The Endoscope is a Surgical Tool When in the Hands of Surgeons.

Santiago Horgan, M.D.
Professor of Surgery

Chief Division of Minimally Invasive Surgery
Director Bariatric and Metabolic Institute
Vice Chairman Business Development
Director Center For the Future of Surgery
Department of Surgery

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Predicting the future…

"I think there is a world market for about five computers"

Thomas Watson
Chairman IBM, 1943

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Predicting the Future...

"640K ought to be enough for anybody"

Bill Gates (1981)

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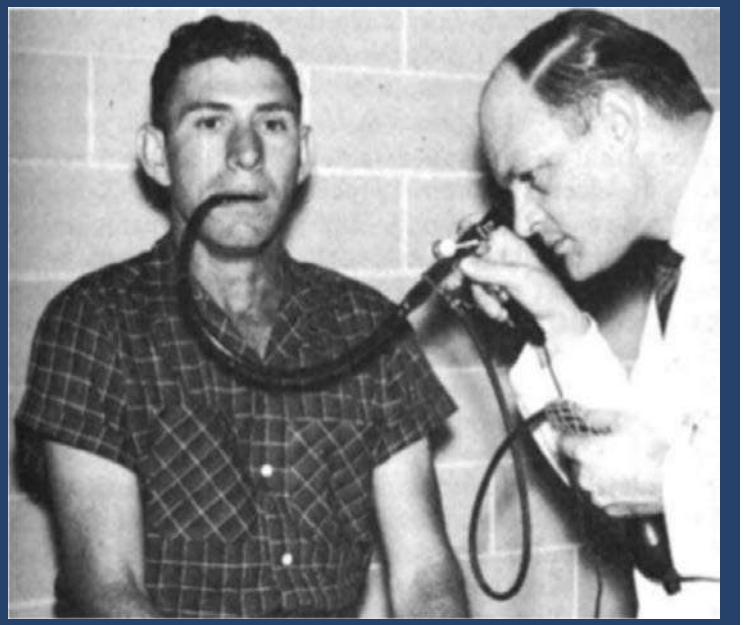
History of Endoscopy

- Desormeaux (1853) coined term “endoscope”
  - first use of Bozzini’s “lichtleiter” in a patient
  - later used metallic tube illuminated by gasogene lamp
- Kussmaul (1868)
  - first successful gastroscopy
- Leiter (1881)
  - esophagoscope with oil lamp
- Kelly (1895) - sigmoidoscope
- Chevalier Jackson (1907) -American surgeon
  - foreign body removal
- Rudolf Schindler (1937)
  - developed semi-flexible endoscope
- Basil Hirschowitz (1957)
  - fiberoptic endoscope

Kelly,



Hirschowitz,
1957

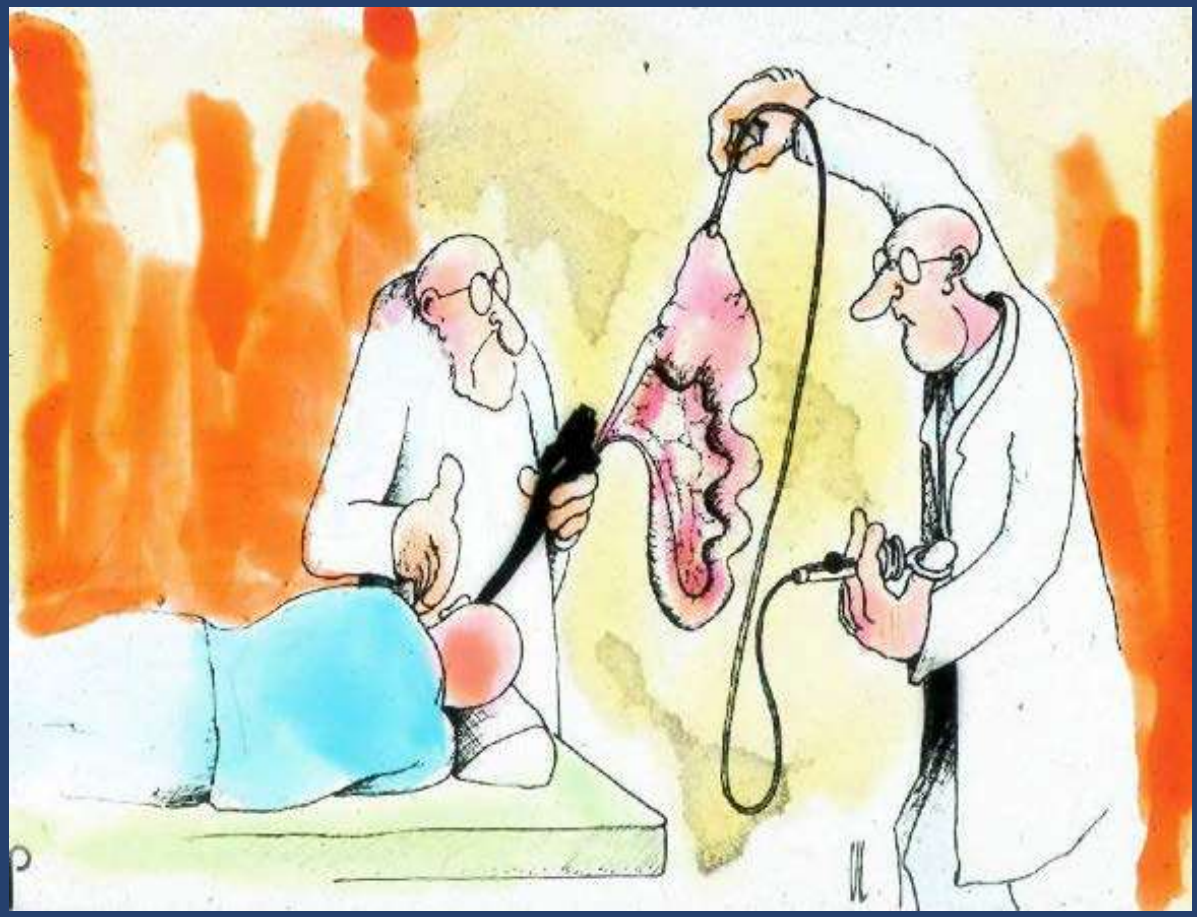
History of Flexible Endoscopy

Role of Surgeons

- Endoscopic Retrograde Choleangiopancreatography
- Colonoscopic polypectomy
- Percutaneous Endoscopic Gastrostomy
- Variceal banding

- Endoscopic GERD therapy ?
- Endoscopic bariatric procedure ?
- Translumenal surgery ?

- NOTES 2005



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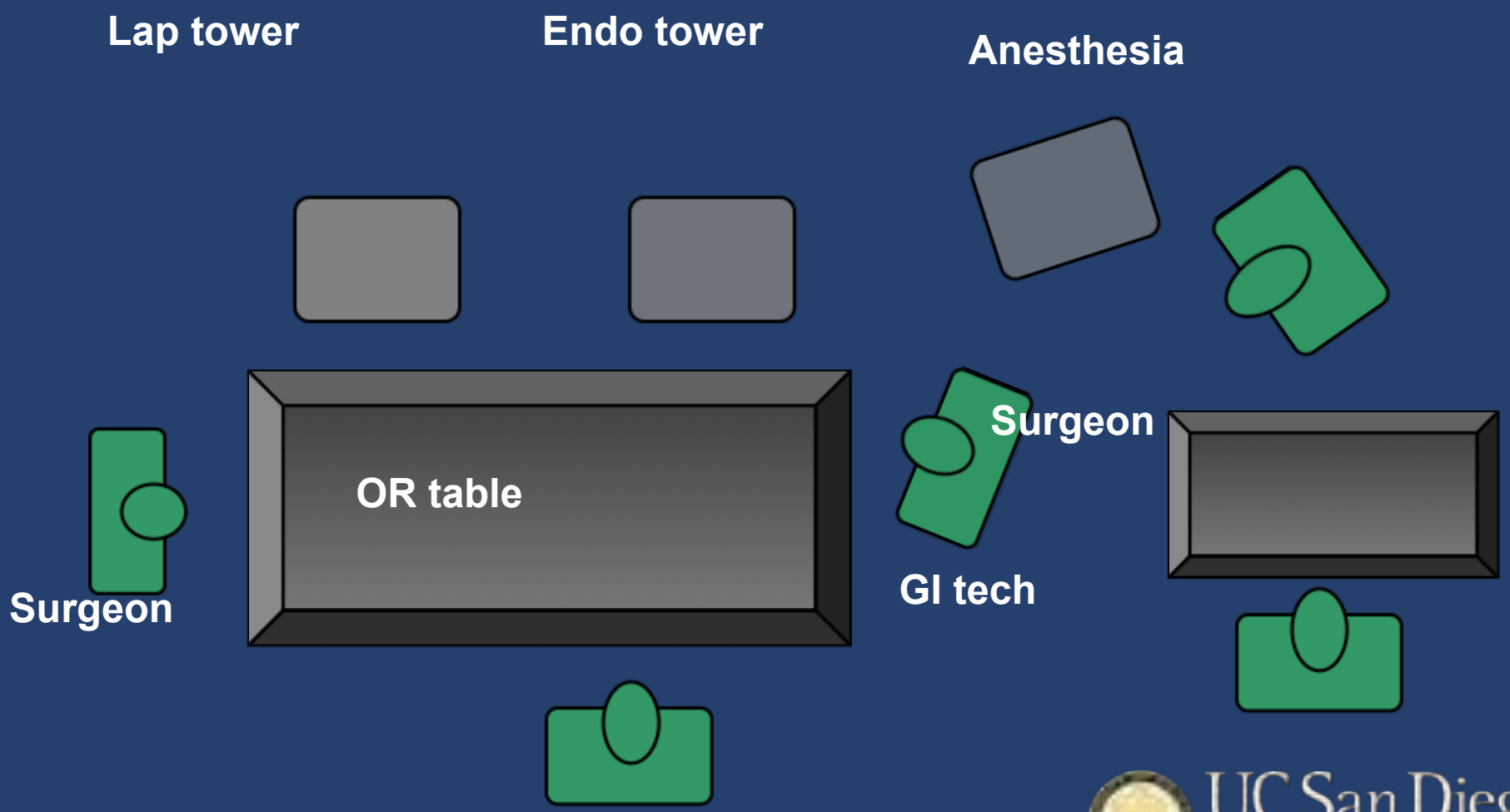
The reasons for NOTES

- Less pain
- No infections
- The concept that technological advancements will help in improving trauma and discomfort of surgery
- Improved cosmetic appearance

Operating Room Setup



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NOTES

Surg Endosc. 2009 Aug;23(8):1900. doi: 10.1007/s00464-009-0471-x. Epub 2009 May 9.

Video. NOTES: transvaginal cholecystectomy with assisting articulating instruments.

Horgan S[1], Mintz Y, Jacobsen GR, Sandler BJ, Cullen JP, Spivack A, Easter DW, Chock A, Savu MK, Ramamoorthy S, Bosia J, Agarwal S, Lukacz E, Whitcomb E, Savides T, Talamini MA.

Surg Endosc. 2014 Feb;28(2):484-91. doi: 10.1007/s00464-013-3227-6. Epub 2013 Oct 23.

Transvaginal organ extraction: potential for broad clinical application.

Jacobsen GR[1], Barajas-Gamboa JS, Coker AM, Cheverie J, Macias CA, Sandler BJ, Talamini MA, Horgan S.

Surg Endosc. 2008 Aug;22(8):1798-802. doi: 10.1007/s00464-008-9915-y. Epub 2008 Apr 25.

Hybrid natural orifice translumenal surgery (NOTES) sleeve gastrectomy: a feasibility study using an animal model.

Mintz Y[1], Horgan S, Savu MK, Cullen J, Chock A, Ramamoorthy S, Easter DW, Talamini MA.

Surg Endosc. 2010 Jan;24(1):16-20. doi: 10.1007/s00464-009-0559-3. Epub 2009 Jun 24.

The impact of proton-pump inhibitors on intraperitoneal sepsis: a word of caution for transgastric NOTES procedures.

Ramamoorthy SL[1], Lee JK, Mintz Y, Cullen J, Savu MK, Easter DW, Chock A, Mittal R, Horgan S, Talamini MA.

