

Rush University System for Health

Interventional EUS: The endoscopic anastomosis is here to stay

Feb 04, 2023

Ajaypal Singh MD

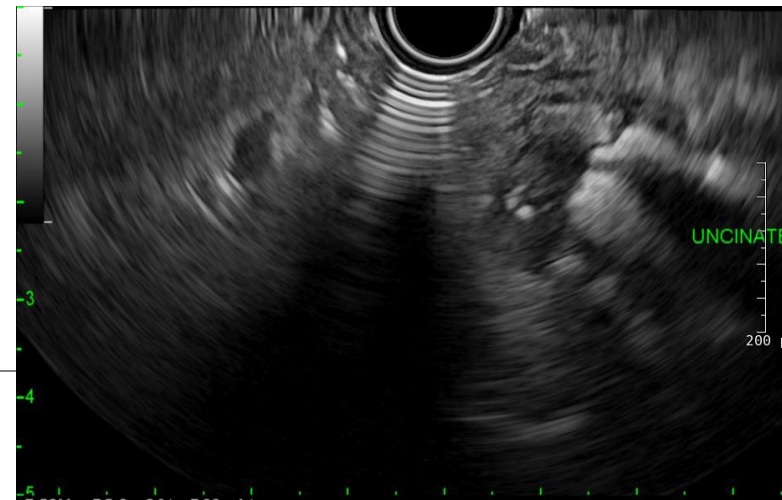
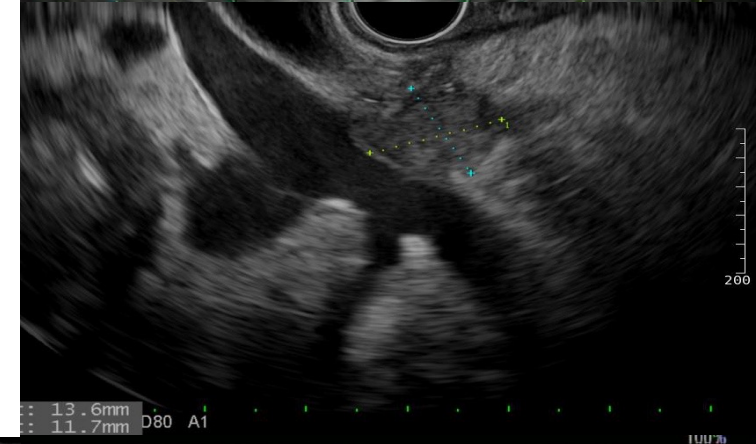
Director, Center for Interventional & Therapeutic Endoscopy (CITE)
Division of Digestive Diseases

Disclosures

Boston Scientific (Speaker)
US Endoscopy (Consultant)

Diagnostic EUS

- Staging of luminal cancer
- Sub-epithelial masses
- Choledocholithiasis
- Pancreatic cysts
- Solid pancreatic lesions
- Biliary and gallbladder malignancy
- Chronic pancreatitis



Interventional EUS

• Drainage

- Pancreatic fluid collections
- Bile duct drainage
- Gallbladder drainage
- Peri-luminal abscesses

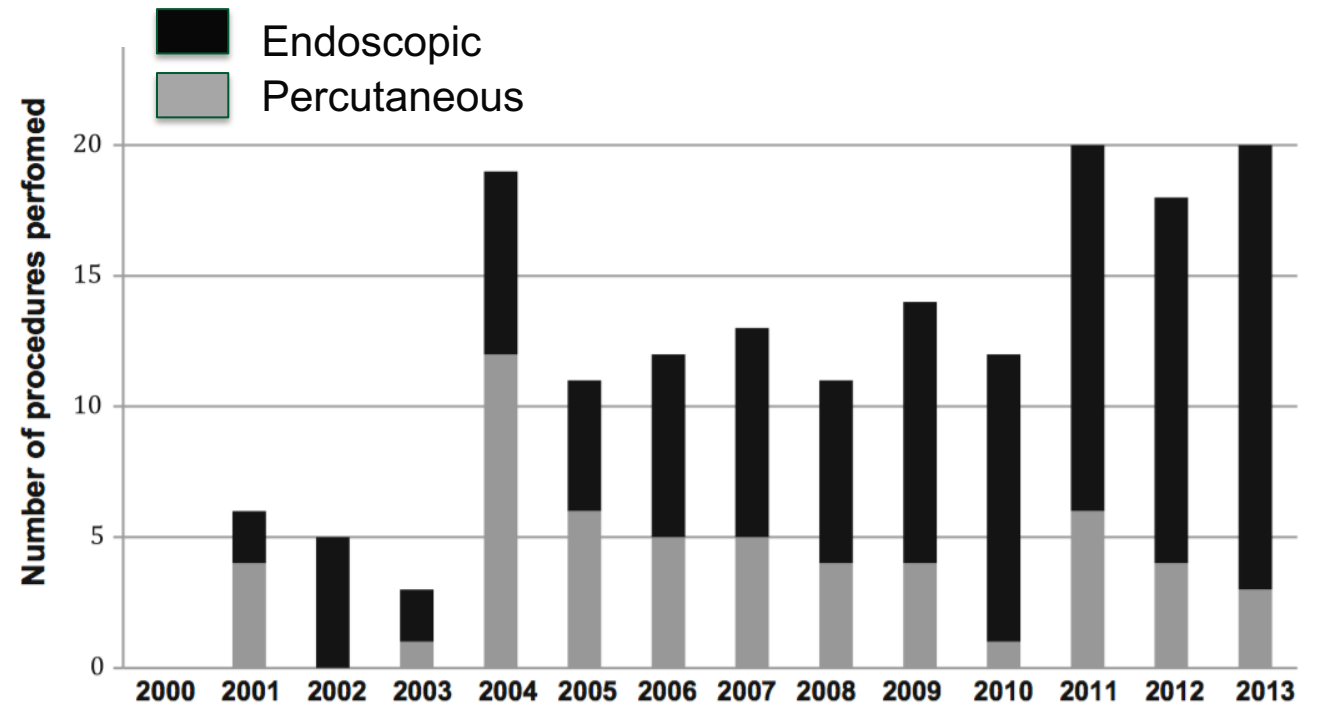
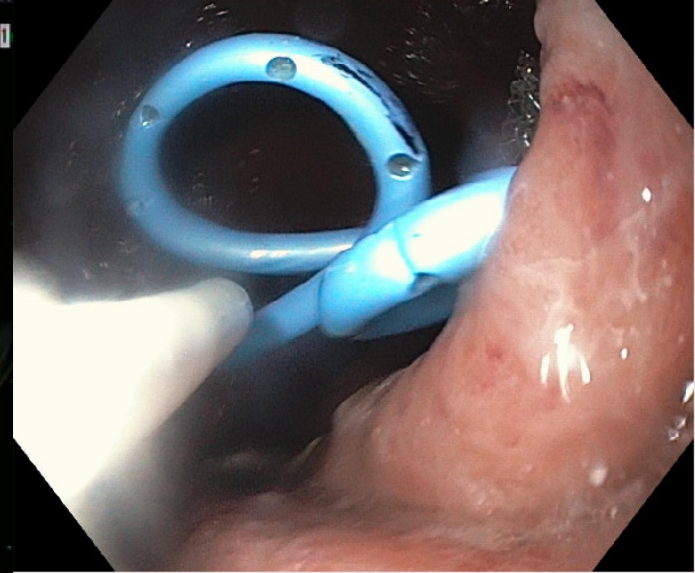
• Bypass

