Eight Year Appraisal

LUCIUS D. HILL, M.D.

From the Department of General and Thoracic Surgery, The Mason Clinic, Seattle, Washington



SINCE the first deliberate repair of hiatal hernia, by Wm. J. Mayo in 1911,[2] countless procedures have been performed to correct herniation of the stomach into the posterior mediastinum. Earlier, these operations consisted primarily of closure of the enlarged hiatus without proper fixation of the stomach. Recurrent herniation was high. With the advent of the Allison type of repair in 1951,[1] attention was turned to fixation of the stomach in its subdiaphragmatic position. Unfortunately, with the Allison type of repair and its many variations, the anterior or weakest portion of the phrenoesophageal membrane is used in an effort to fix the stomach below the diaphragm. Long-term follow up on the Allison type of repair indicates that the recurrence rate is too high. The recently reported series from the Mayo Clinic,[7] where the first repair was done, indicates a documented recurrence rate of 21% which is unacceptable for an elective operative procedure.

Recently, various procedures aimed primarily at anchoring the stomach below the diaphragm have been attempted. Chief among these is the Nissen[8] type of operation which anchors the stomach to the anterior abdominal wall. Although this operation has not met with uniform success, it has become apparent that if the stomach can be maintained in its subdiaphragmatic position, not only is recurrent herniation prevented, but reflux of gastric juice is often curtailed.

The procedure to be presented here has been performed for the past 8 years and is aimed not only at reducing the hernia and closure of the hiatus, but primarily at permanently fixing the gastroesophageal junction in its subdiaphragmatic location to prevent reflux and recurrent herniation.

Materials and Methods

This report consists of 149 consecutive operations for hiatal hernia, performed over an 8-year period. These patients were studied preoperatively with combined pH and pressure studies, conventional gastrointestinal x-rays, and by esophagoscopy in nearly all cases. Cineradiography was employed when diagnostic was difficult and when motility disorders were suspected.

All 149 patients had preoperative gastrointestinal x-rays. One hundred twenty-three patients had preoperative combined pH and pressure studies. One hundred patients have had postoperative pH and pressure studies. In addition, overnight gastric acid was obtained preoperatively in nearly all patients. One hundred forty-two patients had sliding hiatal hernia, while seven patients had paraesophageal hernias.

Indications for Surgery

We advocated operation for repair of hiatal hernia only in patients with significant symptoms or complications. Of 466 patients diagnosed with hiatal hernia in a

Presented at the Annual Meeting of the American Surgical Association, May 11–13, 1967, Colorado Springs, Colorado.

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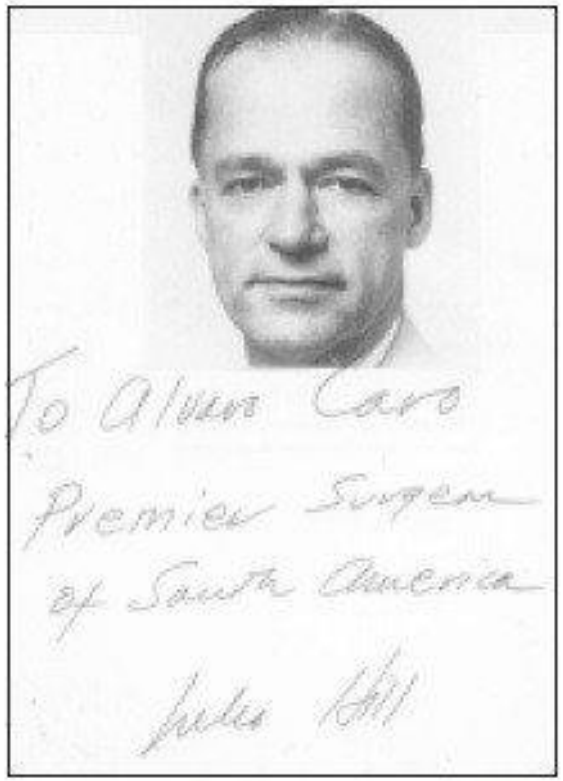


Progress in the Surgical Management of Hiatal Hernia

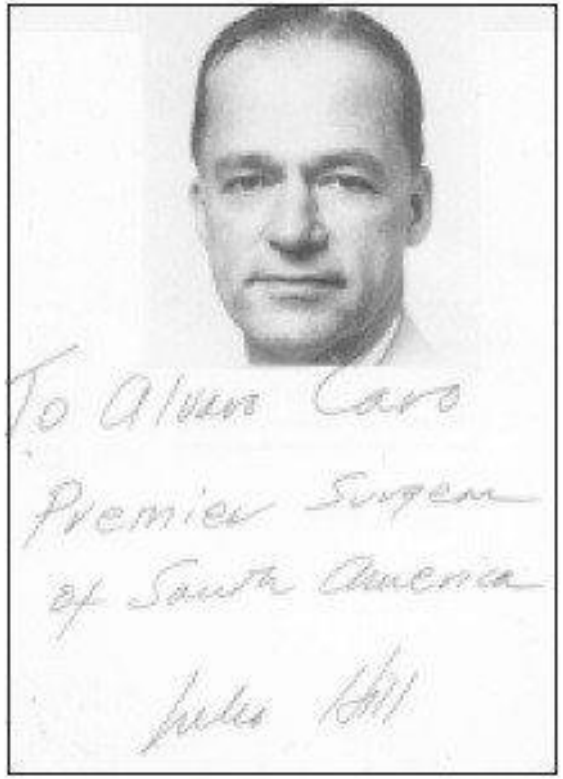
LUCIUS D. HILL, M.D.

Department of Surgery, Virginia Mason Medical Center and University of Washington School of Medicine, Seattle, Washington, U.S.A.

A median arcuate repair which anchors the gastroesophageal junction posteriorly has been used in 559 patients operated on for primary hiatal hernia. With 95% follow-up, there have been 5 (0.89%) recurrences and 2 (0.35%) deaths. Since the introduction of intraoperative manometrics, there have been no recurrences in the last 120 patients operated on for hiatal hernia. A study of the first 126 patients operated on with the use of intraoperative manometry indicates that sphincter competence was restored. The operation, used by surgeons other than the author with equal success when done properly, offers a surgical option for relief of hiatal hernia in those cases when medical treatment has failed or is contraindicated.

quate medical management before surgery is recommended. Although stricture formation with obstruction is an indication for surgery, it has become clear that this represents a complication which should not develop with adequate management. Stricture formation indicates that the patient has been allowed to remain on medical management too long and a relatively straightforward problem has been allowed to become a complicated one.

It has also become clear in the last decade that respiratory complications secondary to hiatal hernia represent a serious problem which has often been



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J THORAC CARDIOVASC SURG 91:511-517, 1986

Reoperation for failed antireflux operations

Experience with gastroesophageal reflux in patients without prior operations has yielded understanding of pathophysiology, surgical techniques, and results. Less is known about patients with failed antireflux operations. This report of 61 patients undergoing repeat antireflux procedures addresses this issues. Not included are patients with gastroesophageal reflux after ulcer operations or with inappropriate antireflux operations for motility disorders. Group A patients (n = 34) had only one previous operation, Group B (n = 19) had two, and Group C (n = 8) had three or more. Group C had significantly ($p < 0.05$) more dysphagia and less heartburn than Group A. This observation correlated with findings from manometry, pH testing, and endoscopy, which showed progressively worse esophageal body function and a greater incidence of severe esophagitis and esophageal leak, but less gastroesophageal reflux, in Group C than B and in Group B compared to A. Operative mortality was 4.9%. Repeat antireflux operations in the 58 survivors were as follows: Group A included 25 standard antireflux procedures and seven bowel interpositions, and 75% were transthoracic. Group B included 16 antireflux procedures and one bowel interposition, and 82% were transthoracic. Group C included four antireflux procedures and three interpositions, and all were transthoracic. Clinical results were excellent or good in 85% in Group A, 66% in Group B, and only 42% in Group C (A versus C, $p < 0.05$). Surgical complications increased from 27% in Group A to 75% in Group C ($p < 0.05$). Conclusions: (1) Patients with one prior operation and recurrent gastroesophageal reflux are similar to patients with no prior operations. (2) Results of repeat antireflux operations deteriorate with increasing operations because of impaired esophageal function and progressive tissue destruction. Therefore, second reoperations must be definitive and resection and reconstruction with healthy tissue considered. (3) A transthoracic approach is preferable for first reoperations and mandatory after multiple antireflux procedures.