Surg Obes Relat Dis. 2009 Sep-Oct;5(5):633-6. doi: 10.1016/j.soard.2009.04.015. Epub 2009 May 9.

NOTES laparoscopic-assisted transvaginal sleeve gastrectomy in humans--description of preliminary experience in the United States.

Fischer LJ[1], Jacobsen G, Wong B, Thompson K, Bosia J, Talamini M, Horgan S.

Surg Endosc. 2011 Feb;25(2):586-92. doi: 10.1007/s00464-010-1225-5. Epub 2010 Aug 24.

Clinical experience with a multifunctional, flexible surgery system for endolumenal, single-port, and NOTES procedures.

Horgan S[1], Thompson K, Talamini M, Ferreres A, Jacobsen G, Spaun G, Cullen J, Swanstrom L.

J Laparoendosc Adv Surg Tech A. 2008 Aug;18(4):583-7. doi: 10.1089/lap.2007.0153.

NOTES: a review of the technical problems encountered and their solutions.

Mintz Y[1], Horgan S, Cullen J, Stuart D, Falor E, Talamini MA.

Harefuah. 2008 Oct;147(10):792-6, 837-8.

[Natural orifice trans-luminal endoscopic surgery (notes)--a new era in general surgery].

[Article in Hebrew]

Elazary R[1], Horgan S, Talamini MA, Rivkind AI, Mintz Y.

Surg Endosc. 2010 Mar;24(3):531-5. doi: 10.1007/s00464-009-0636-7. Epub 2009 Aug 18.

The inflammatory response in transgastric surgery: gastric content leak leads to localized inflammatory response and higher adhesive disease.

Ramamoorthy SL[1], Lee JK, Luo L, Mintz Y, Cullen J, Easter DW, Savu MK, Chock A, Carethers J, Horgan S, Talamini MA.

Surg Endosc. 2013 Feb;27(2):394-9. doi: 10.1007/s00464-012-2473-3. Epub 2012 Jul 18.

Transgastric large-organ extraction: the initial human experience.

Dotai T[1], Coker AM, Antozzi L, Acosta G, Michelotti M, Bildzukewicz N, Sandler BJ, Jacobsen GR, Talamini MA, Horgan S.

J Laparoendosc Adv Surg Tech A. 2007 Aug;17(4):402-6.

NOTES: the hybrid technique.

Mintz Y[1], Horgan S, Cullen J, Ramamoorthy S, Chock A, Savu MK, Easter DW, Talamini MA.

Surg Endosc. 2009 Jul;23(7):1512-8. doi: 10.1007/s00464-009-0428-0. Epub 2009 Apr 3.

Natural orifice surgery: initial clinical experience.

Horgan S[1], Cullen JP, Talamini MA, Mintz Y, Ferreres A, Jacobsen GR, Sandler B, Bosia J, Savides T, Easter DW, Savu MK, Ramamoorthy SL, Whitcomb E, Agarwal S, Lukacz E, Dominguez G, Ferraina P.

Surg Endosc. 2009 Aug;23(8):1770-4. doi: 10.1007/s00464-008-0206-4. Epub 2008 Dec 5.

Women's positive perception of transvaginal NOTES surgery.

Peterson CY[1], Ramamoorthy S, Andrews B, Horgan S, Talamini M, Chock A.

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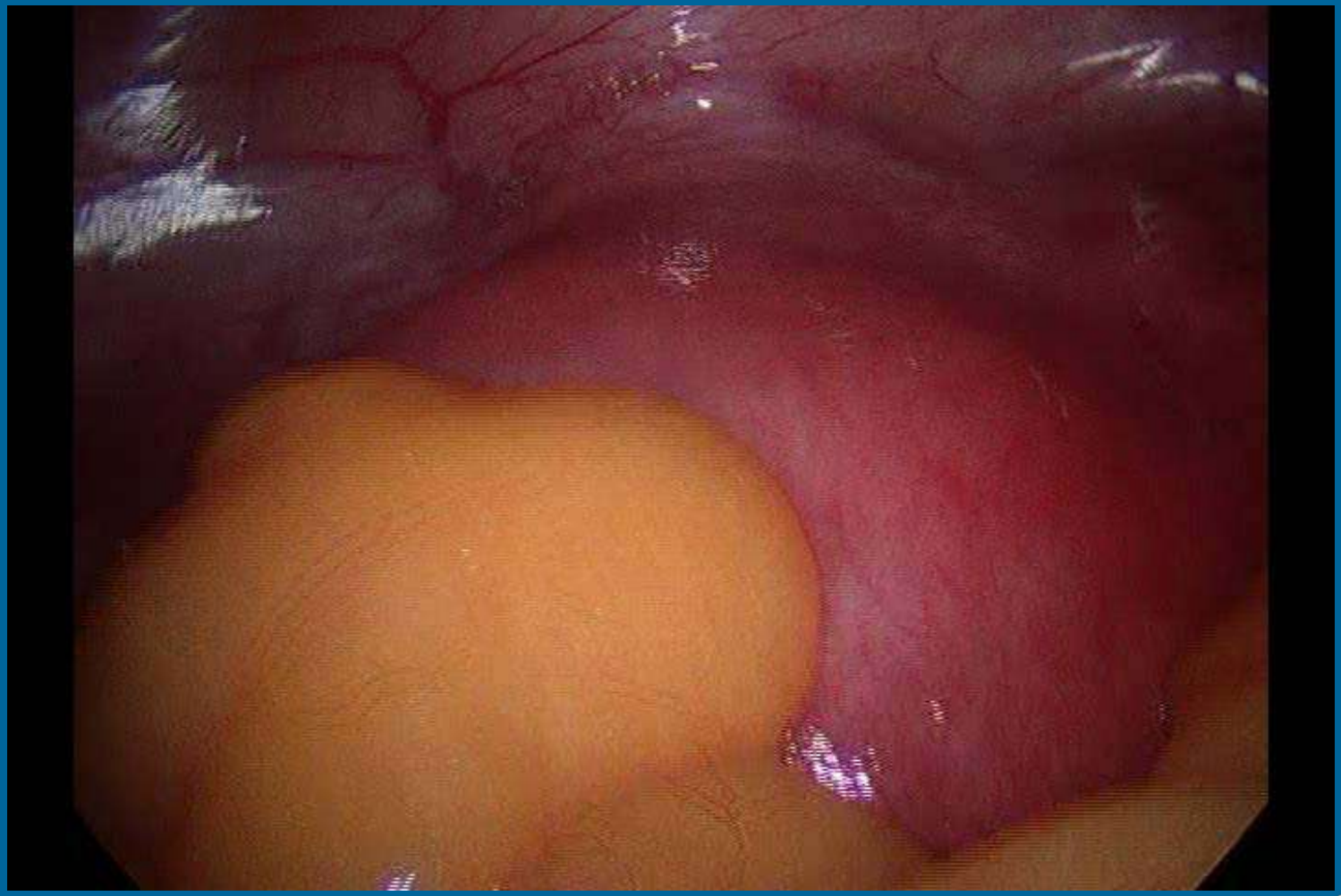
Transvaginal access



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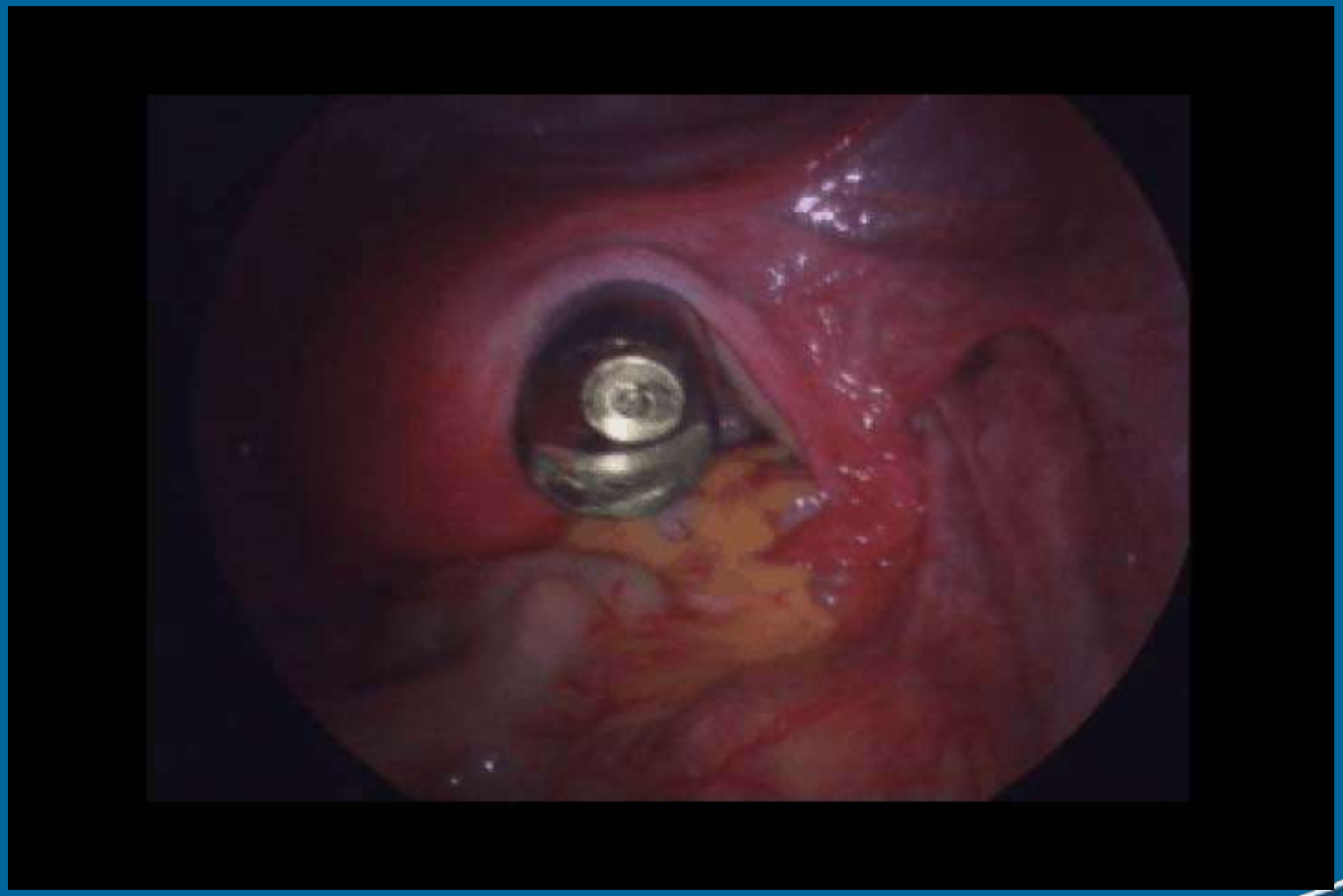
Retraction