- RYGB/EDGE procedure
- Afferent loop syndrome
- Gastro-jejunostomy

• Ablation

- Pancreatic cysts
- Solid tumors
- Celiac plexus interventions

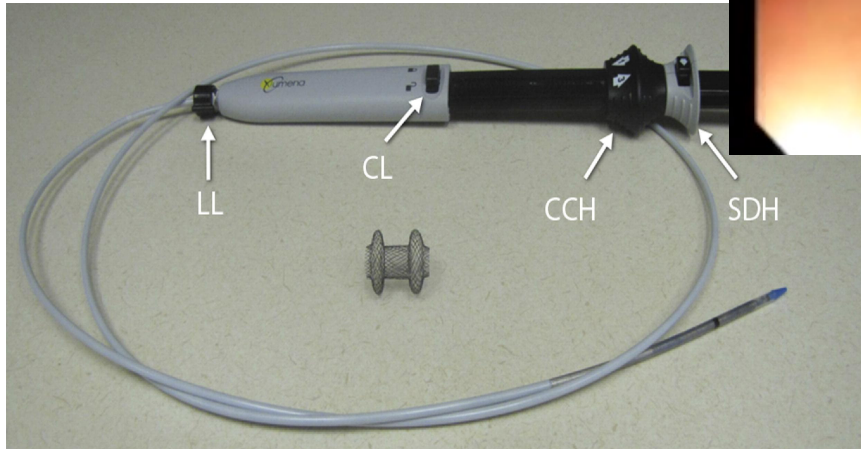
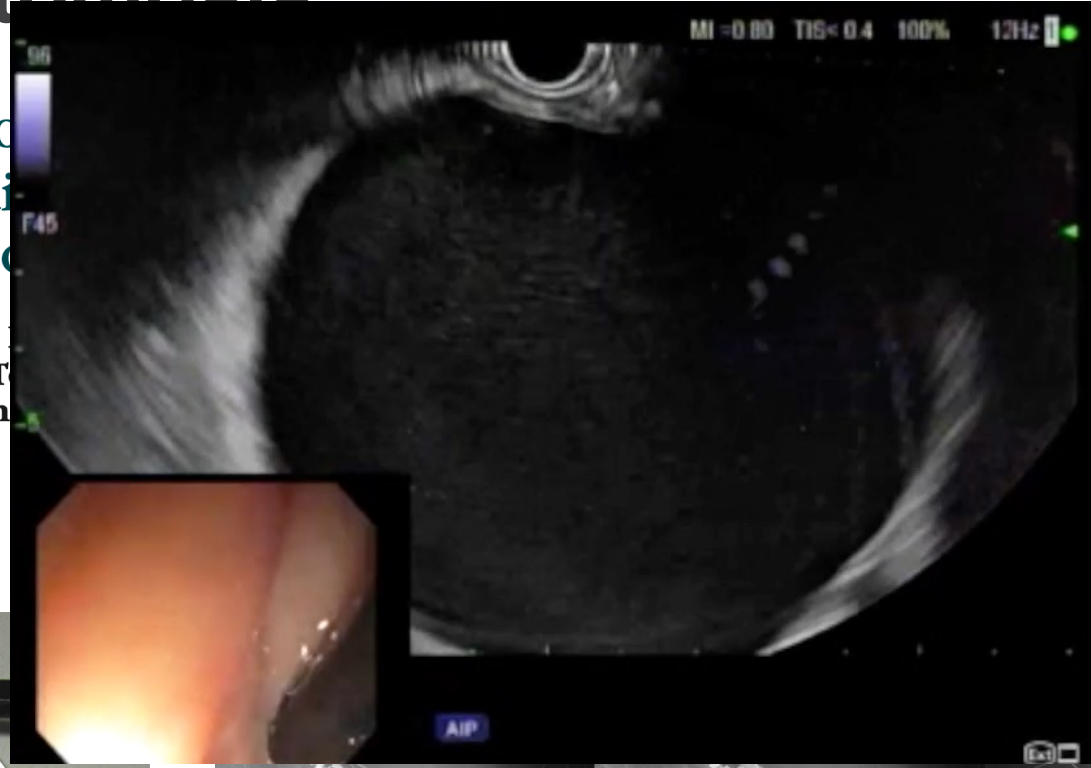
• Endohepatology