Alex G. Little, M.D., Mark K. Ferguson, M.D., and David B. Skinner, M.D., *Chicago, Ill.*

Choice of Operation – Shared Decision Making

Laparotomy versus Laparoscopy

Type of antireflux operation

Nissen

Toupet

Dor

Hill

Esophageal anchoring/lengthening

Prosthesis

Variables

- **Esophageal Motility**
- **Esophageal length/Location of EG junction**
- **Gastric Motility**
- **Presence of Paraesophageal hernia**
- **Previous surgery**

Risks of Surgery

Injury to esophagus

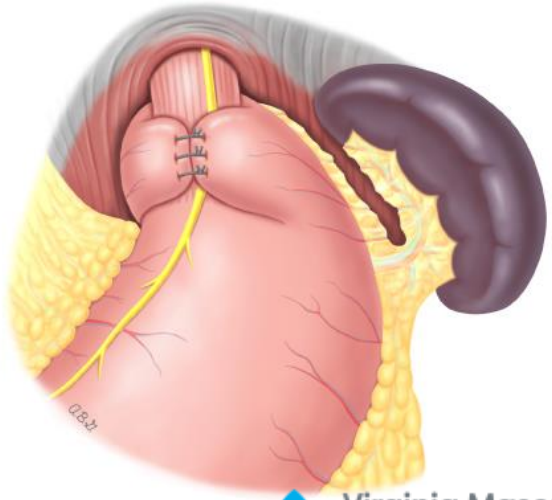
Division of the Vagus Nerves – gastroparesis

Injury to adjacent organs (Liver, spleen, heart, lungs)

Gastric herniation through the fundoplication

Disruption of fundoplication

Side Effects: Gastric bloat, flatulence, dysphagia



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Surgical Outcomes: Regression of Barretts

Barrett's Esophagus Can and Does Regress after Antireflux Surgery: A Study of Prevalence and Predictive Features

Richard R Gurski, MD, PhD, Jeffrey H Peters, MD, FACS, Jeffrey A Hagen, MD, FACS, Steven R DeMeester, MD, FACS, Cedric G Bremner, MD, FACS, Parakrama T Chandrasoma, MD, Tom R DeMeester, MD, FACS

BACKGROUND: To investigate the factors leading to histologic regression of metaplastic and dysplastic Barrett's

- 91 patiets
- 77 surgical, 14 medical management
- Histopathologic regression occurred in 36.4 surgical patients 36.4% vs 7.1% treated with PPIs
- Better regression with short (<3cm), 58%, vs long (> 3cm), 20%, Barretts

Table I. Progression and regression of the length of Barrett's esophagus after antireflux surgery.

Author (year)	Number of Barrett's patients with antireflux surgery	Progression after antireflux surgery (%)	Partial regression after antireflux surgery (%)	Complete regression after antireflux surgery (%)
Brand (1980) [9]	10	?	?	4 (40%)
Skinner (1983)[10]	13	0 (0%)	2 (15.3%)	1 (7.6%)
Wellinger (1988)[8]	39	0 (%)	0 (0%)	0 (0%)
DeMeester (1990) [11]	35	0 (0%)	0 (0%)	0 (0%)
Williamson (1990)[3]	37	?	4 (10.8%)	0 (0%)
Attwood (1992)[4]	19	?	?	2 (10.5%)
Sagar (1995)[7]	56	9 (16.1%)	19 (33.9%)	5 (8.9%)
Ortiz (1996) [5]	32	3 (9.3%)	8 (25.0%)	0 (0%)
TU Munich (1996)	66	6 (9.1%)	8 (12.1%)	3 (4.5%)

Stein HJ, Siewert JR. Barrett's esophagus: pathogenesis, epidemiology, functional abnormalities, malignant degeneration and surgical management. Dysphagia 1993;8:276-288.

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GERD related outcomes with surgery

RANDOMIZED CONTROLLED TRIAL

Seventeen-year Outcome of a Randomized Clinical Trial Comparing Laparoscopic and Conventional Nissen Fundoplication

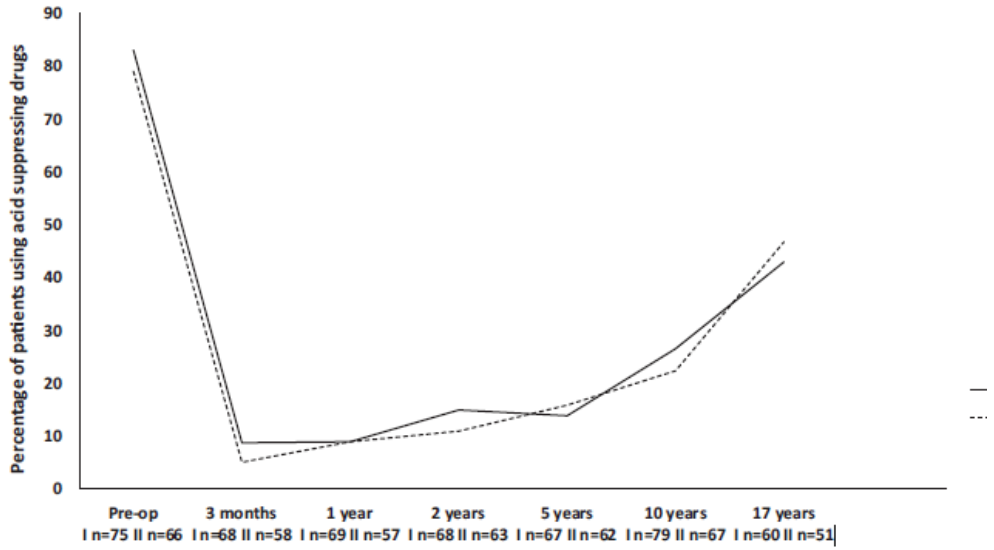
A Plea for Patient Counseling and Clarification

Jelmer E. Oor, MD, David J. Roks, MD,*‡ Joris A. Broeders, MD, PhD,* Eric J. Hazebroek, MD, PhD,* and Hein G. Gooszen, MD, PhD†*

- 1997 and 1999
- 177 patients with proton pump inhibitor (PPI)-refractory GERD were randomized to open or laparoscopic Nissen fundoplication
- reflux symptoms
- Dysphagia
- general health
- PPI use
- need for surgical reintervention

At 17 years:

- 60% of patients are off PPI
- 90 % lap, 95% open surgery symptom relief
- More surgical reinterventions with open due to incisional hernias



Ann Surg 2017 Jul;266(1):23-28.