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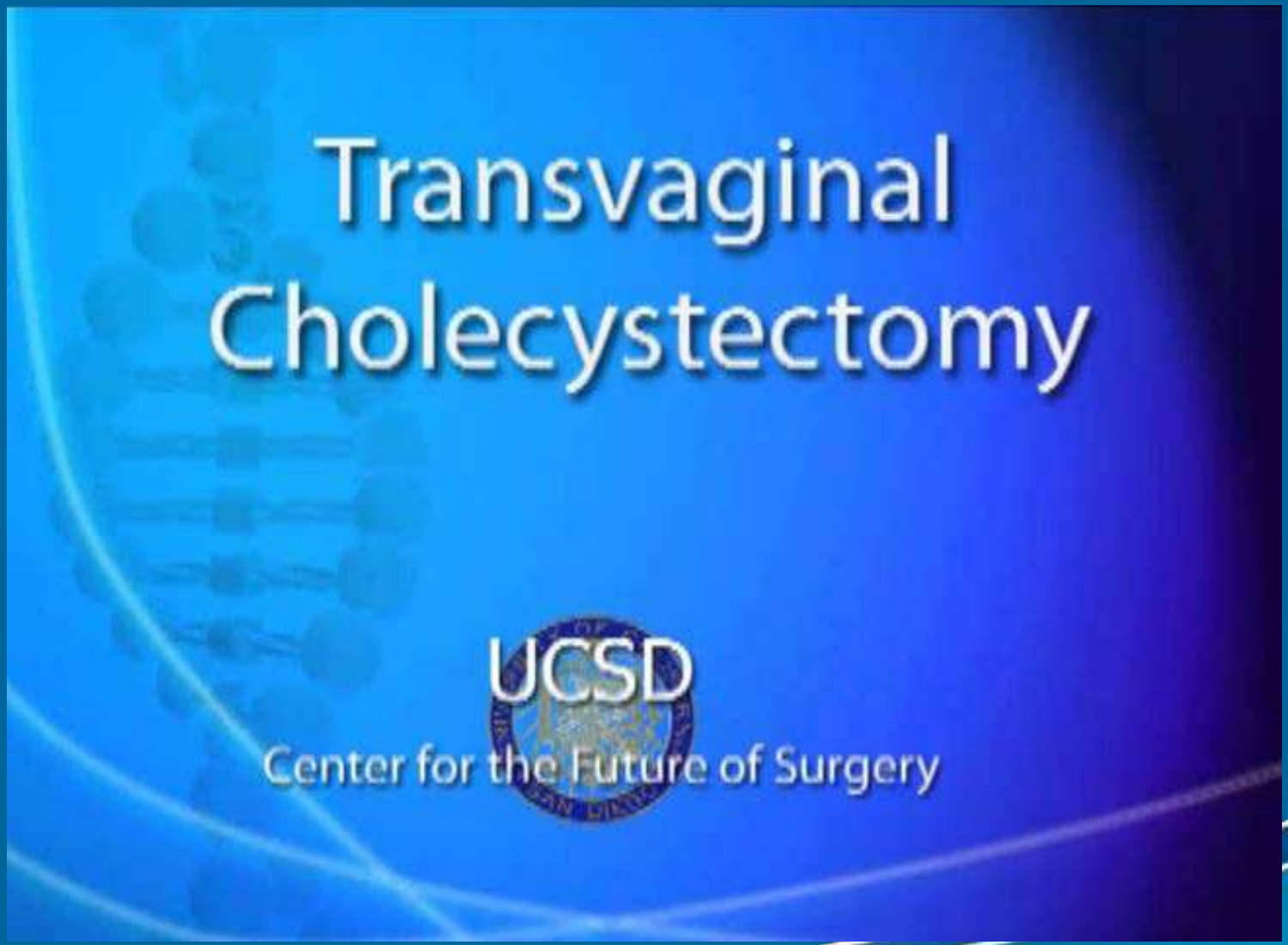
Transvaginal cholecystectomy



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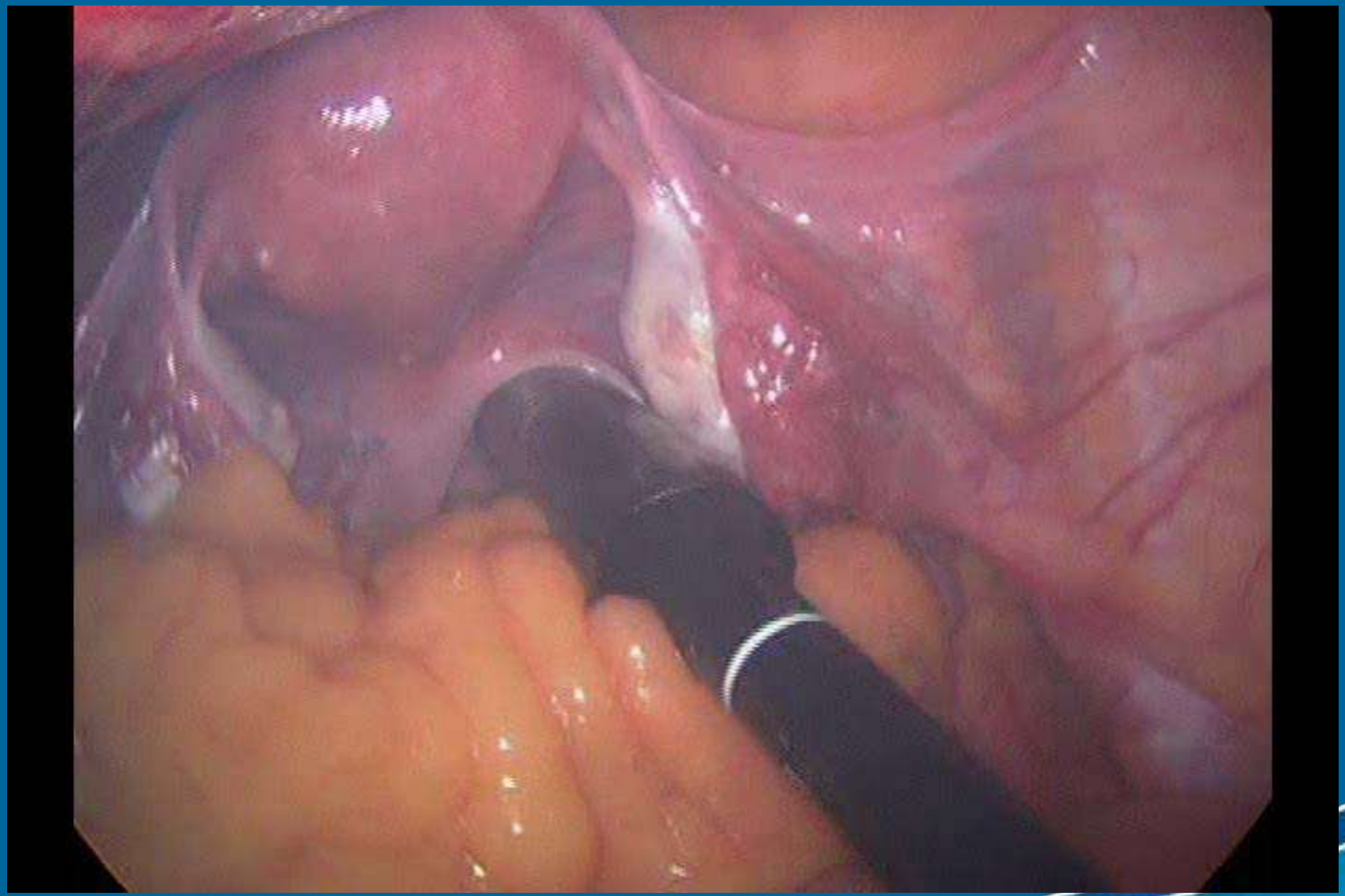
Removal



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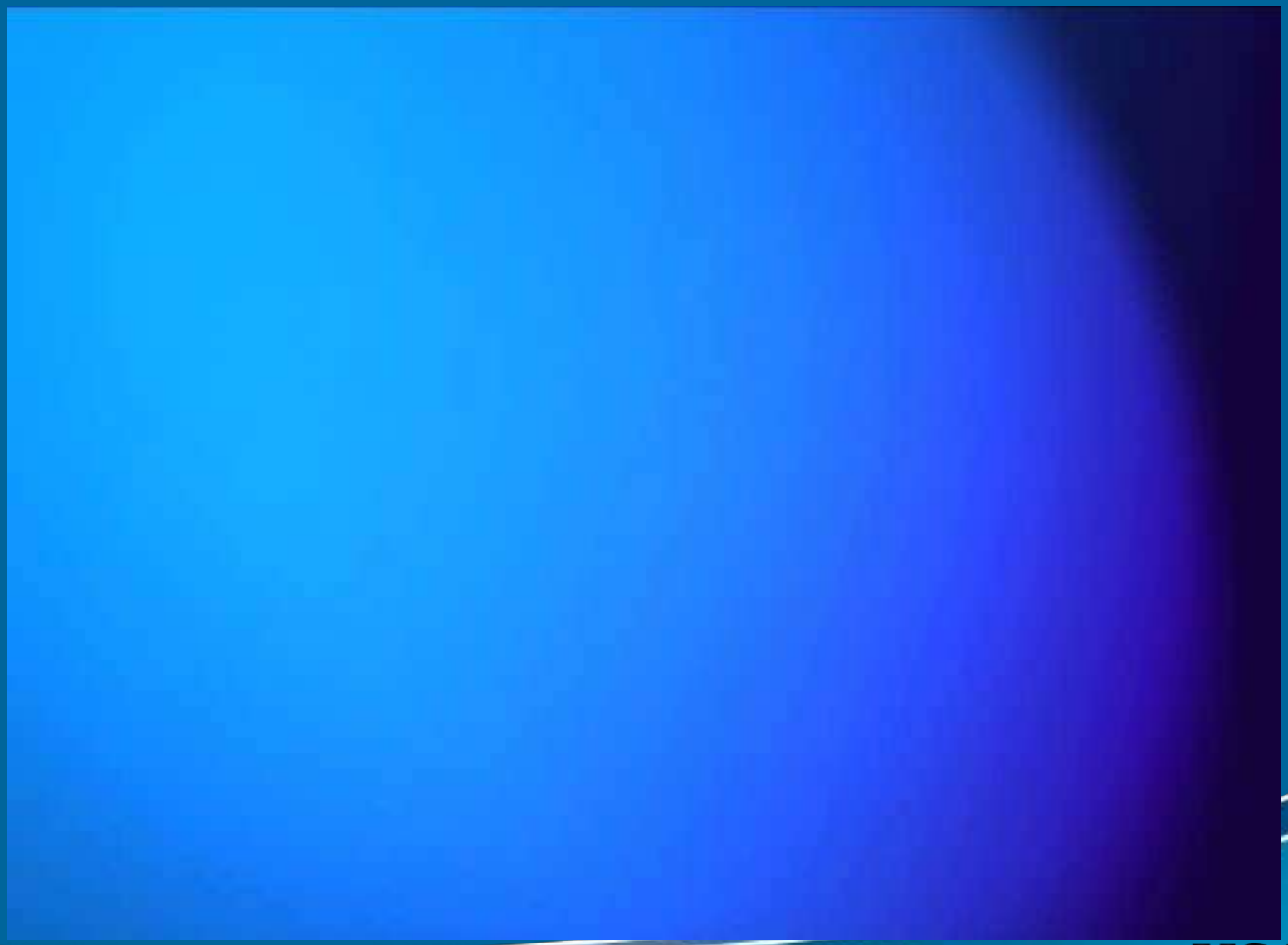
Post op



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Transgastric set-up

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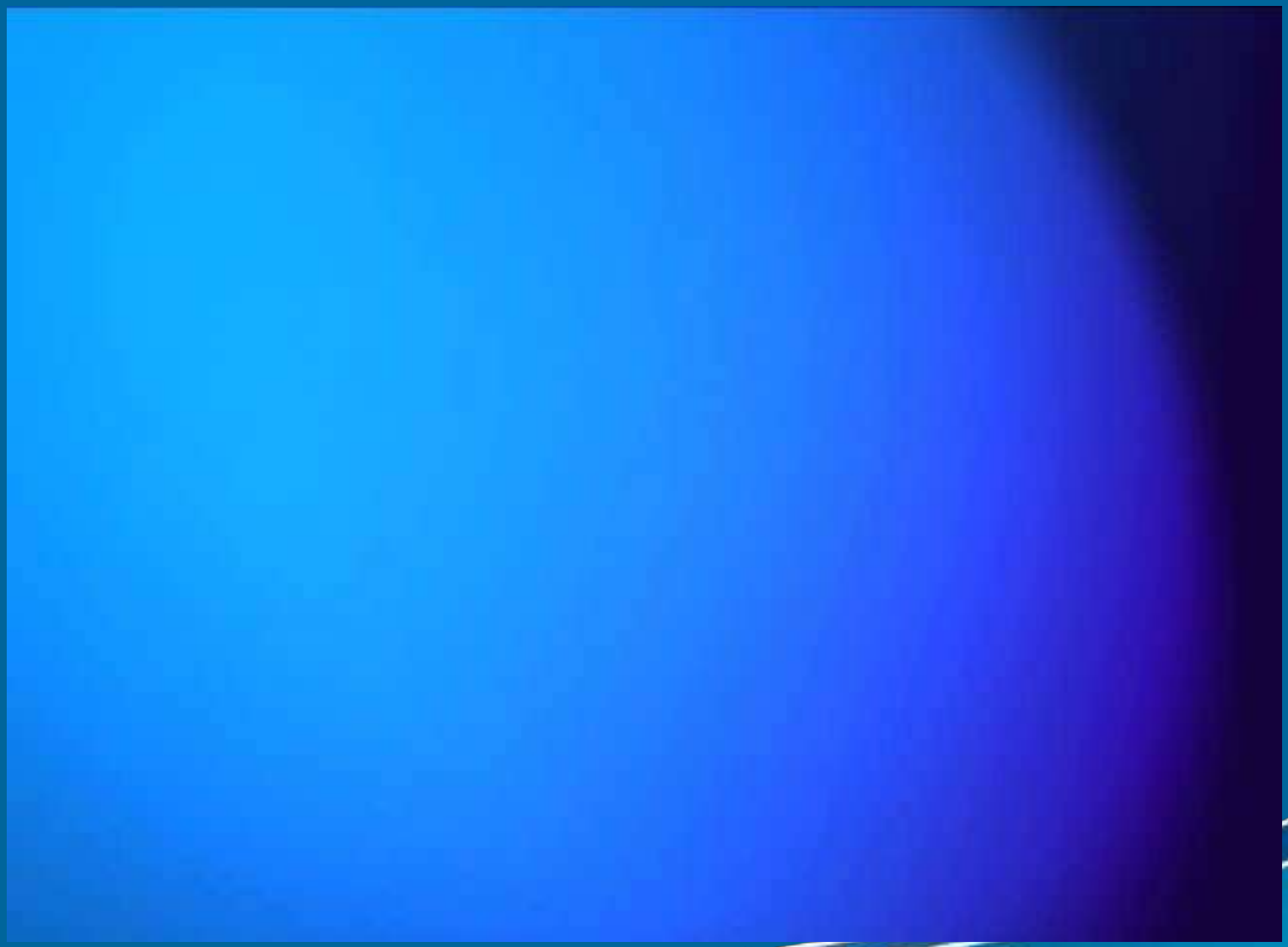
Transgastric appendectomy