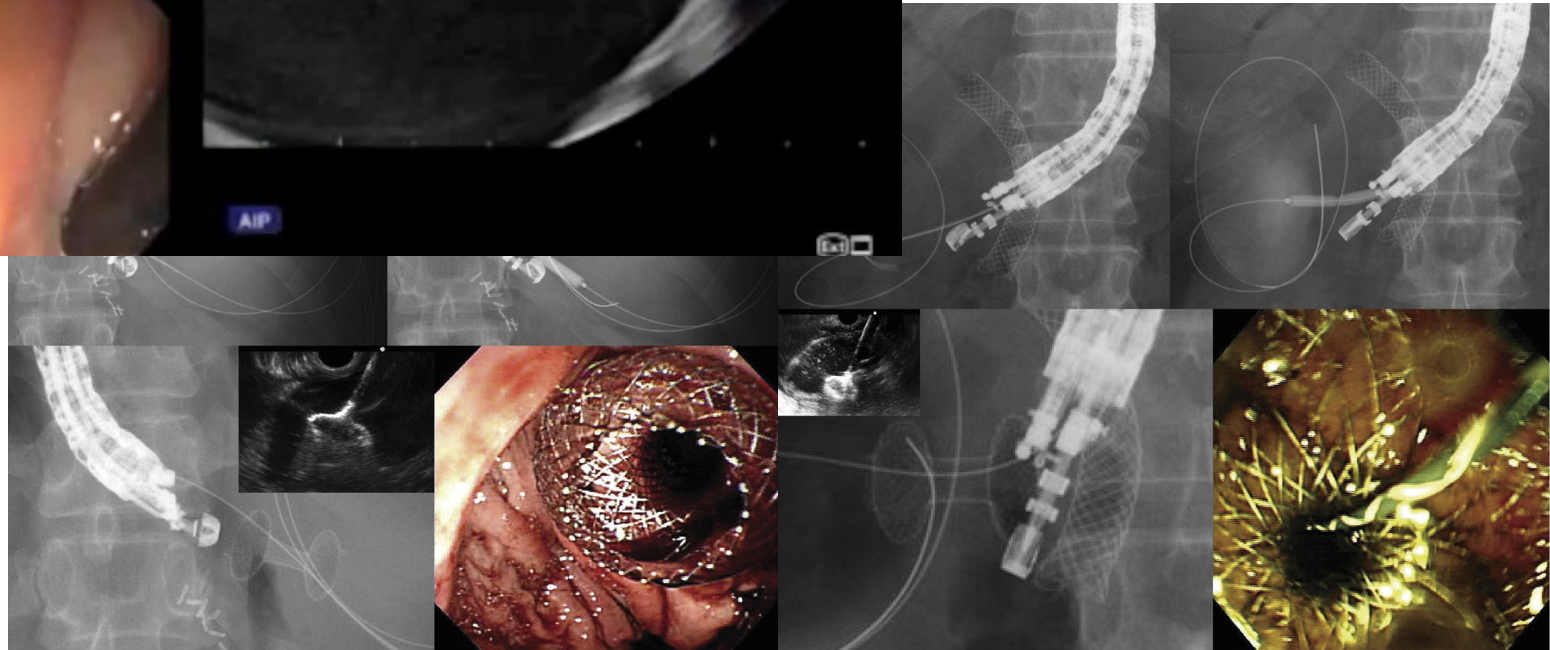
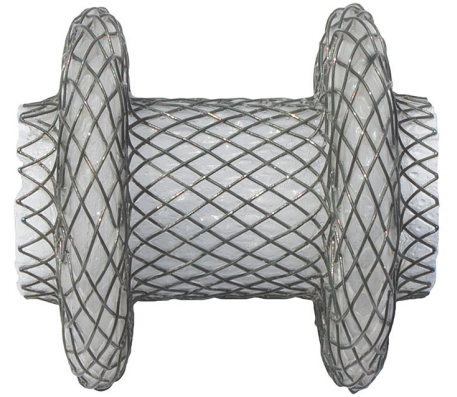
Endoscopic anastomosis

Clinical evaluation of endosonography-guided drainage (with video)

Takao Itoi, MD,¹ Kenneth
Fumihide Itokawa, MD,¹ T
Shujiro Tsuji, MD,¹ Nobuh
Tokyo, Japan



GIE 2012



Lun

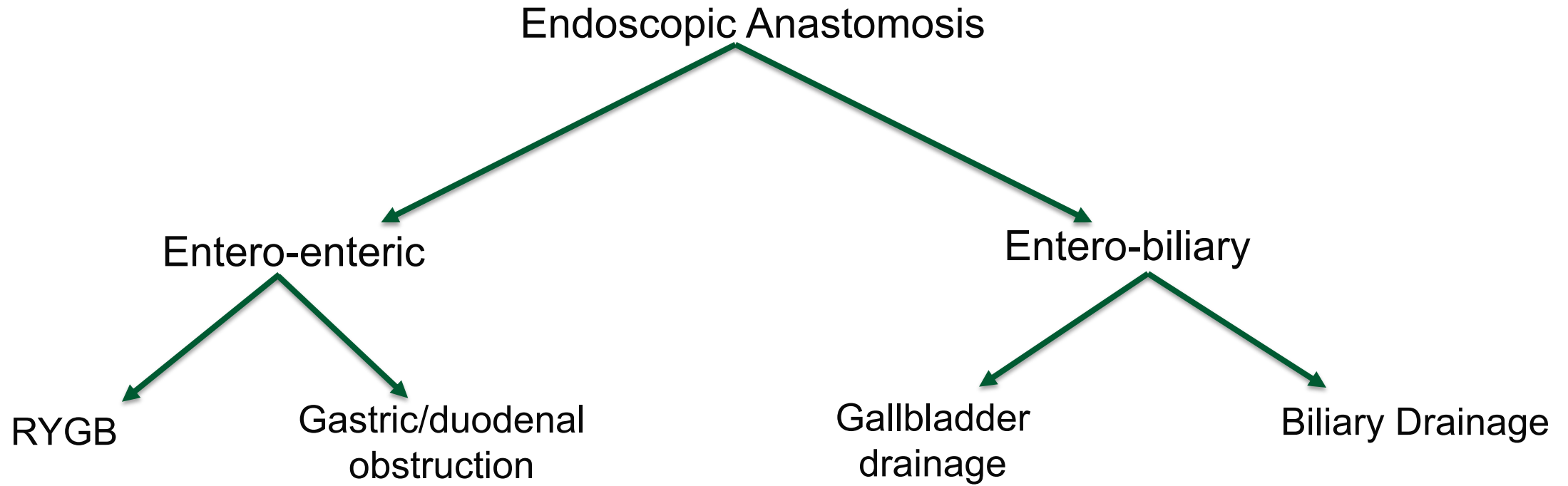


Ideal bowel anastomosis

- Accurate/good approximation (no leaks)
- Lack of tension
- Good blood supply
- Clean (lack of peritoneal contamination)
- Connect viable tissue to viable tissue
- Patency (short and long term)
- Discomfort/QoL/comoribidities