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Open versus MIS

- Longer initial recovery
- More durable in the setting of a large Paraesophageal hernias
- Increased risk of Incisional hernias

- Longer Operative time
- Reduced hospital stay
- Equivalent relief of heartburn at 12 months
- Standard of care in absence of hiatal hernia
- Higher recurrence rate with large Paraesophageal hernia

Randomized trial

Randomized clinical trial of laparoscopic *versus* open fundoplication for gastro-oesophageal reflux disease

R. Ackroyd, D. I. Watson, A. W. Majeed, G. Troy, P. J. Treacy and C. J. Stoddard

Department of Surgery, Royal Hallamshire Hospital, Glossop Road, Sheffield S10 2JF, UK
Correspondence to: Mr R. Ackroyd (e-mail: roger.ackroyd@sth.nhs.uk)

BJS

Correspondence | Full Access |

Randomized clinical trial of laparoscopic *versus* open fundoplication for gastro-oesophageal reflux disease (*Br J Surg* 2004; 91: 975-982)

F. M. Riegler, J. Lenglinger, E. P. Cosentini

First published: 20 September 2004 | https://doi.org/10.1002/bjs.4826 | Citations: 2

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Open PEH Dyspnea Outcomes

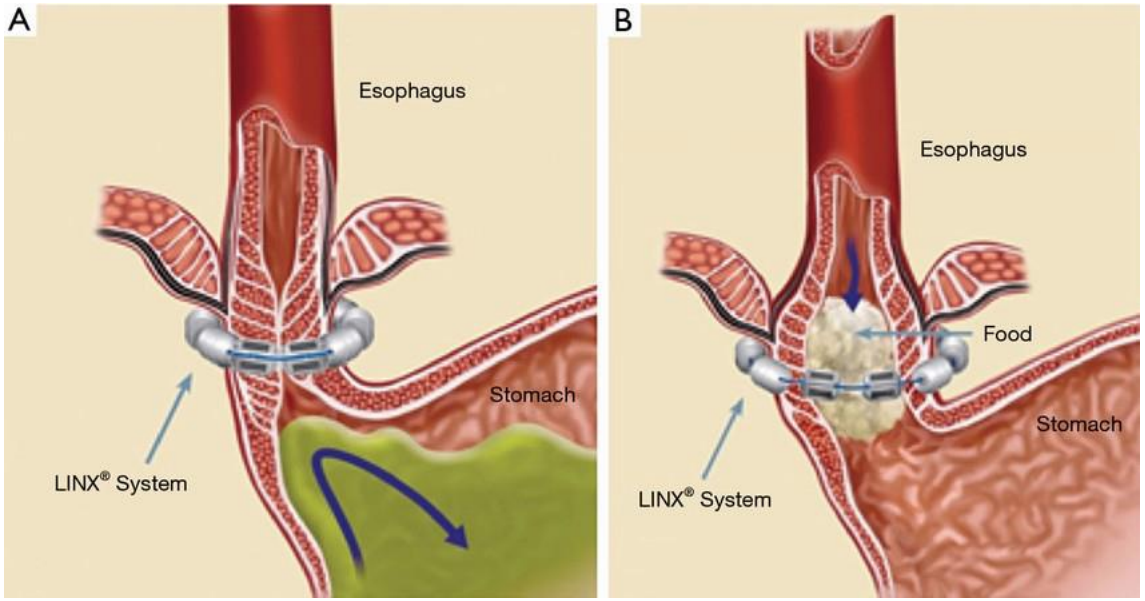
The other explanation for dyspnea: giant paraesophageal hiatal hernia repair routinely improves pulmonary function

Wirsching, Klevebro, Boshier, Hubka, Kuppusamy, Low

Diseases of the Esophagus, Volume 32, Issue 9, September 2019, doz032

- Spirometry results improved in 80% of the patients (21% of whom showed an improvement of >20% compared to the preoperative level)
- '*Significant*' improvement in respiratory function was seen in 122 of 299 (41%) patients.
- Patients presenting with moderate and severe preoperative pulmonary obstruction demonstrated '*significant*' improvement in FEV1 in 48% and 40% of cases, respectively. Large PEHs, characterized by a percentage of intrathoracic stomach >75%, was strongly associated with '*significant*' improvement in FEV1 (P = 0.001).

Magnetic Sphincter Augmentation (LINX)



- FDA Approved in 2012
- Indications:
- Abnormal pH study
- Response to PPI
- Absence of Large hiatal hernia (<3 cm)
- Contraindications: Allergy to certain metals

- Promising short-term data (5 years) suggesting equivalence to fundoplication
- Requires operative placement
- Case reports of required explanation due to dysphagia and esophageal erosion.

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Anatomy and Pathophysiology ✓

Endoscopic Management ✓

Open and Minimally Invasive Surgery ✓

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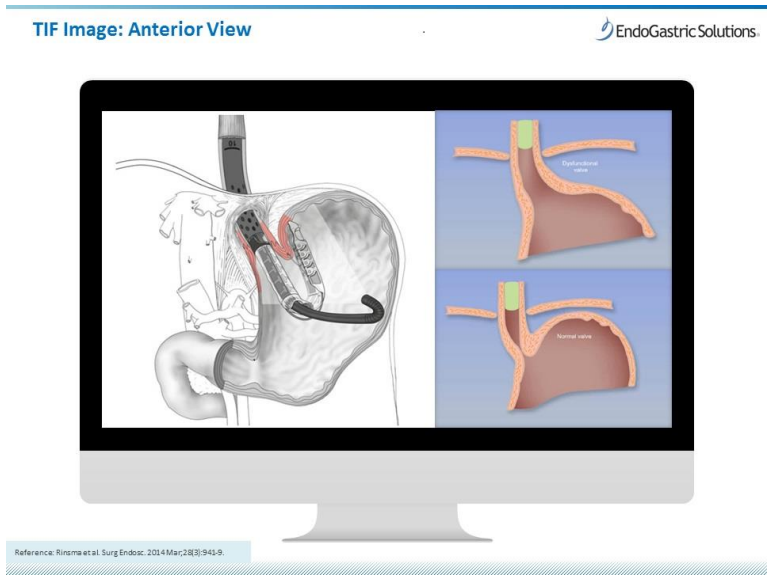
Transoral Incisionless Fundoplication (TIF)

- Indications: typical symptoms of GERD, <2 cm HH
- full-thickness serosa-to-serosa plication that is 3 to 5 cm in length
- partial fundoplication



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TIF versus PPI

The TEMPO Trial at 5 Years: Transoral Fundoplication (TIF 2.0) Is Safe, Durable, and Cost-effective