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Transgastric cholecystectomy

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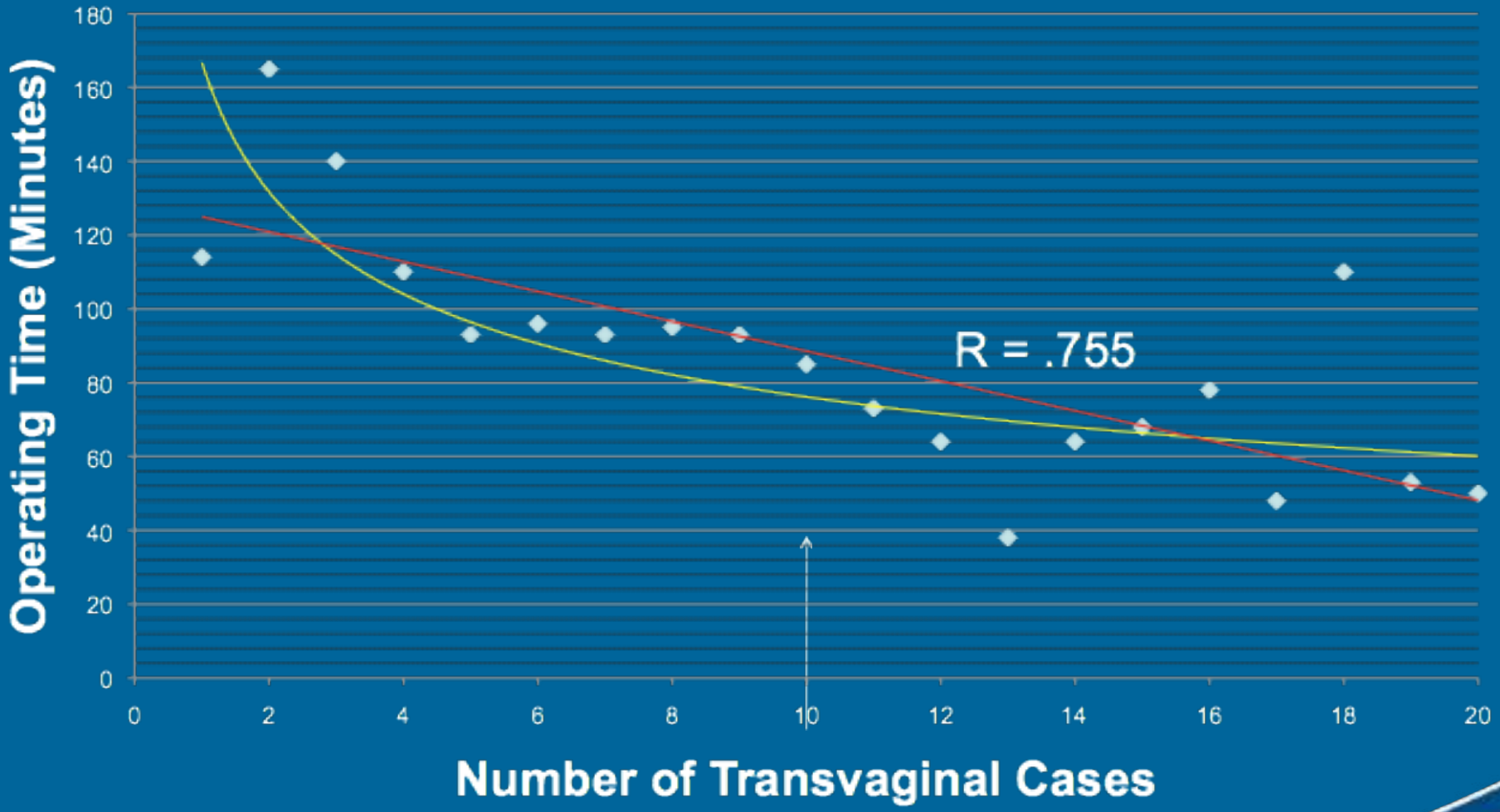
Learning curve



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NOTES
TRANSORAL REMNANT EXTRACTION (TORE) FOR SLEEVE GASTRECTOMY

Sheetal Nijhawan, MD
Saniea Majid, MD
Toshio Katagiri, MD
Takayuki Dotai, MD
Bryan Sandler, MD
Garth Jacobsen, MD
Michael Sedrak, MD
Alan Wittgrove, MD
Mark Talamini, MD
Santiago Horgan, MD

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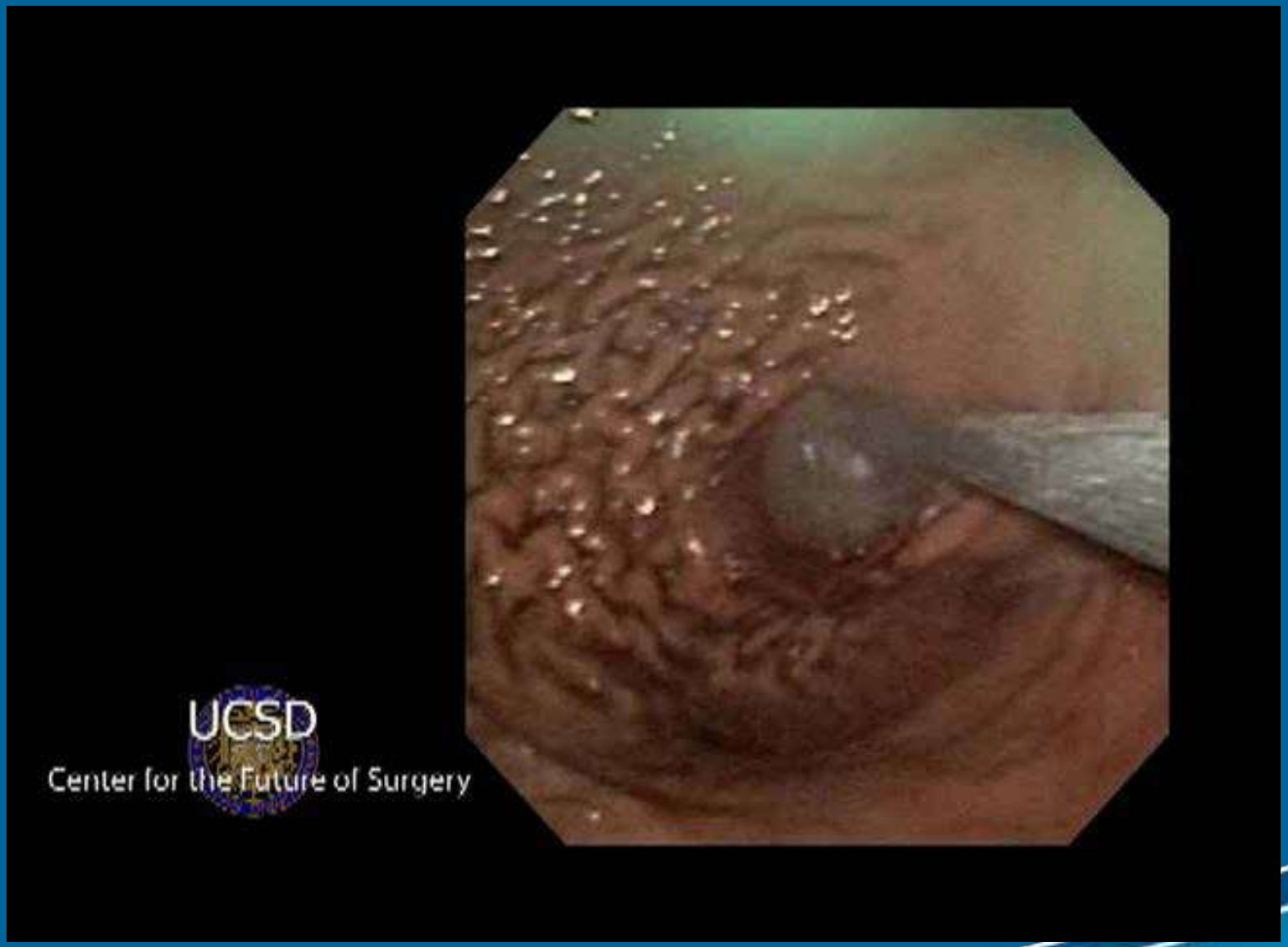
Gastric Closure



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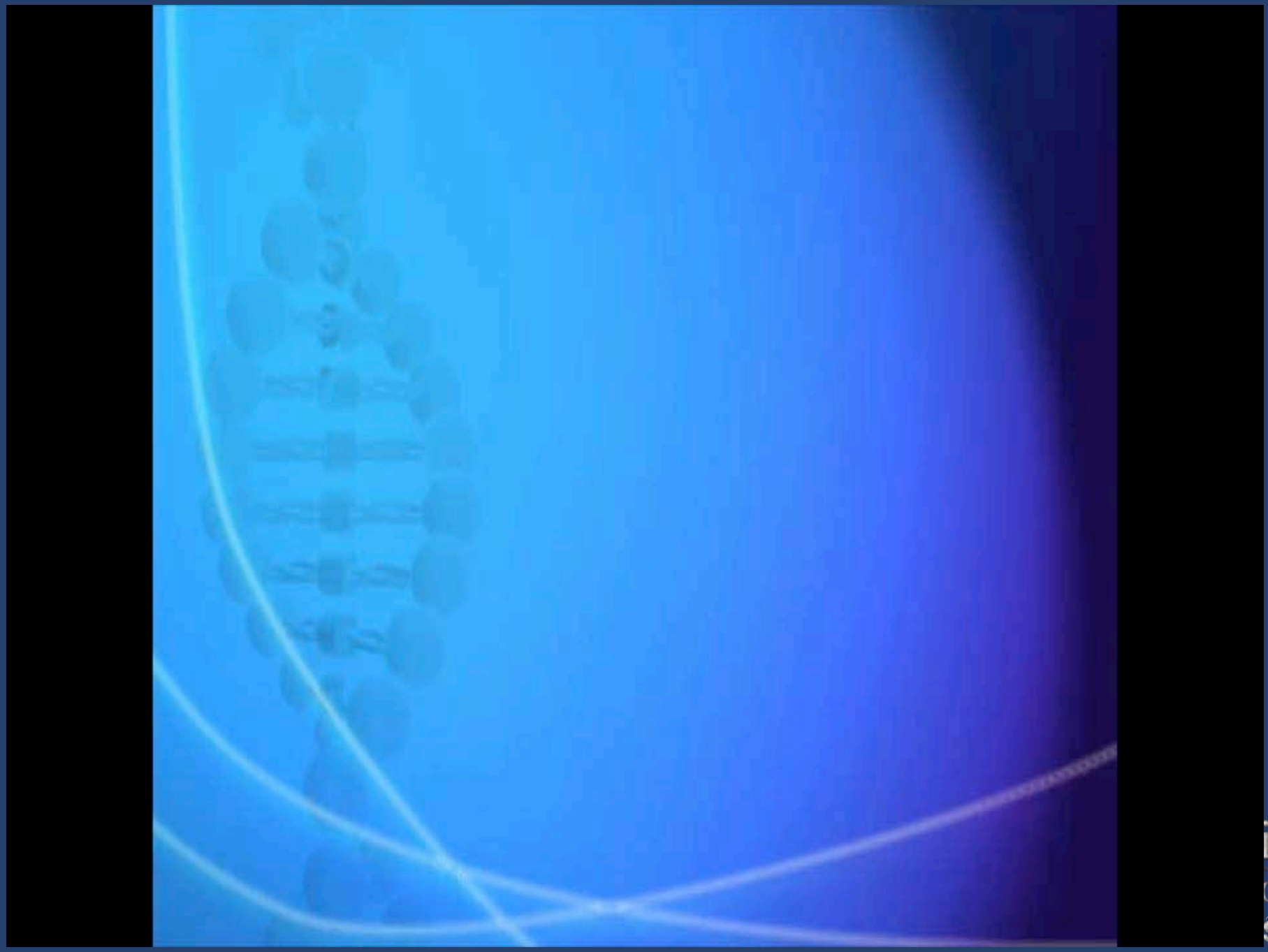
Intragastric surgery