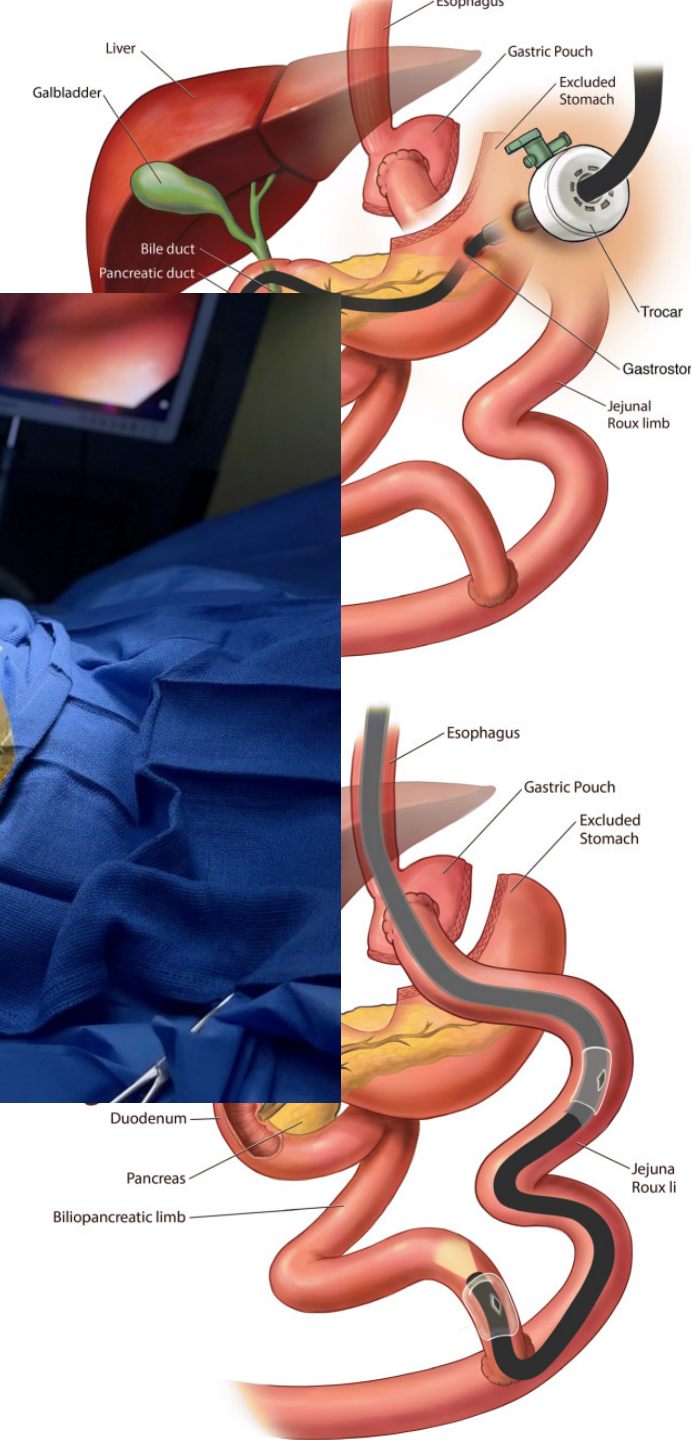
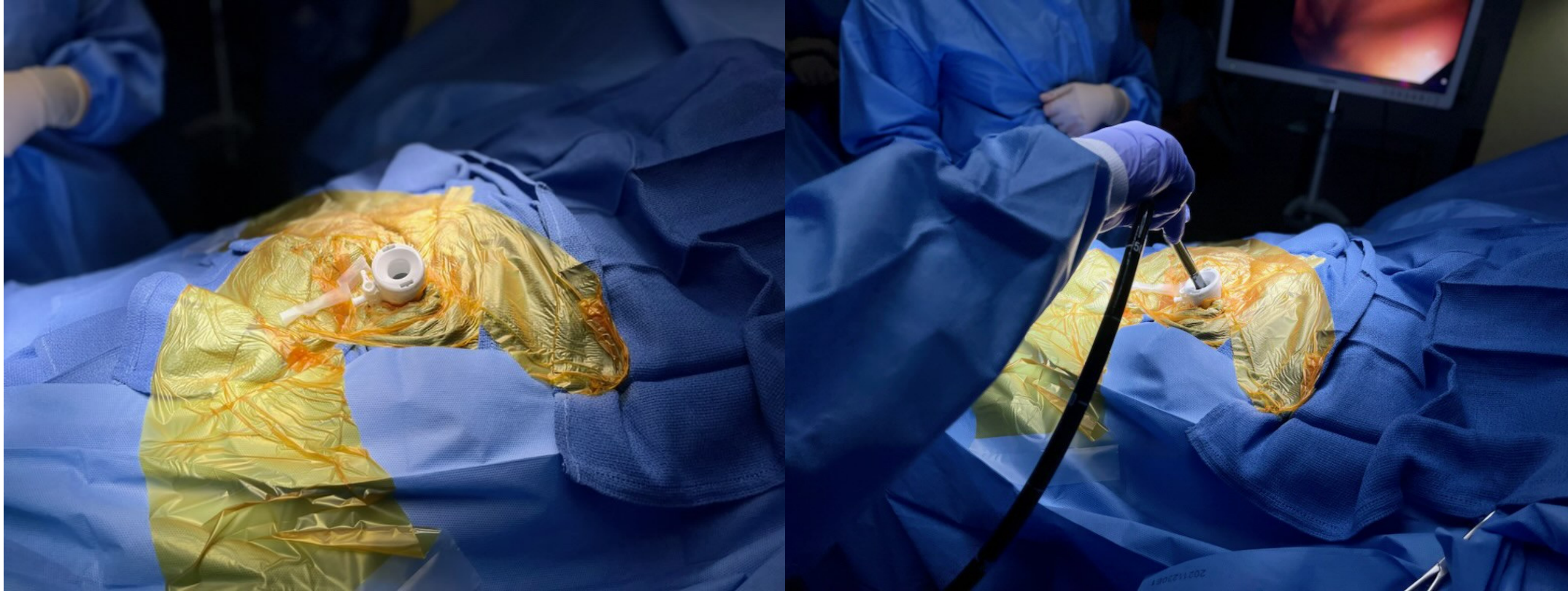