Surgical Innovation
1–9


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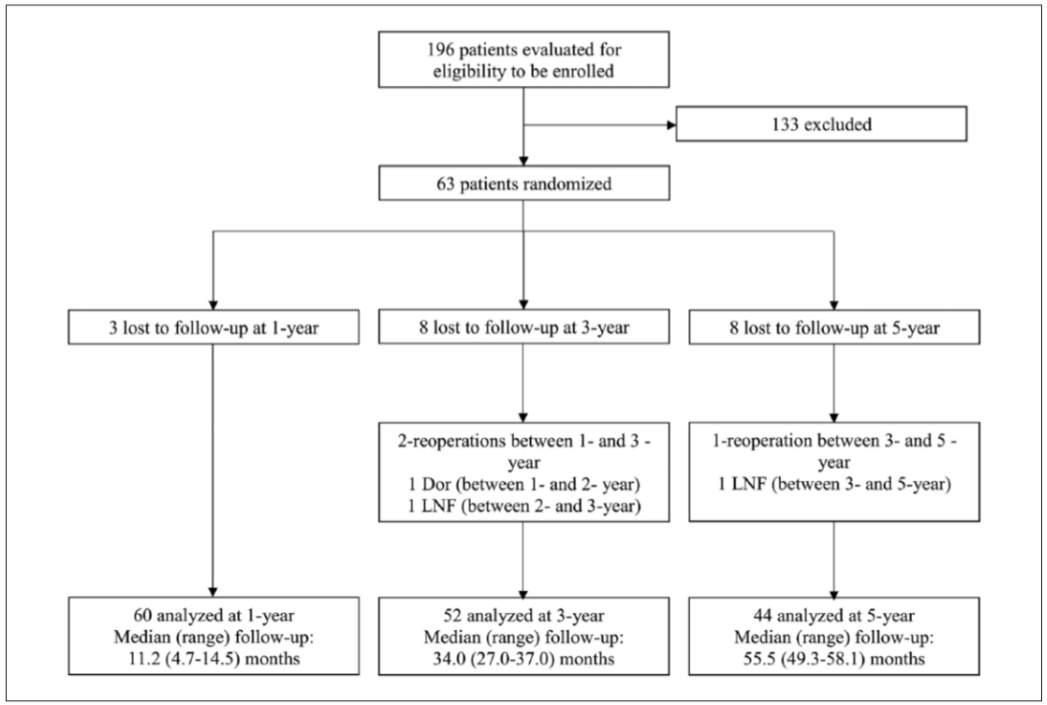


At 5 years

- Elimination of regurgitation 86%
- Elimination of use of atypical symptoms of reflux 80%
- Off PPI 66%

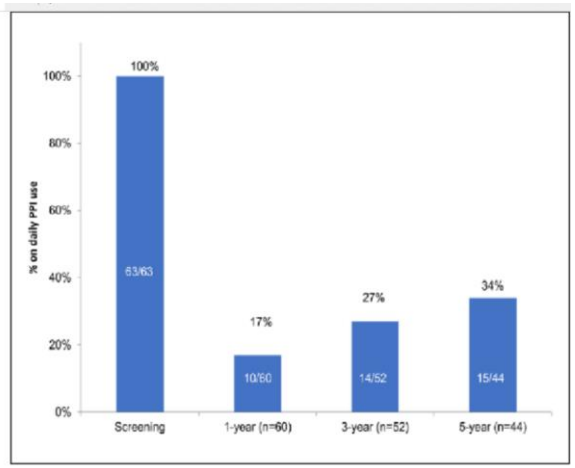
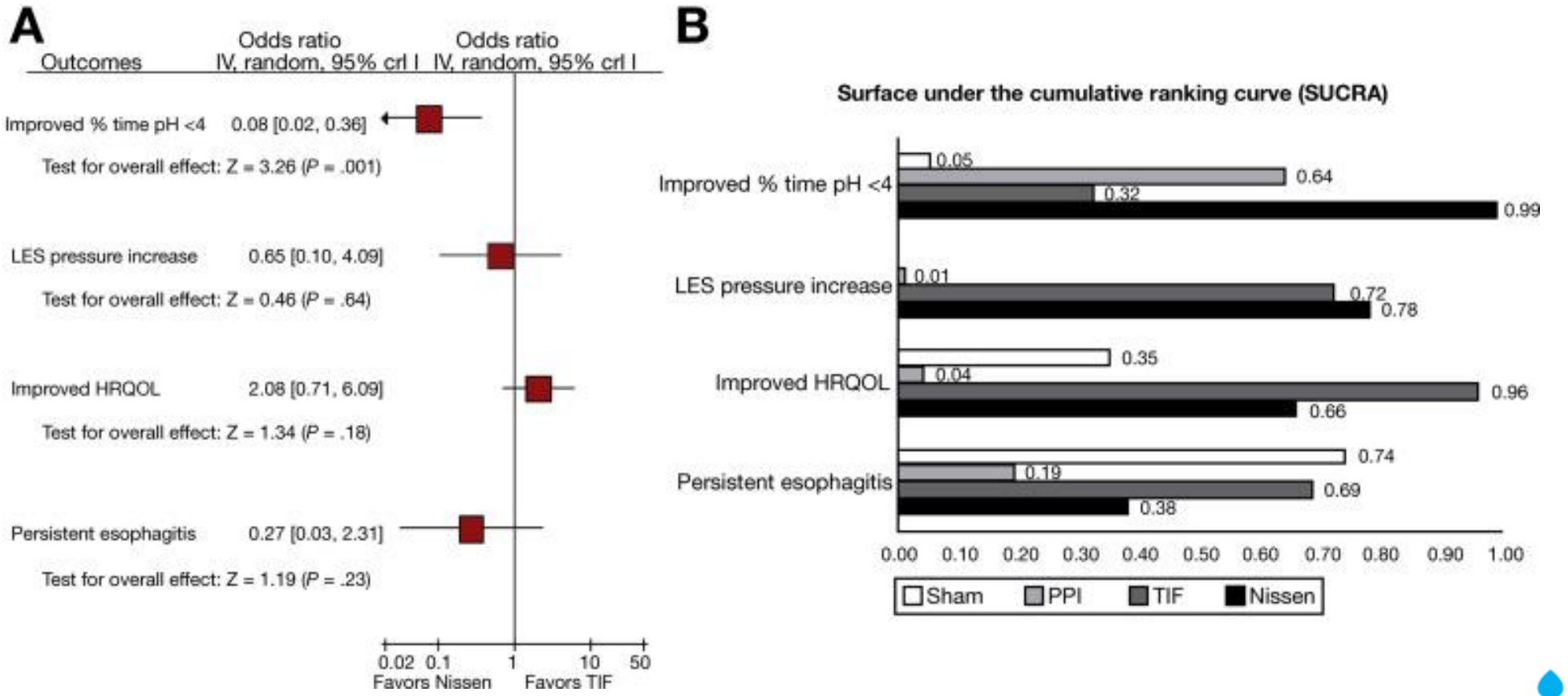


Figure 6. Percentage of patients on daily proton-pump inhibitor (PPI) therapy at screening and 1-, 3-, and 5-year follow-up assessments.

Laparoscopic Nissen versus TIF

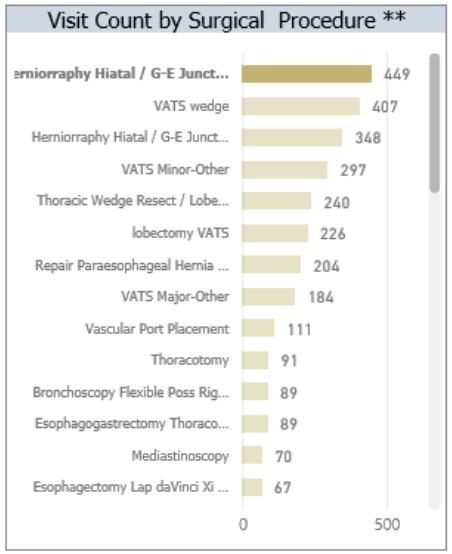
Efficacy of Laparoscopic Nissen Fundoplication vs Transoral Incisionless Fundoplication or Proton Pump Inhibitors in Patients With Gastroesophageal Reflux Disease: A Systematic Review and Network Meta-analysis