Laparo-endoscopic Transgastric Resection of GIST

- 14 patients total
- Conclusions:
- Progress is still needed to push the envelope in the care of cancer patients
- Minimally invasive surgical approaches are emerging as a valid and potentially better approach for resecting malignancies
- Advancing surgical techniques with new approaches such as laparo-endoscopy may limit surgical trauma while meeting oncologic standards

	Number	Percent (%)
Operative time (min)		
Mean	84.1 ± 33.9	
Median	80	
Range	35-167	
Estimated blood loss (ml)		
Mean	20 ± 12.8	
Median	20	
Range	5-50	
Length of postoperative hospital stay (days)		
Mean	1.8 ± 1.5	
Median	1	
Range	1-6	
Patients with Intra-Operation Complication		
Yes	0	0
No	14	100
Reoperation		
Yes	0	0
No	14	100
Patients with Post-Operation Complication		
Bleed at resection site/hematemesis	2	14.3
Nausea	3	21.4
Abdominal Pain	2	14.3
Other (Urinary retention)	1	7.1
30-day mortality		
Yes	0	0
No	14	100

Treatment of Achalasia
Evolution of the Technique

- Open Surgery: 1990
- Thoracoscopic/Laparoscopic Surgery: 1995
- Robotic Surgery: 2000
- POEM 2010: First USA site to perform POEM

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The Steps And Outcome Of Trans Esophageal Endoscopic Myotomy (TEEM)

Takayuki Dotai MD
Toshio Katagiri MD
Sheetal Nijhawan MD
Saniea Majid MD
Ozanan Meireles MD
Michael Sedrak MD
Abraham Mathew MD
Bryan Sandler MD
Garth Jacobsen MD
Mark Talamini MD
Santiago Horgan MD

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Results

- 110 patients

- Hospital stay: 2 days per protocol
- Pain: minimal

- OR time: 60 minutes (50 -80

- Manometric findings:
  - LES preop: 35 mmHg
  - LES post op: 8 mmHg

ACES
articulated circular endoscopic stapler

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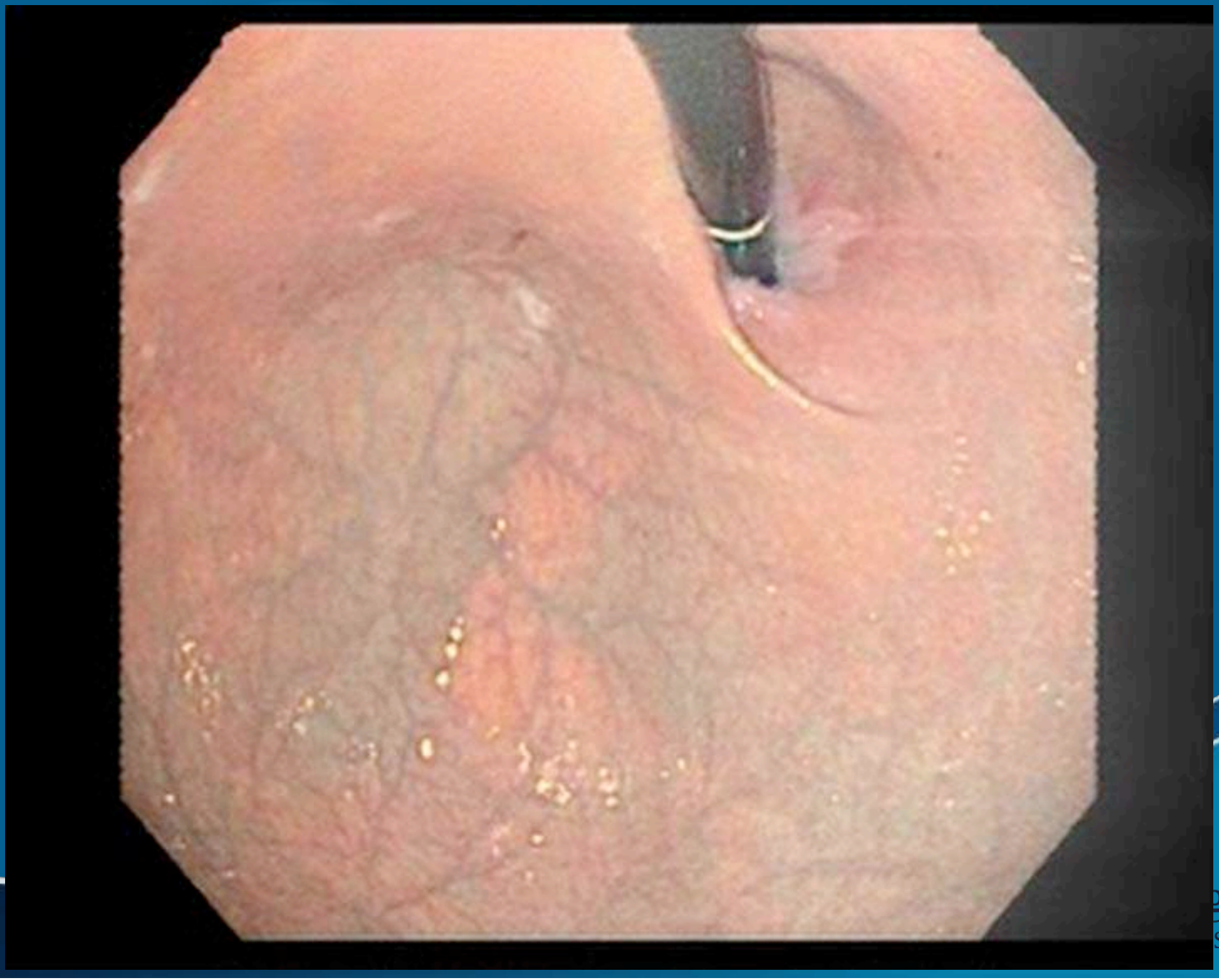

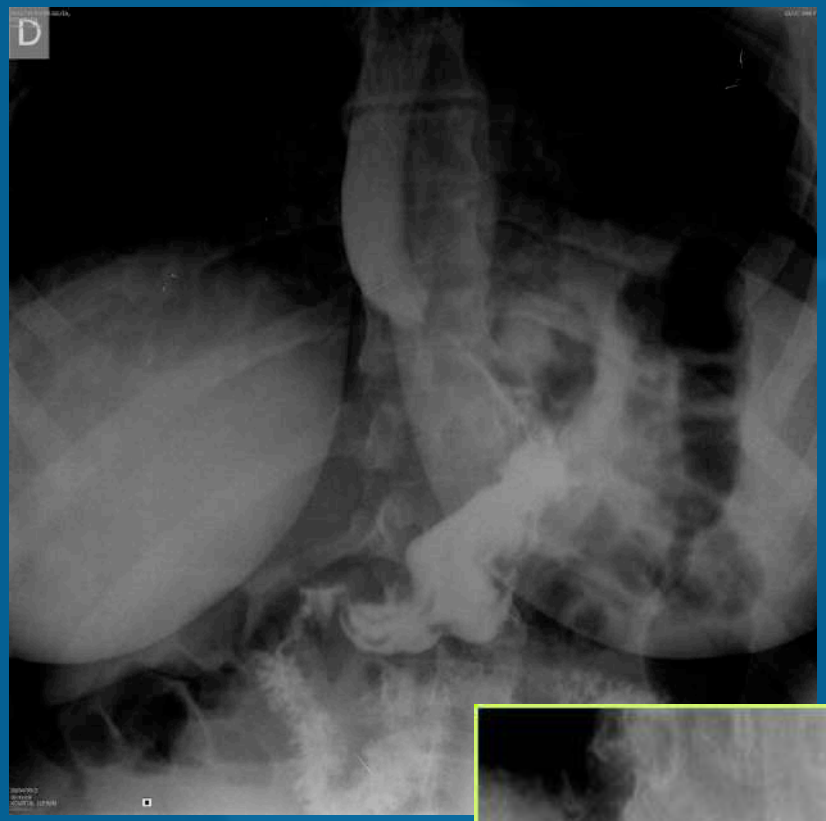

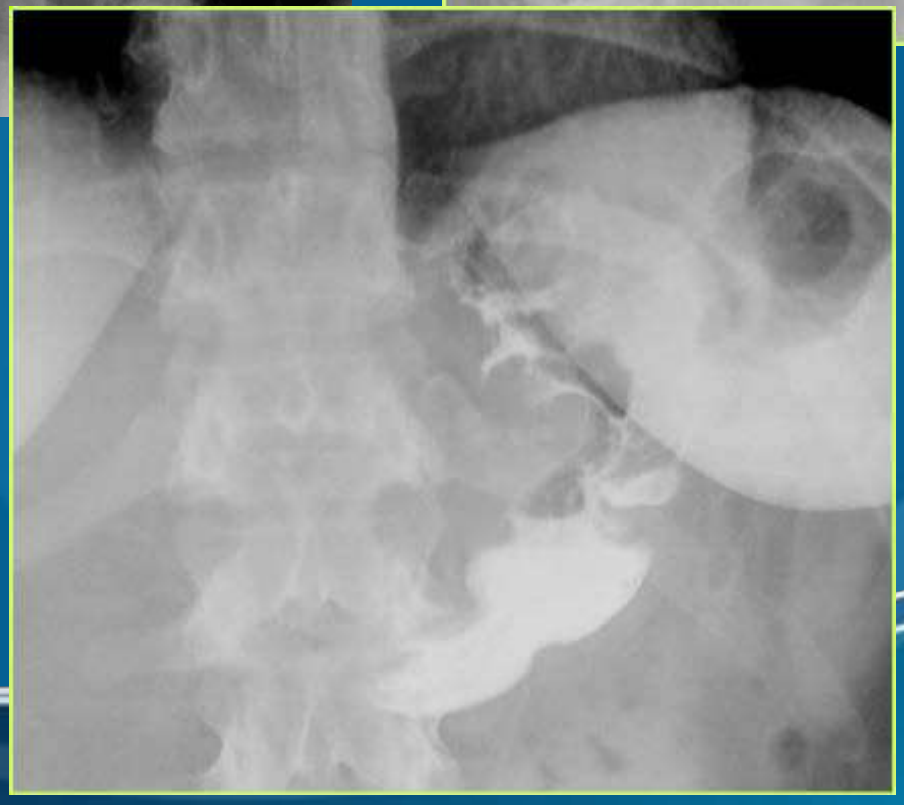

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Results

Weight loss

Follow up	# patients	Mean % EWL	Mean % Total Weight loss (kg)
7 days	21	13.8	4.9
1 month	17	21.0	7.5
2 months	15	24.6	9.2
3 months	10	28.4	11.2
6 months	21	30	12
9 months	10	31	13

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Endoluminal Bypass

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Endoscopic, Endolumenal Bypass