Interventional EUS: reaching the unreachable



- Gastrogastrostomy
- Jejunogastrostomy
- Gastroenterostomy
- Cholecystogastrostomy
- Cholecystoduodenostomy
- Choledochoduodenostomy
- Hepaticogastrostomy
- Rendezvous access

Post RYGB interventions: EDGE/EDGI



Khara et al. Current Gastroenterol Rep 2021

EDGE evolution to EDGI

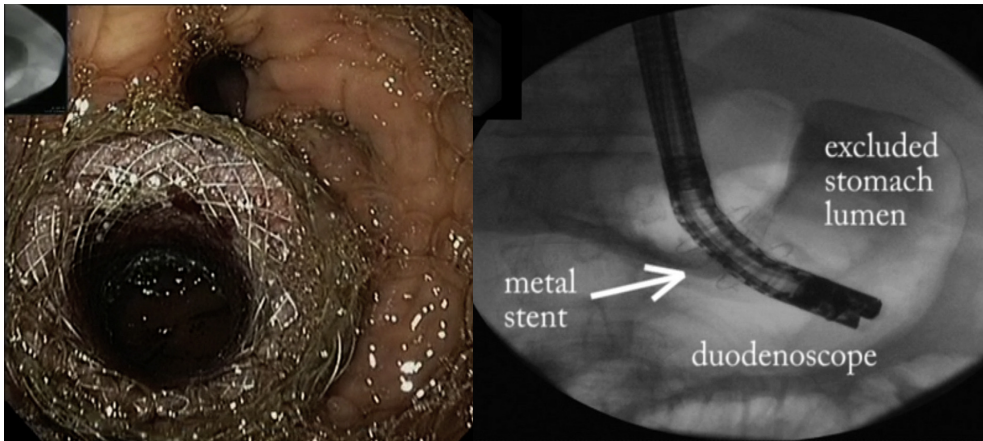
GASTROENTEROLOGY IN MOTION

Ralf Kiesslich and Thomas D. Wang, Section Editors

Internal EUS-Directed Transgastric ERCP (EDGE): Game Over

Prashant Kedia, Reem Z. Sharaiha, Nikhil A. Kumta, and Michel Kahaleh

Division of Gastroenterology and Hepatology, Weill Cornell Medical College, New York, New York



Gastroenterology 2014

Endoscopic ultrasound-directed transgastric ERCP (EDGE) for Roux-en-Y anatomy: a novel technique

Authors

Prashant Kedia¹, Nikhil A. Kumta¹, Jessica Widmer², Subha Sundararajan³, Mark Cerefice⁴, Monica Gaidhane¹, Reem Sharaiha¹, Michel Kahaleh¹

Endoscopy 2014

Endoscopic ultrasound-Directed transgastric ERCP (EDGE): A single center U.S. experience with follow up data on fistula closure

Theodore W. James, MD and Todd H. Baron, MD

Obesity Surg 2019

DYNAMIC MANUSCRIPT

Gastric access temporary for endoscopy (GATE): a proposed algorithm for EUS-directed transgastric ERCP in gastric bypass patients

Thomas J. Wang^{1,3} · Christopher C. Thompson^{2,3} · Marvin Ryou^{2,3}

Surg Endosc 2019

The EDGI new take on EDGE: EUS-directed transgastric intervention (EDGI), other than ERCP, for Roux-en-Y gastric bypass anatomy: a multicenter study

Matthew R. Krafft¹, William Hsueh¹, Theodore W. James², Thomas M. Runge³, Todd H. Baron², Mouen A. Khashab³, Shayan S. Irani⁴, John Y. Nasr¹

Endosc Int Open 2019

EDGI technique

- Consent, multi-disciplinary approach
- General anesthesia
- Make sure below the
- Decide gastric vs. jejunum anastomosis)
- Glucagon, IV antibiotic
- LAMS size

B



Gastric pouch

Lumen apposing
metal stent

Remnant stomach



Bilio
pancreatic
Limb

Wang et al. Surg Endosc 2019

Outcomes for RYGB-ERCP

Meta-analysis

76 studies, 3569 ERCPs

	DAE-ERCP	LA-ERCP	EDGE-ERCP
Technical Success	87.3	99.1	97.9
Cannulation Success	74.7	98.6	98
Therapeutic Success	69.1	98.5	97.9
Adverse Events	5.7	15.1	13.1

n.s.

No difference in outcomes between single and double balloon enteroscopy

Golfakis et al. Life. 2022

Similar outcomes, then why EDGE

Meta-analysis
5 studies
268 patients (92/176)

	LA-ERCP	EDGE-ERCP	Risk Diff.	P-value
Tech. success	98.3%	97.8%	0.00	0.96
Adverse Events	20.4%	13%	-0.08	0.09

Length of stay: -1.2 days ($p=0.0004$)

Procedure time: -98.2 mins ($p<0.00001$)

Modality	Major AEs per patient	Minor AEs per patient	Cost per patient (US\$)	Cost per QALY
EDGE	0.06	0.01	4,877	5,188
DAE-ERCP	0.07	0.17	10,097	11,263
LA-ERCP	0.12	0.003	28,130	34,259



Oliveira et al. Cureus 2022
James et al. Endoscopy 2019

EDGE: Clinical outcomes

- 178 patients, 13 centers
- Technical success: 98.3%
- Mean procedure time: 92 mins
- Adverse events: 15.7%

Persistent Fistula: 10%

	N (175)	Severity (mild/mod/severe)	Intervention
Perforation	6	3 / 2 / 1	Surgery:1 Endoscopic closure: 4
Symptomatic Pneumoperitoneum	3	1 / 0/ 2	Laparoscopy: 2 Needle decompression: 1
LAMS misdeployment	9	8 / 1 / 0	All bridging stent
Intra-procedural migration	2	1 / 0 / 1	Abort procedure: 1 Hypotension/intubation: 1
Delayed migration	2	2 / 0 / 0	No intervention
Bleeding	2	0 / 2 / 0	Transfusion & endoscopy: 2

Runge et al. Endoscopy 2021
Shin et al. GIE 2021



EDGI lessons learnt: Issues and how to minimize

- **Stent migration**

- single vs. double session
- shortened interval
- stent size (20 mm > 15mm)
- securing the LAMS
- location of anastomosis

- **Persistent fistula**

- shorter indwell time
- stent size (15 mm > 20 mm ??)
- gastric vs. jejunal access, avoid staple line
- APC treatment, DPS placement
- do we really need to worry about fistula

How to decide ?