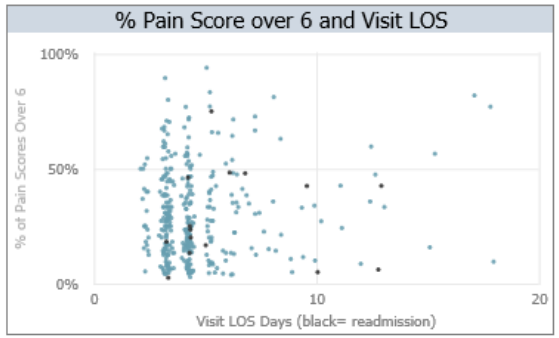
Joel E. Richter,[1] Ambuj Kumar,[2] Seth Lipka,[3] Branko Miladinovic,[2] and Vic Velanovich[4]

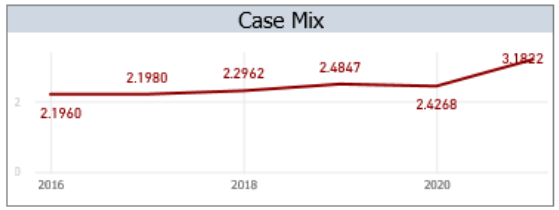


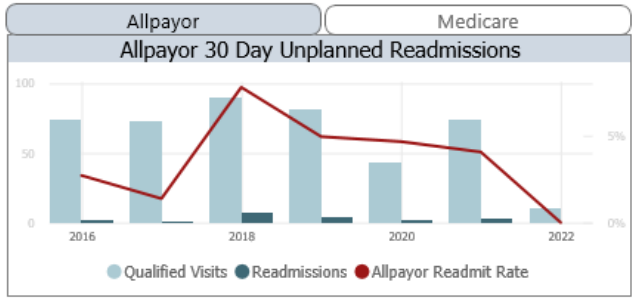
VM Data – Open PEH

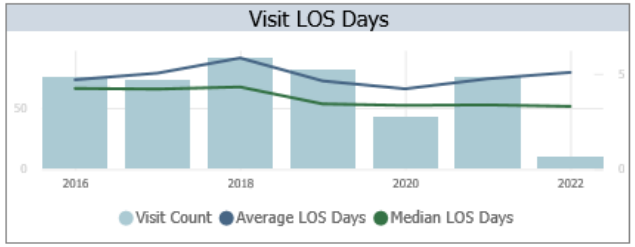
Discharged Visits	CCU Patient Days	Patient Days	CCU Admissions	CCU Readmissions	Ave LOS Days	Med LOS Days	Medicare Readmit	Allpayor Readmit	% Pain > 6	Delerium Pts	Case Mix
449	82.9	2,214.9	31	4	4.9	4.2	6.0%	4.3%	34%	31	2.4245

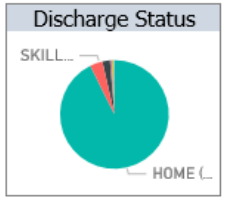


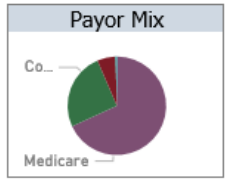


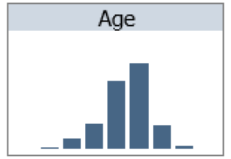


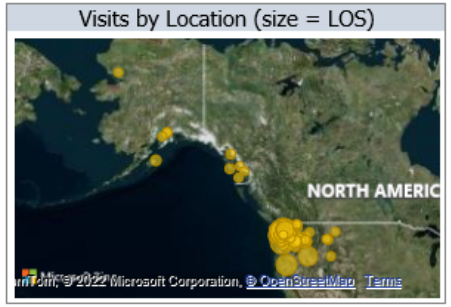


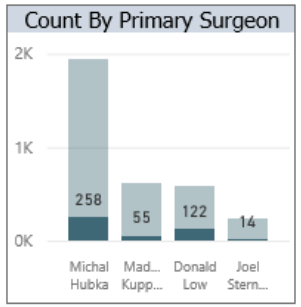


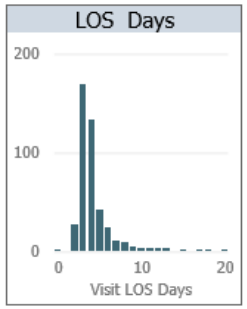


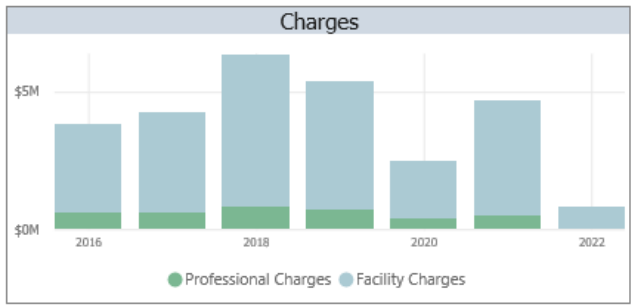


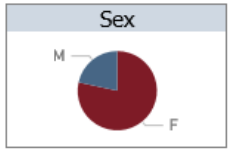


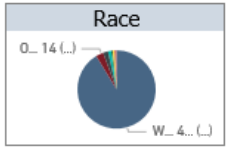












- **449** patients
- Median LOS **4.2 days**
- Readmission rate **4.3 %**
- Dispo **home 92%**

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VM Data Laparoscopic Antireflux/PEH

Discharged Visits	CCU Patient Days	Patient Days	CCU Admissions	CCU Readmissions	Ave LOS Days	Med LOS Days	Medicare Readmit	Allpayor Readmit	% Pain > 6	Delerium Pts	Case Mix
348	9.7	771.9	8	(Blank)	2.2	1.6	4.2%	3.5%	31%	5	2.1650

- **348** patients
- Median LOS **1.6 days**
- Readmission rate **3.5%**
- Dispo **home 99.7%**

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VM Data DaVinci Antireflux/PEH

- **204** patients
- Median LOS 1.5 **days**
- Readmission rate 1.9**%**
- Dispo **home 99.5%**