- Fully endoscopic, trans-oral endolumenal procedure

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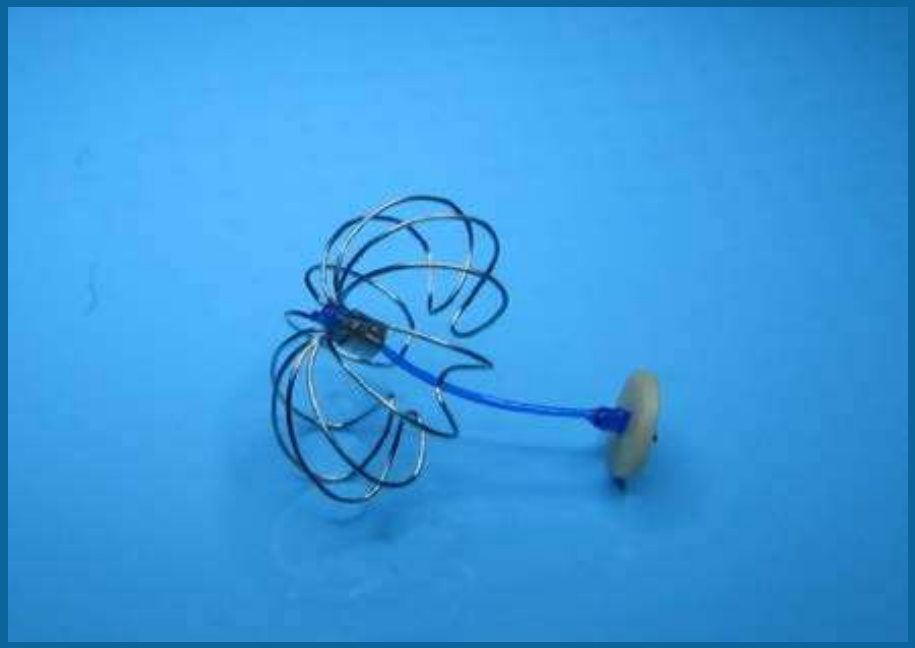
Endoscopic, Endolumenal Bypass



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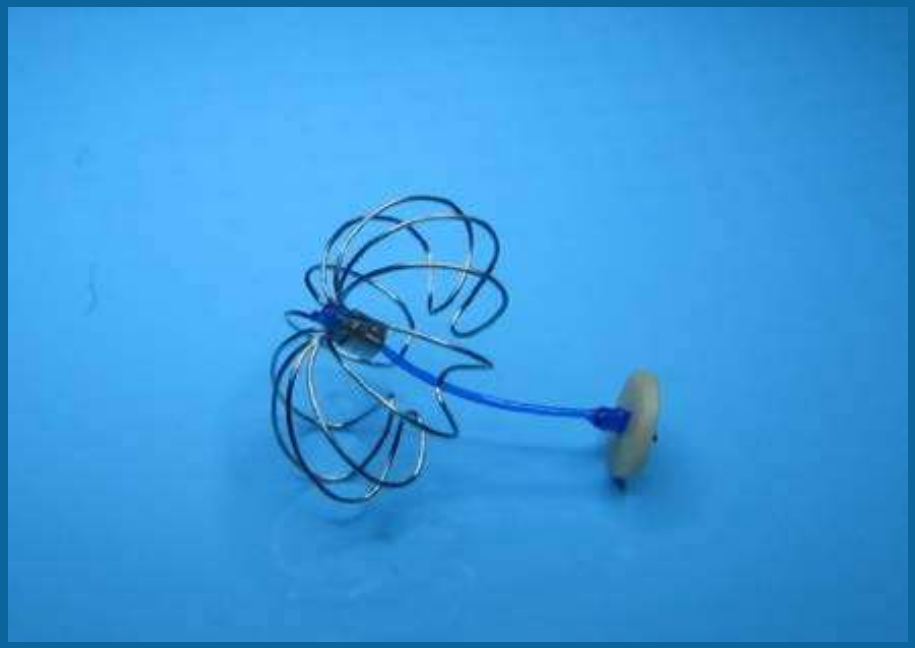
Endoscopic, Endolumenal Bypass



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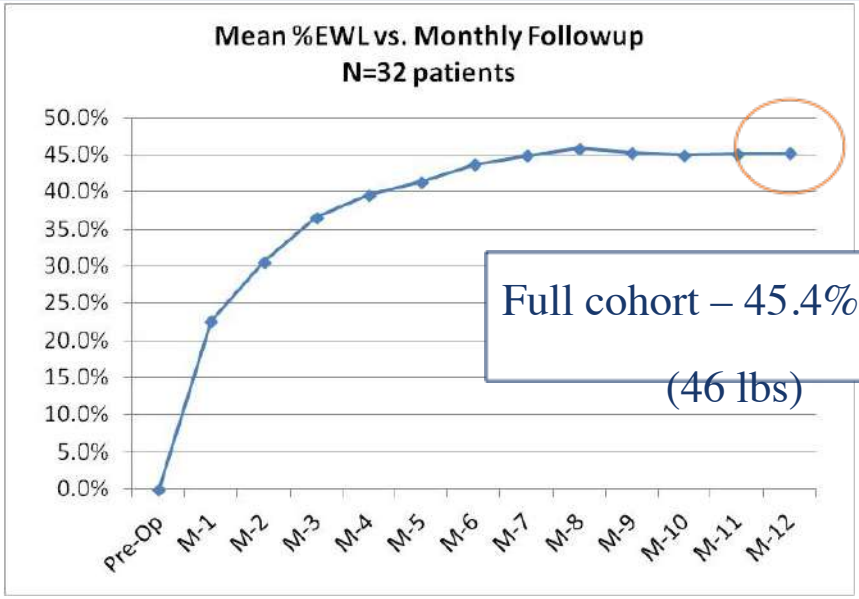
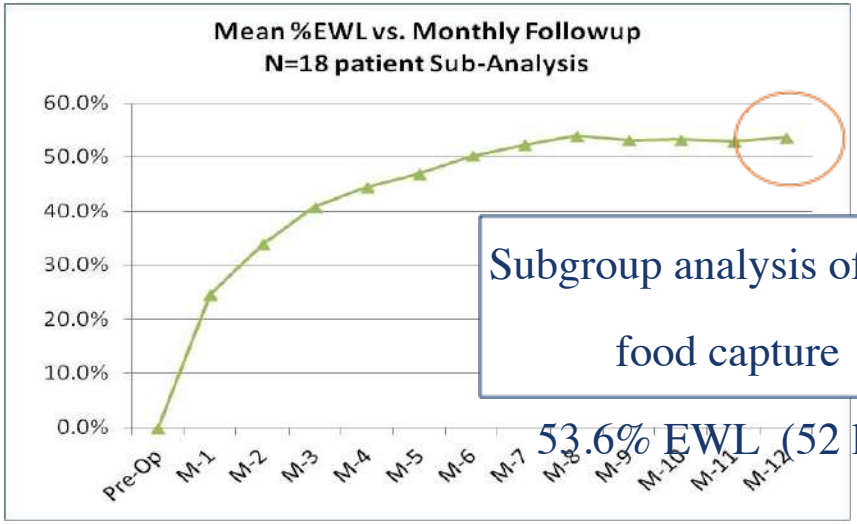
Clinical Data



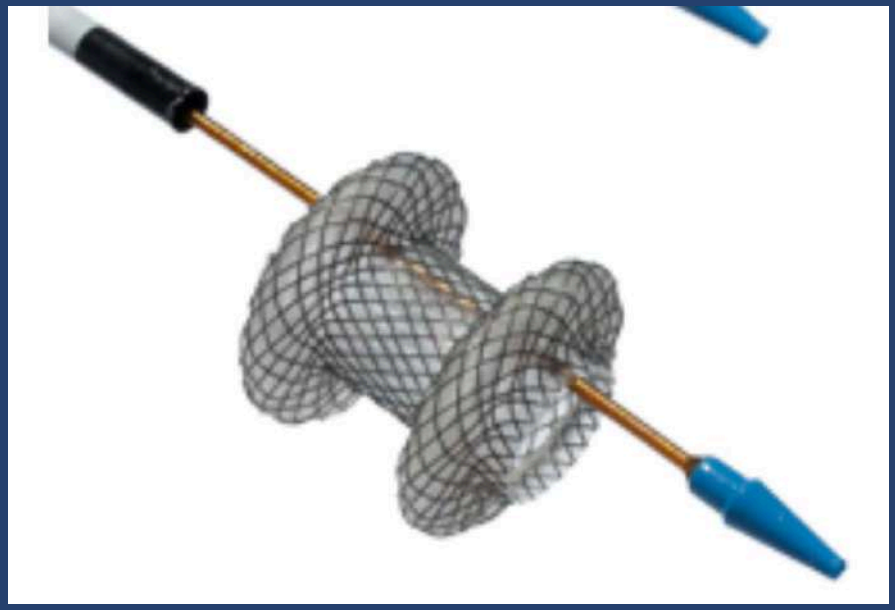
Full cohort – 45.4% EWL (46 lbs)

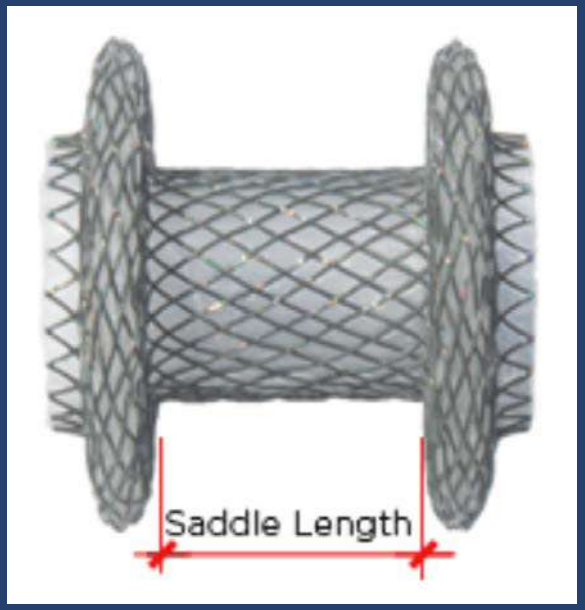


Subgroup analysis of good food capture

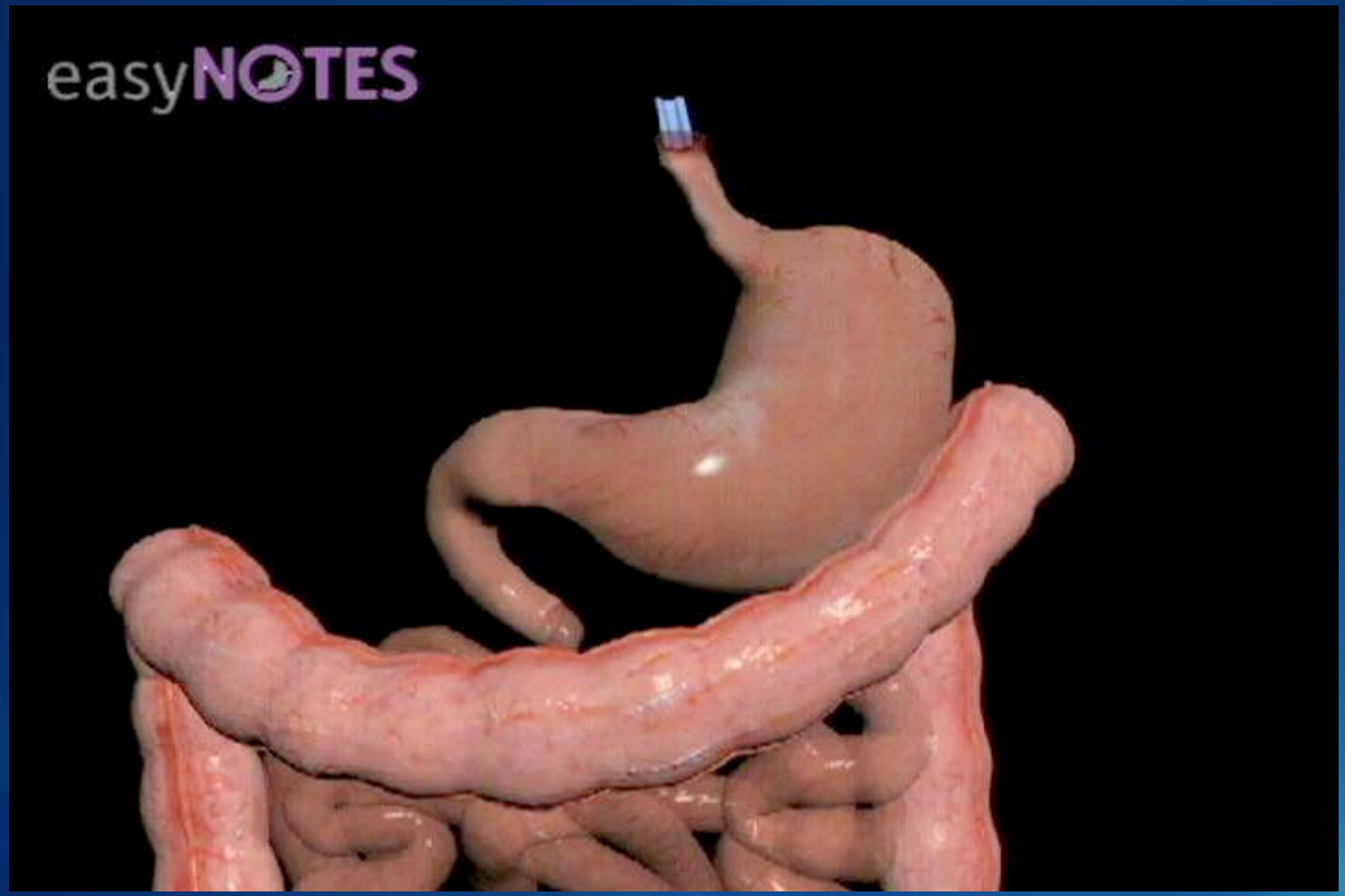
53.6% EWL (52 lbs)