- **Indication**

- Benign vs. malignant disease

- **Surgical needs**

- Needs cholecystectomy or not

- **Anatomy**

- “Hostile” abdomen

- **Local resources**

- Surgery support, endoscopic expertise

Univariate analysis of factors associated with 11 total migrations

	RR	95%CI	P value
Stent size 15mm vs 20mm	5.271	1.473-18.868	0.007
Sutures vs no sutures	0		0.033
Dilation vs no dilation	0.221	0.061-0.808	0.084
Gastric route vs jejunal	1.972	0.447-8.708	0.502
Electrocautery vs no electrocautery	0.300	0.077-1.163	0.141

Lap ERCP still has a role
Patients with stones and gallbladder

Ghandour et al. GIE 2023

Gastric outlet obstruction: Gastroenterostomy

Surgical bypass

- High efficacy and technical success
- High long term patency

Enteral stenting

- High technical and short term clinical success
- Short LoS and very low morbidity

EUS-gastroenterostomy

- Long hospital stay and high morbidity
- Long term stent patency (30% occlusion)

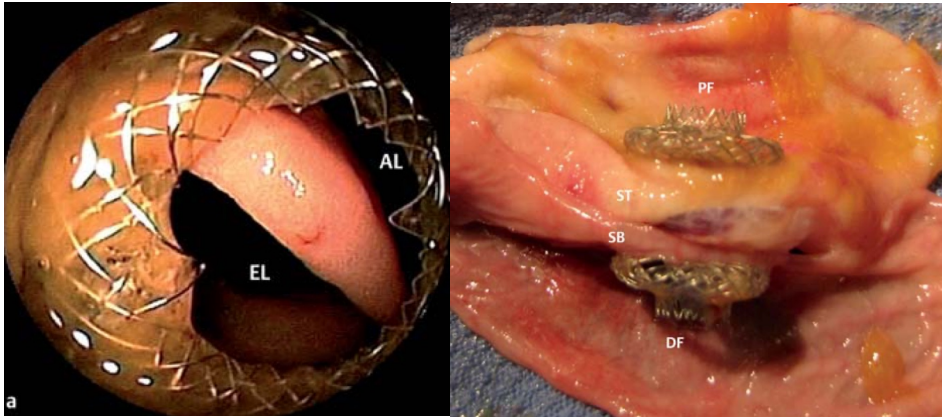


Entero-enteric anastomosis: Gastrojejunostomy

Endoscopic ultrasound-guided gastroenterostomy using novel tools designed for transluminal therapy: a porcine study

Authors

K. F. Binmoeller, J. N. Shah

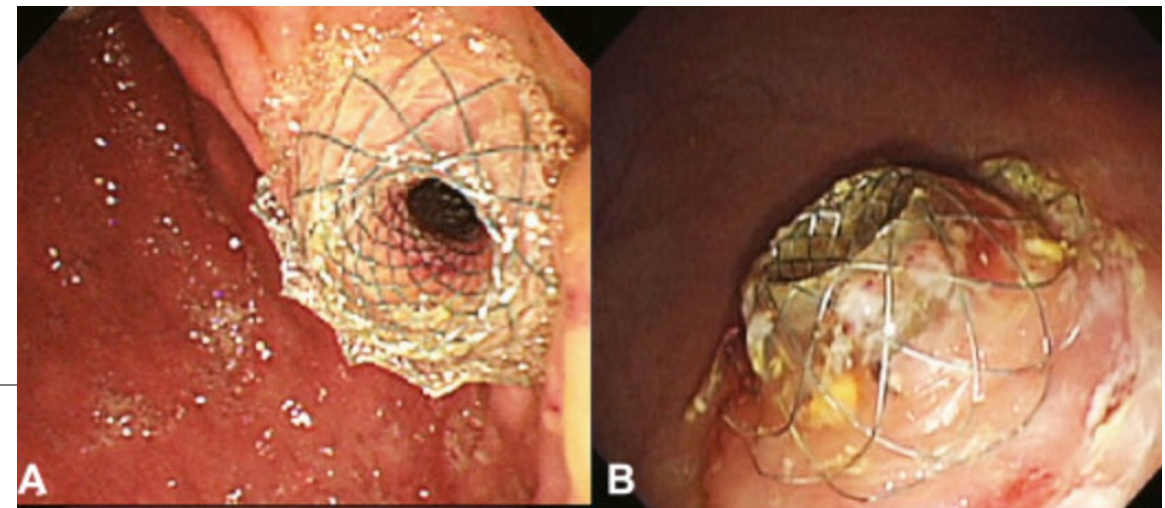
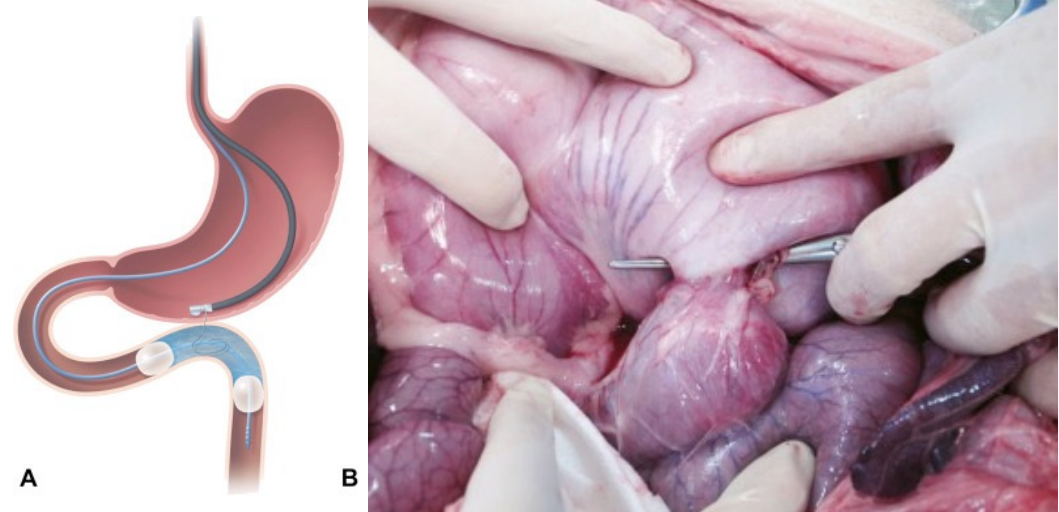