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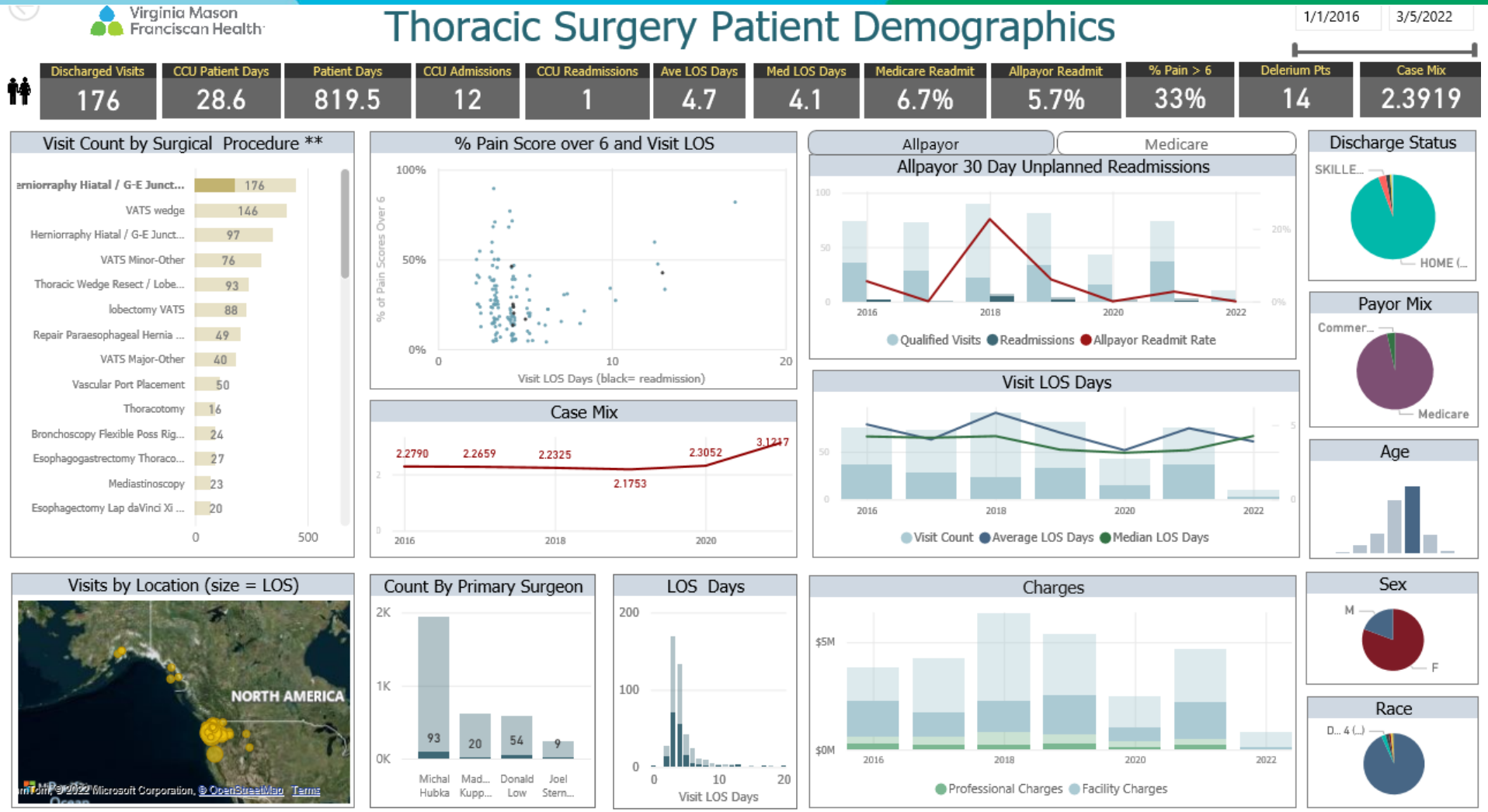
70 yo patient with a Giant PEH



- **176** patients
- Median LOS 4.1 **days**
- Readmission rate 5.7%
- Dispo **home 94%**

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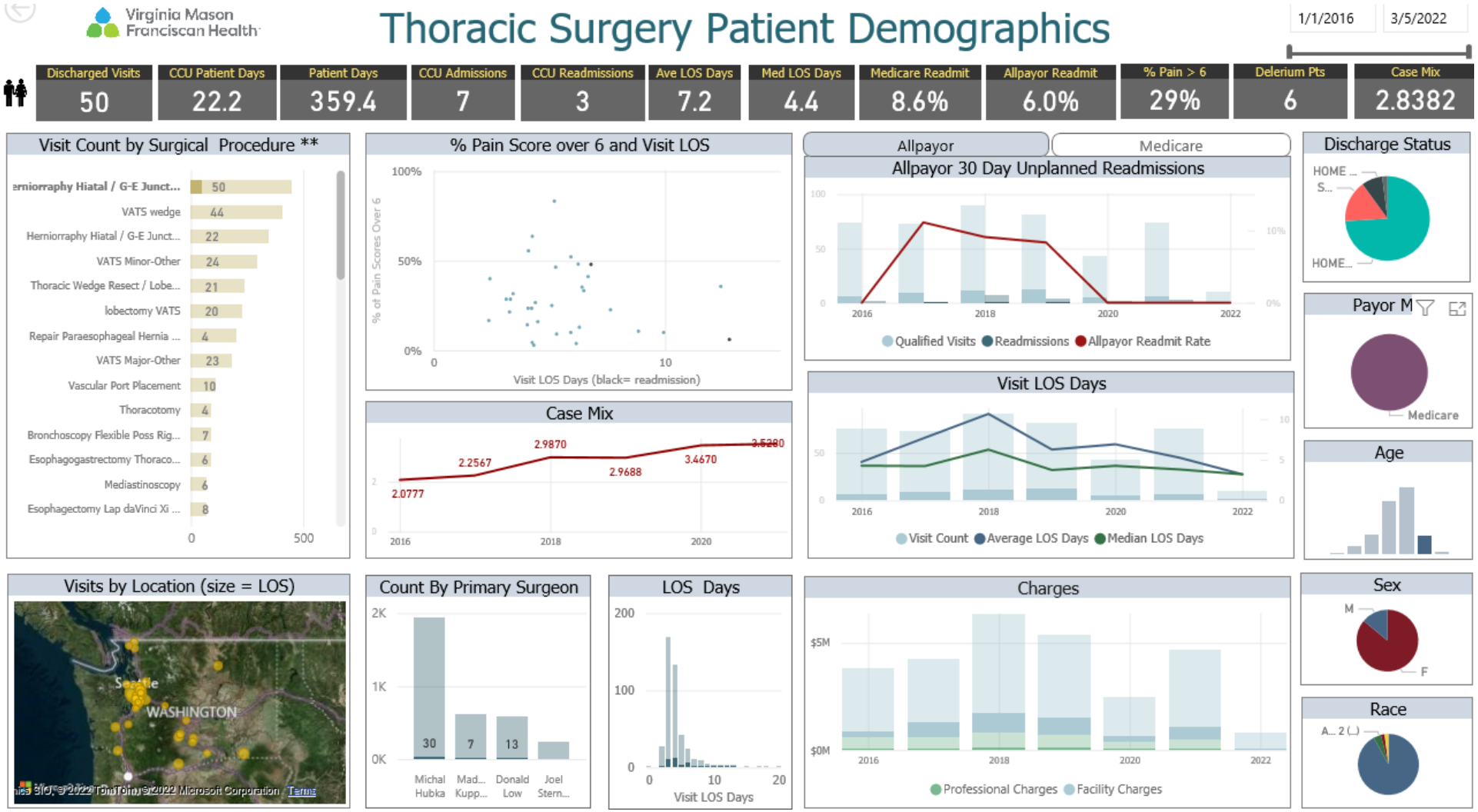
80 yo patient with a Giant PEH



- **50** patients
- Median LOS 4.4 **days**
- Readmission rate 6%
- Dispo **home 74%**