A New Anastomosis Technique





Hadassah Medical Center



Endoscopic Leak Closure

- 41 patients treated with over-the-scope clip application
  - 17 acute leaks (<6 months)
  - 20 chronic leaks (>6 months)
  - 4 uncontrolled GI bleeding

- Acute leak resolution better than chronic (94% vs 50%)

- 70% overall resolution
  - 10 required multiple clips
  - 5 re-operations

Liu et al. *Surg Endosc* 2017 - accepted

Endoscopic Stent Placement

- 67 bariatric patients with leaks
- 88% leak closure rate with stents
  - radiographic closure documented after stent removed
- Migration most common stent complication (17%)
- 9% of patients (6/67) required revision surgery due to unsuccessful leak closure with stent
- 6-8 weeks appears to be optimal time for stent removal

Puli et al. *Gastrointest Endosc* 2012

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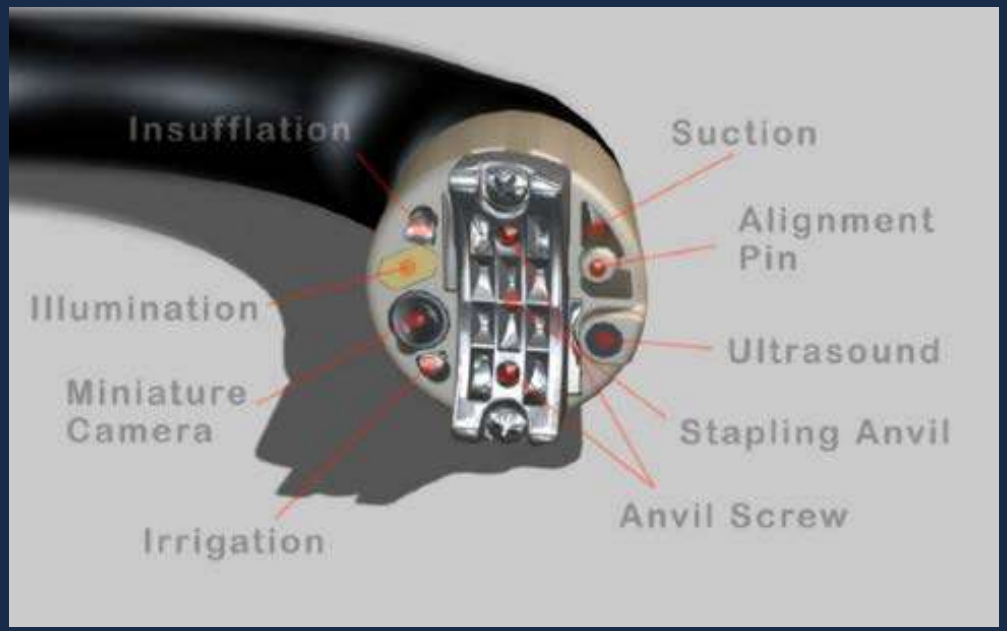
Medigus



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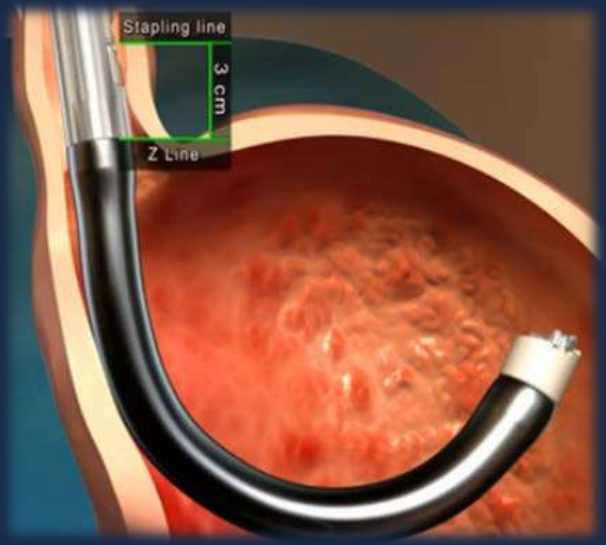
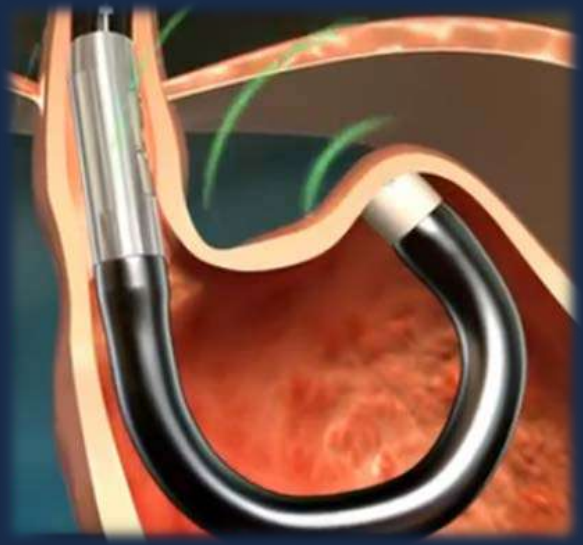
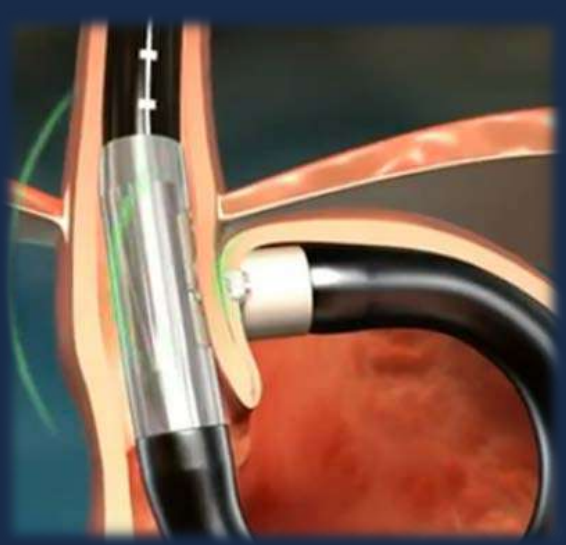
Procedure Overview

- Overtube placed
- Stapler inserted and retroflexed
- Tissue clamped and staples fired







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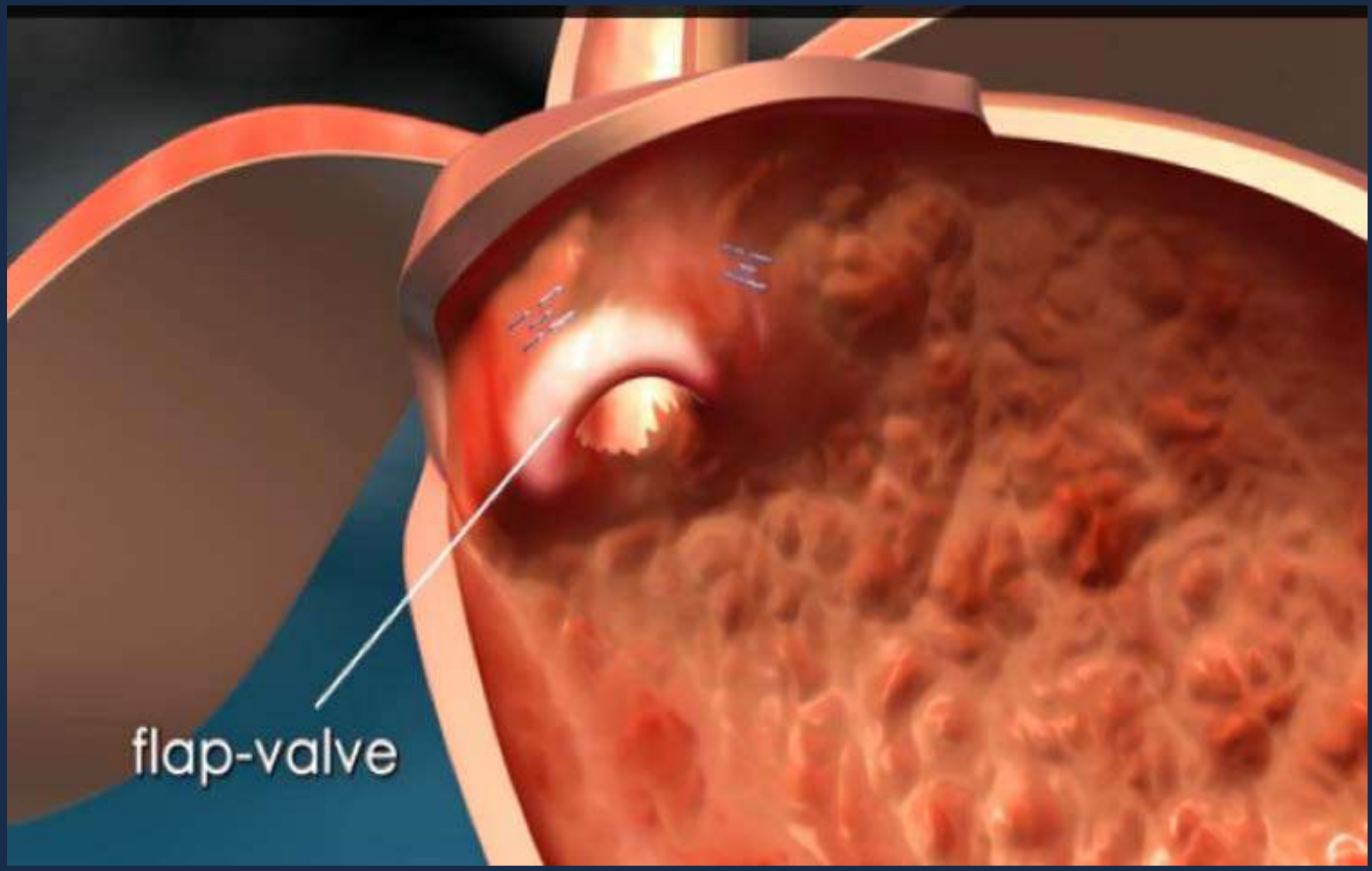
Procedure Goal: Anterior Fundoplication