Binmoeller et al. Endoscopy 2012

Itoi et al. GIE 2013

Novel EUS-guided gastrojejunostomy technique using a new double-balloon enteric tube and lumen-apposing metal stent (with videos)

Takao Itoi, MD, PhD, FASGE,¹ Fumihide Itokawa, MD, PhD,¹ Toshio Uraoka, MD,²
Takuji Gotoda, MD, PhD, FASGE,¹ Joichiro Horii, MD, PhD,² Osamu Goto, MD, PhD,²
Fuminori Moriyasu, MD,¹ Jong Ho Moon, MD, PhD,⁴ Yuko Kitagawa, MD, PhD,³ Naohisa Yahagi, MD, PhD²

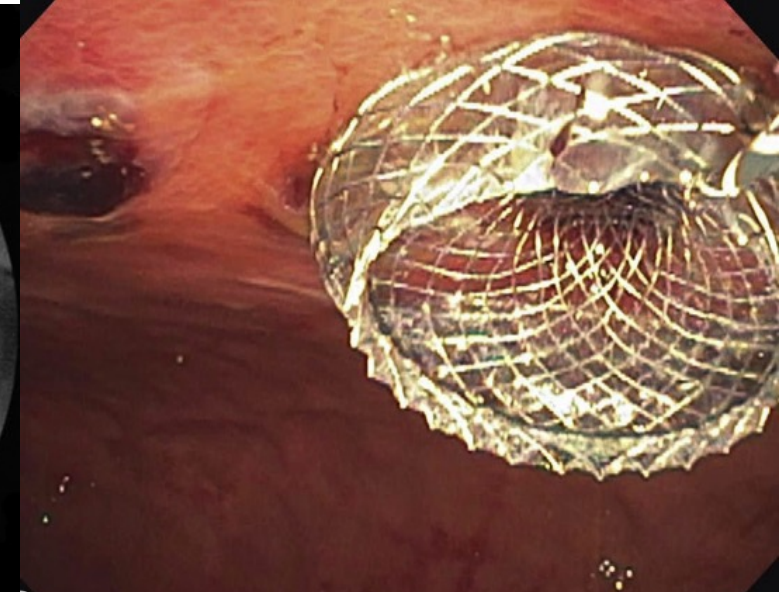
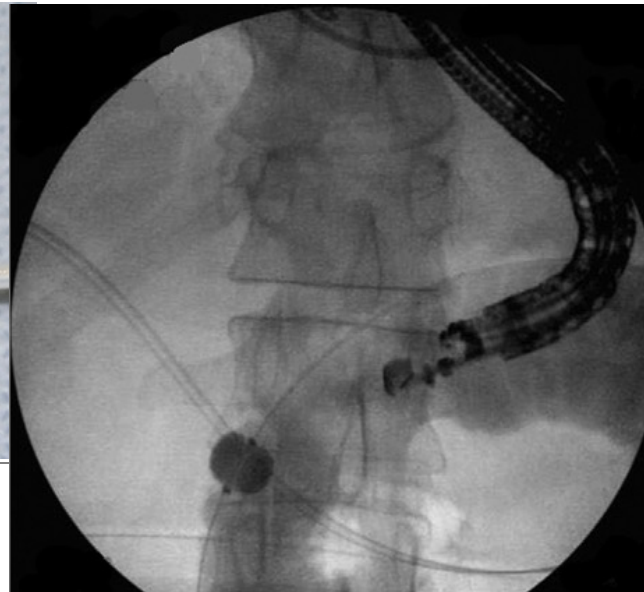
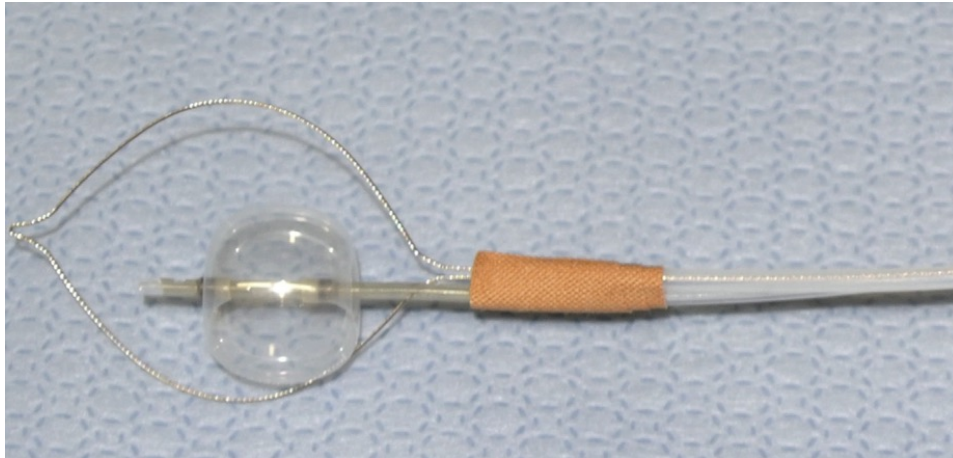


EUS-guided gastroenterostomy: the first U.S. clinical experience (with video)