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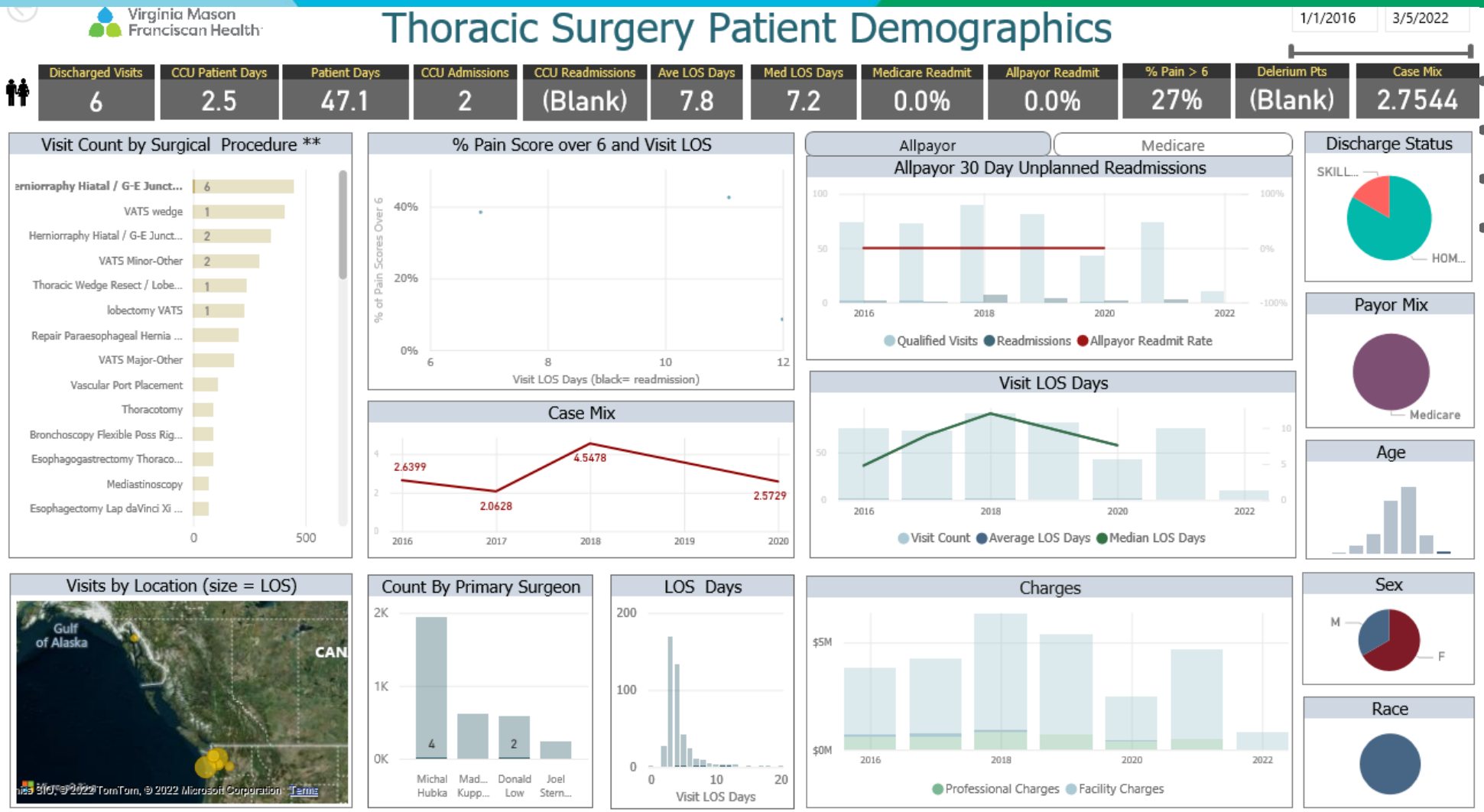
90 yo patient with a Giant PEH



- **6** patients
- Median LOS 7.2 **days**
- Readmission rate 0%
- Dispo **home 83.4%**

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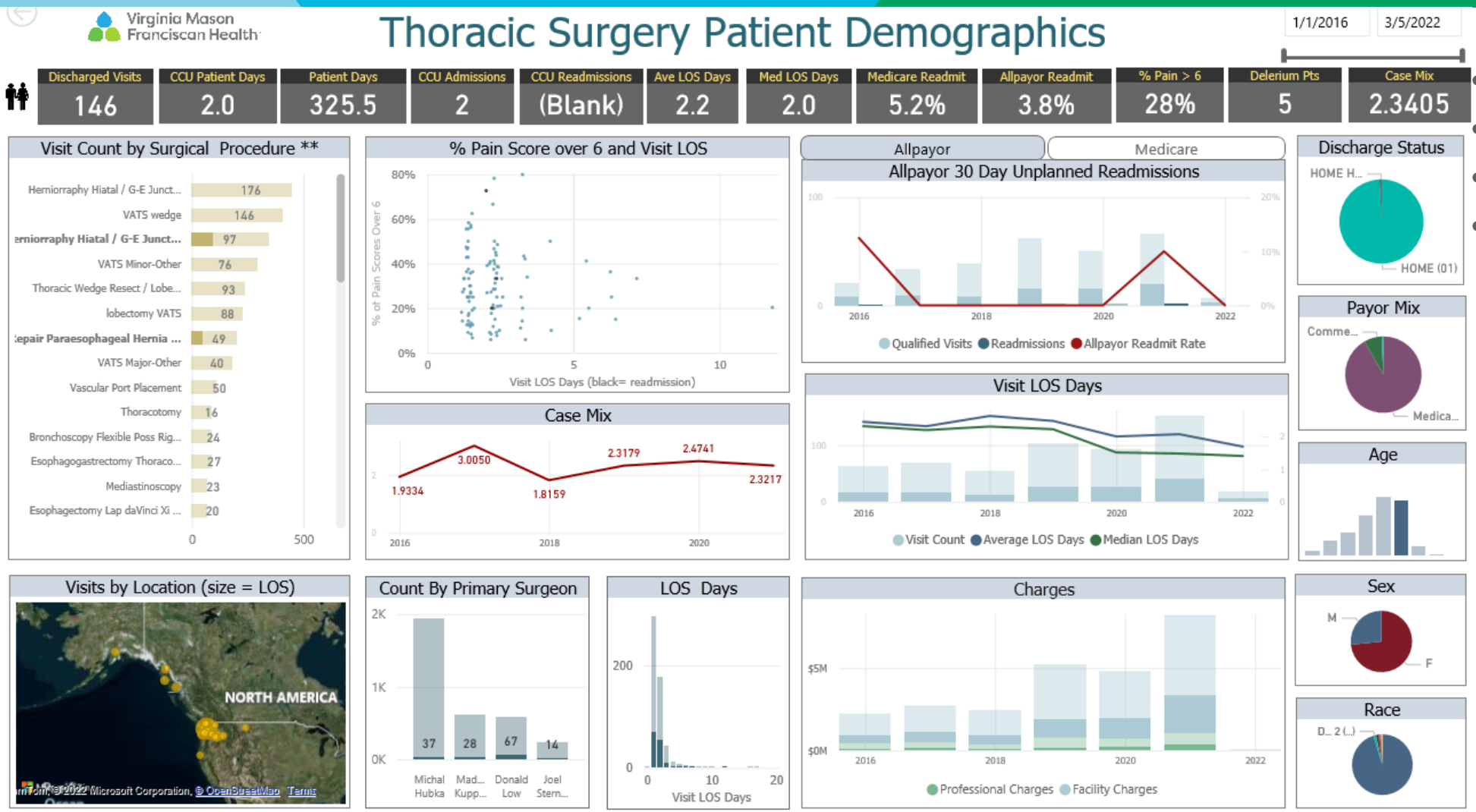
70 yo patient with a small/moderate PEH



- **146** patients
- Median LOS 2.0 **days**
- Readmission rate 3.8%
- Dispo **home 99.3%**