- Endoscopic flap valve reconstruction



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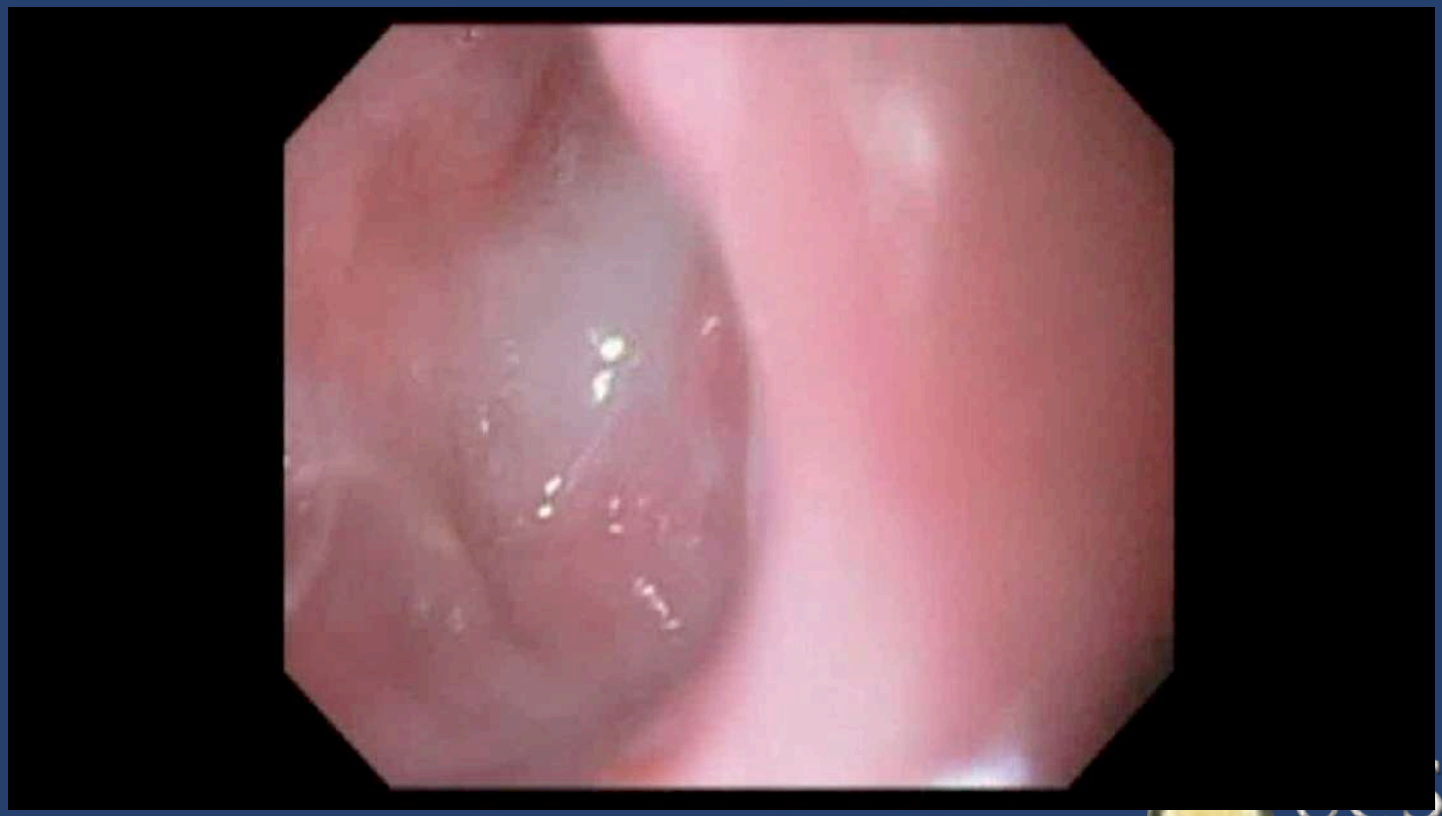
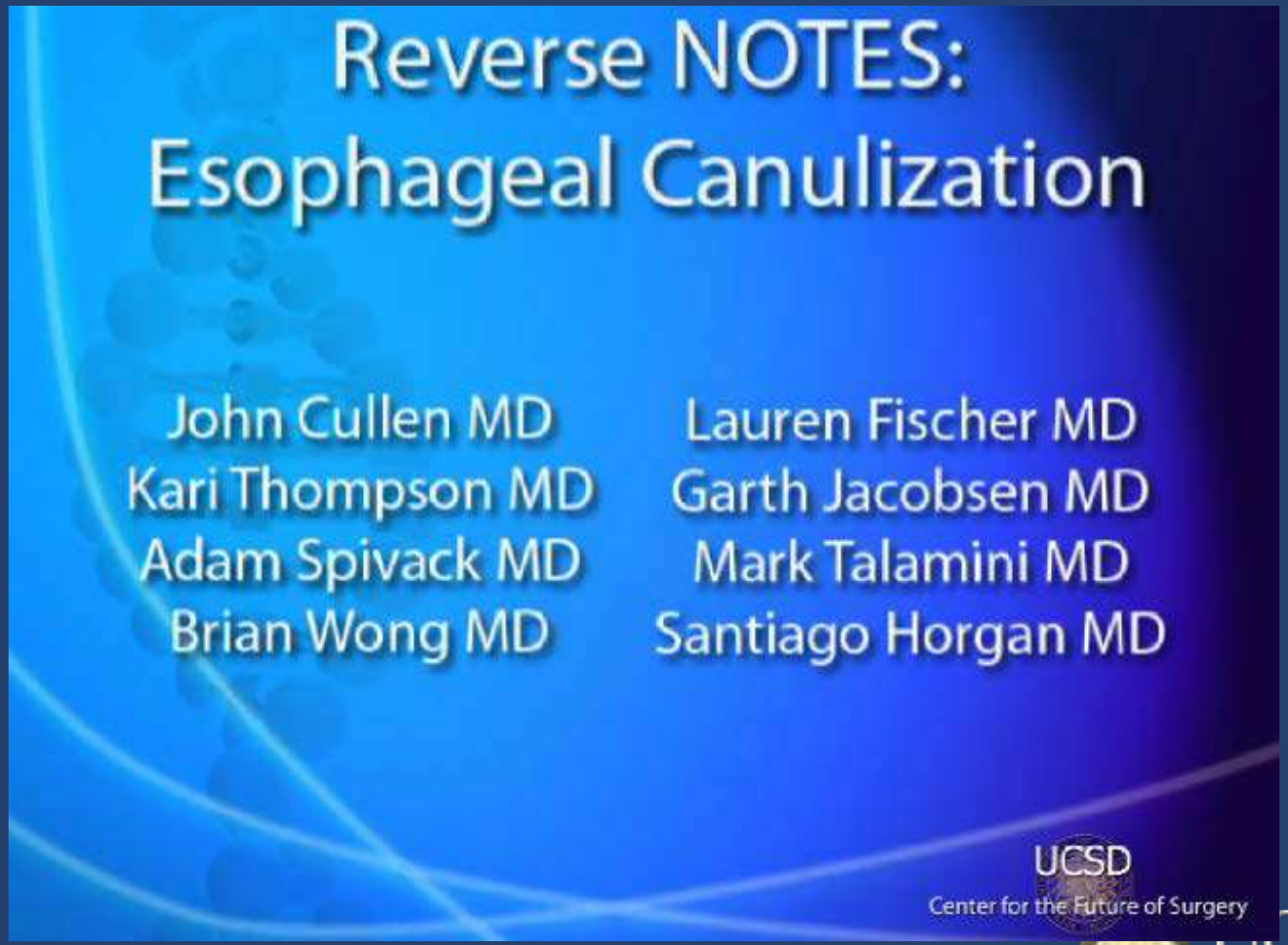
Collaboration with Head and Neck Surgery

- Endoscopic treatment of Zenker's Diverticulum



Reverse NOTES: Hypopharyngeal stenosis



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ABS Establishes New Requirement for Endoscopic Training and Assessment

MARCH 6, 2014 | MEDIA CONTACT: CHRISTINE SHIFFER, 215-568-4000 EXT. 137

A new national curriculum in endoscopy to be required of all general surgery trainees

The American Board of Surgery (ABS), the national certifying body for general surgeons and related specialists, announces a new requirement to ensure all ABS-certified general surgeons have completed a standard curriculum in the use of endoscopic techniques. This new requirement will apply to applicants for board certification in general surgery who complete their residency training in the **2017-2018** academic year or thereafter.

During their general surgery residency, applicants will be required to have completed the ABS Flexible Endoscopy Curriculum (pdf). The curriculum provides a consistent instructional program for residents to acquire the essential knowledge and skills to perform flexible endoscopy.

Flexible Endoscopy Curriculum (pdf)

The Flexible Endoscopy Curriculum is designed to provide general surgery residency programs with a stepwise, milestone-based program for the teaching of endoscopic procedures over the five years of residency. For each step (level), there are a variety of suggested resources, including direct links to content on the SCORE® Portal (www.surgicalcore.org). The ABS is not mandating the use of any particular resource and encourages programs to take advantage of the resources for endoscopic training already in existence at their institution.

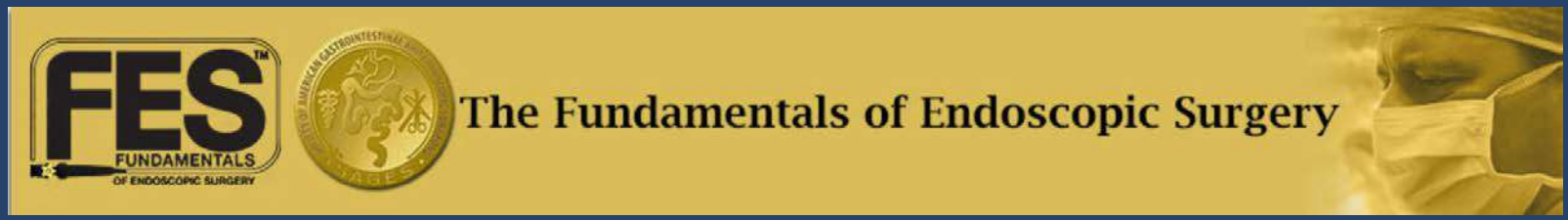
Programs should track residents' progress by documenting when each level of the curriculum is completed. In addition, one of the final milestones in the curriculum is successful completion of the Fundamentals of Endos program offered by the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES validated assessment of a surgeon's competency in flexible endoscopy and includes didactic ma examination, and a hands-on skills test. Residents will be required to provide evidence of FES c

The FES didactic materials are available without charge at www.fesdidactic.org. Preparation for already available at an institution—**purchase of a simulator is neither necessary nor requ** and exam is available at www.fesprogram.org.

THE AMERICAN BOARD OF SURGERY

FLEXIBLE ENDOSCOPY CURRICULUM FOR GENERAL SURGERY RESIDENTS

Fundamentals of Endoscopic Surgery



- SAGES Fundamentals of Endoscopic Surgery (FES) program is a comprehensive educational and assessment tool designed to teach and evaluate the fundamental knowledge, clinical judgment and technical skills required in the performance of basic gastrointestinal (GI) endoscopic surgery
- Both web-based didactic curriculum and 2-part validated assessment
- http://www.fesprogram.org

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Surgical Education: *Then*

- Trainees were truly residents of the hospital
- Surgery was life
- Apprenticeship model
- No work-hour restrictions
- High case volume
- Absence of surgical simulation

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SRL 2006

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Club Med

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Center for the Future of Surgery

- 5 operating suites
- 22 fully functioning operating bays
- 2 da Vinci Surgical Robotic Systems
- Porcine, cadaver and inanimate simulation labs
  - 15 full simulation labs per month

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Background

- Established since 2011
- The CFS has trained > 20,000 medical professionals
  - 8661 Surgeons in practice
  - 754 Physicians in other specialties
  - 3346 Surgical Residents
  - 2820 Medical students
  - 978 Nurses
  - 2643 Other health professionals and Industry representatives

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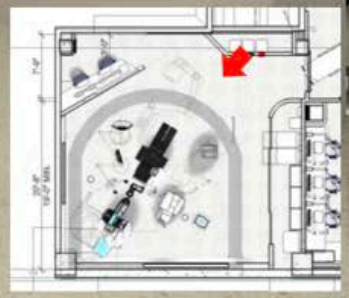

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ICG Coated Needle Project: Simulating Lost Needle During Laparoscopic Surgery in a Rabit Model

Jonathan DeLong, Erin Ward, Sarah Blair, Santiago Horgan
UC San Diego Department of Surgery

Conclusions

- The future is now - endoscopic tool/technique/development will continue
- Laparoscopic procedures will be affected by this evolution in flexible endoscopy
- Endoscopic training and competence is essential during surgical training

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