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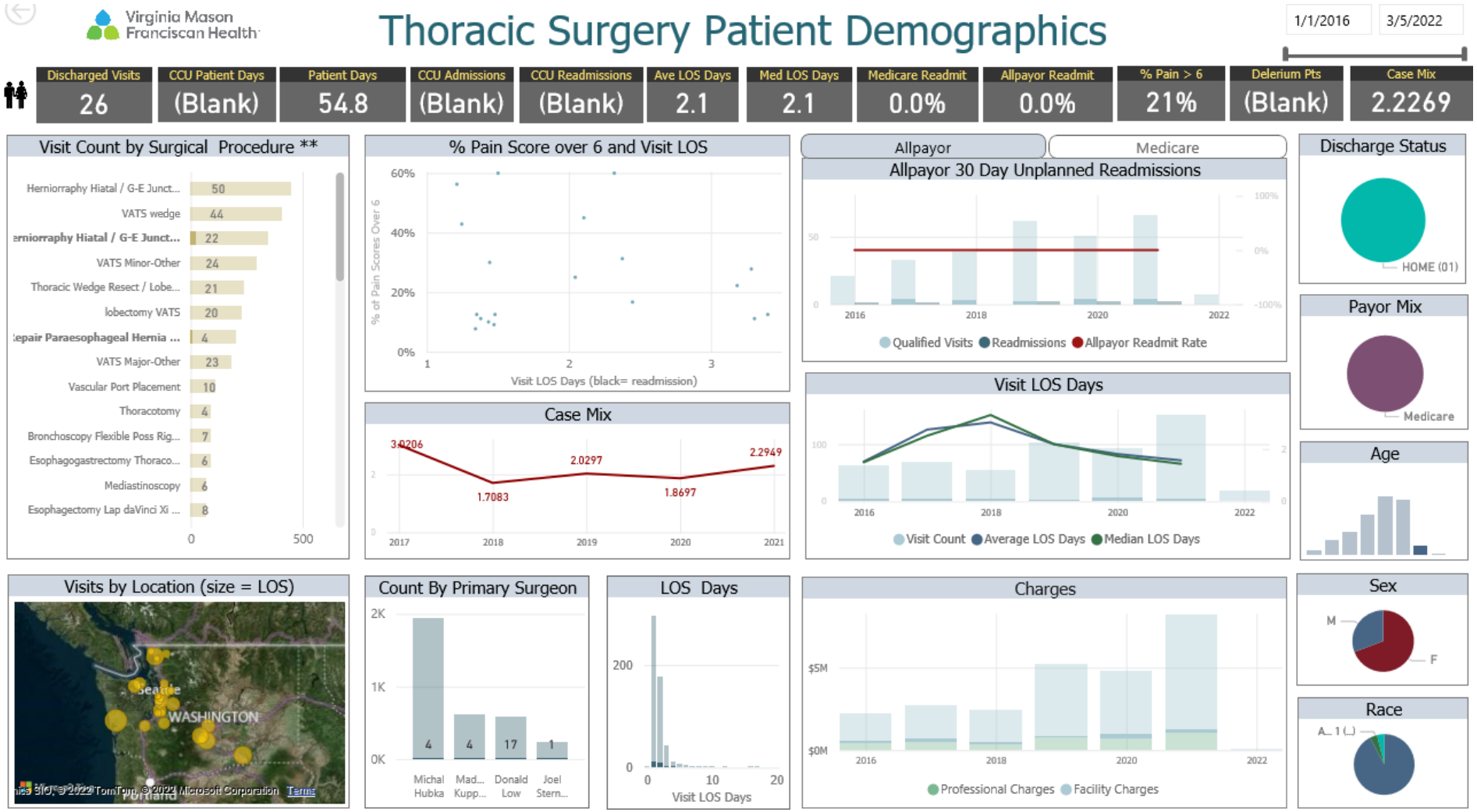
80 yo patient with a small/moderate PEH



- **26** patients
- Median LOS 2.1 **days**
- Readmission rate 0%
- Dispo **home 100%**

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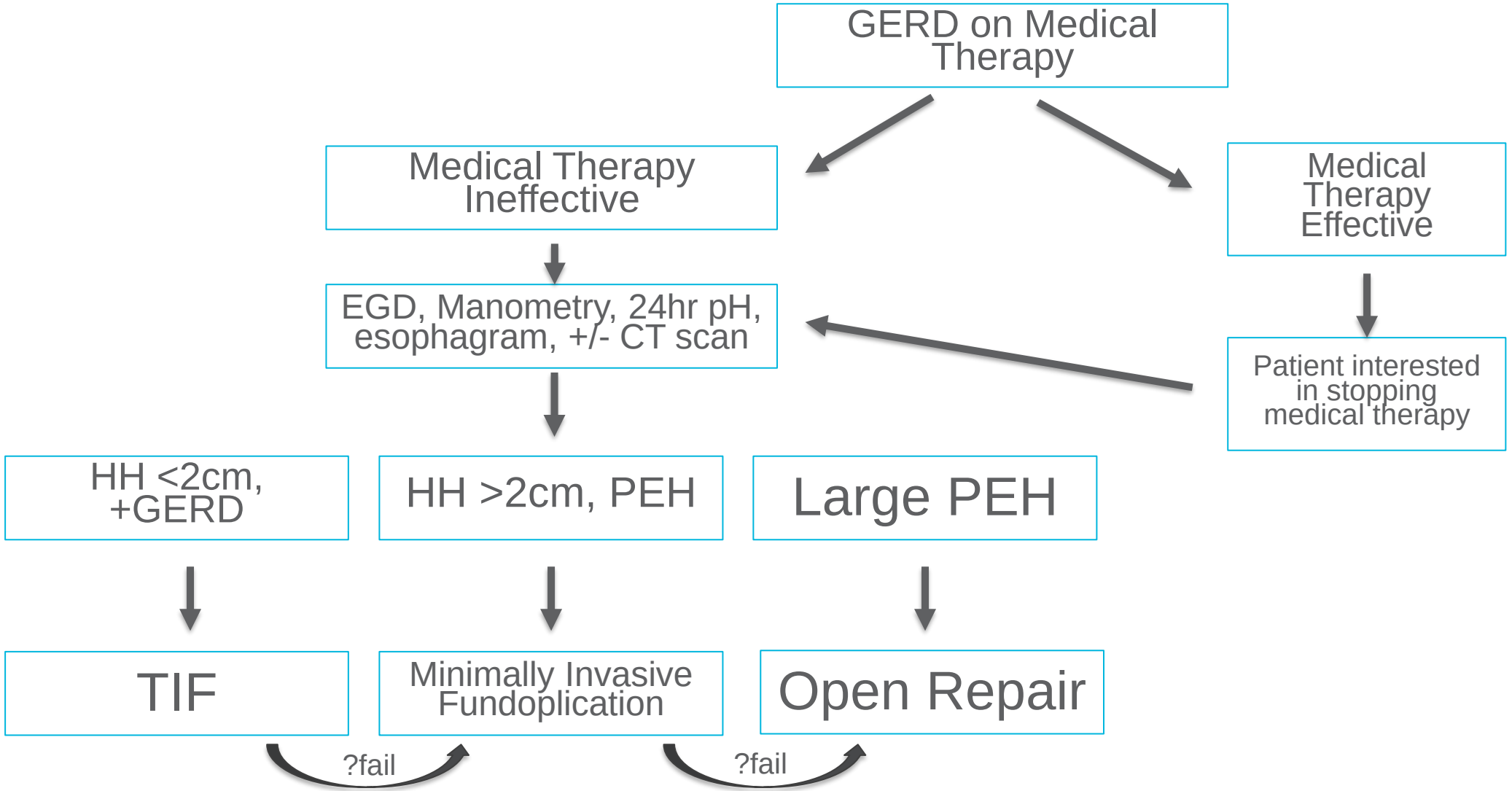
Virginia Mason GERD Treatment Algorithm



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Conclusions

- Multidisciplinary evaluation and shared decision making
- Careful preoperative evaluation of anatomy, physiology and pathology is a MUST!!!
- Minimally invasive approach offers advantages over open surgery in appropriate patients
- Role of endoscopic therapy is evolving
- Barrett's surveillance/endoscopic therapy is mandatory
- Post operative recovery and dietary advancement is extremely important

THANK YOU!