Mouen A. Khashab, MD,¹ Vivek Kumbhari, MD,¹ Ian S. Grimm, MD,² Saowanee Ngamruengphong, MD,¹
Gerard Aguila, RN,¹ Mohamad El Zein, MD,¹ Anthony N. Kalloo, MD,¹ Todd H. Baron, MD²

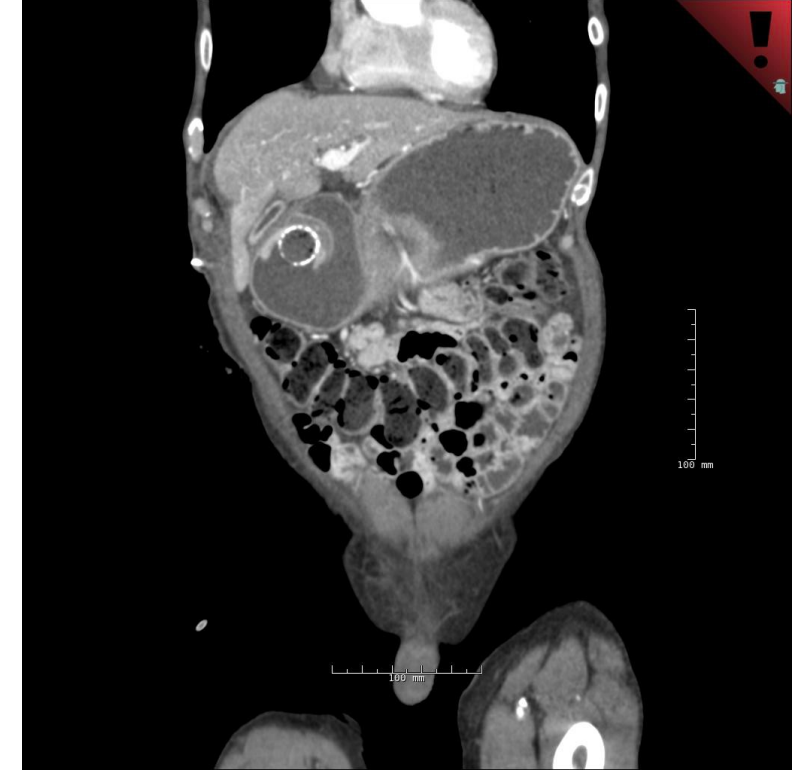
GIE 2015

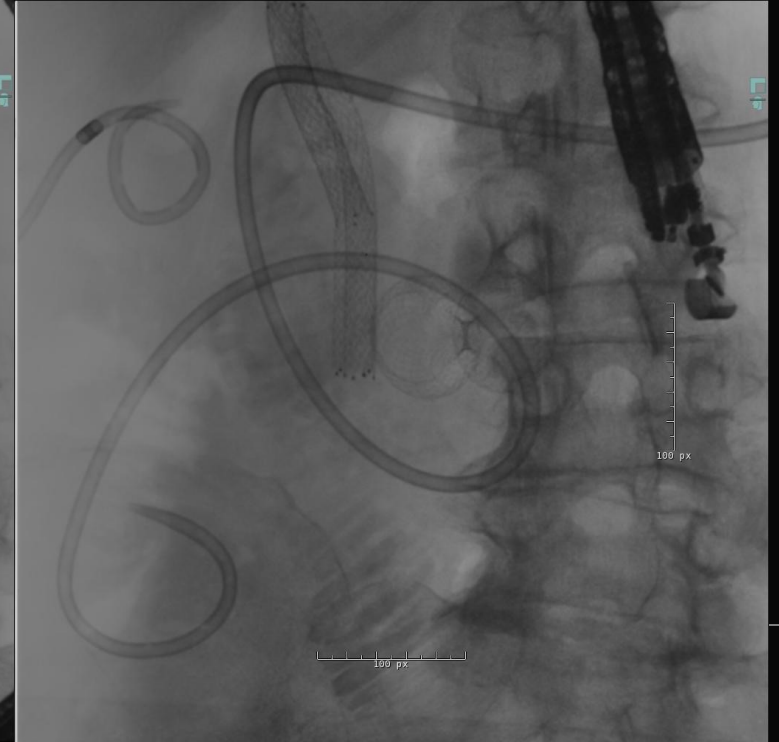
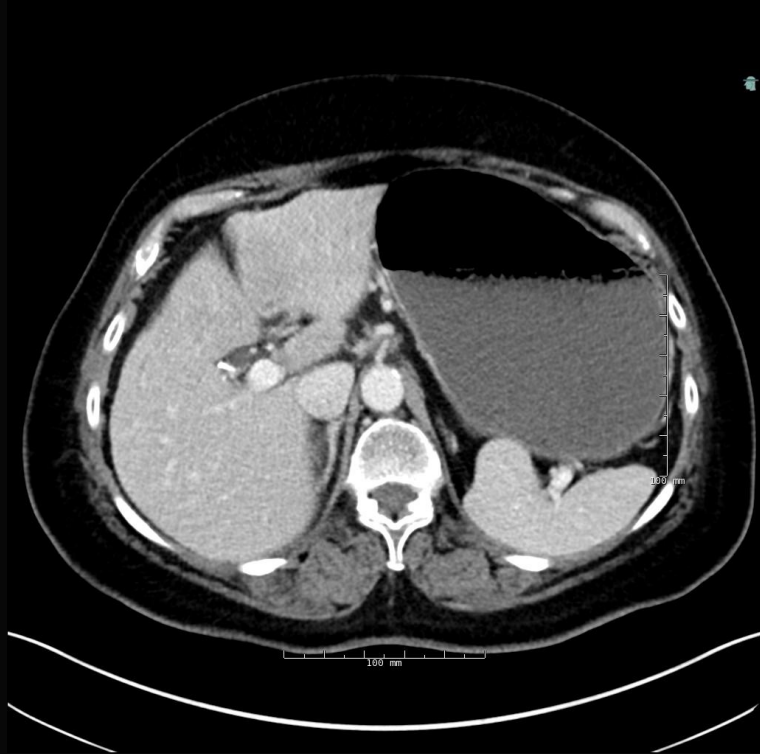
- 10 patients
- 7 with benign disease
- One free hand technique, all other balloon assisted
- Technical success: 90%
- One needed surgical bypass

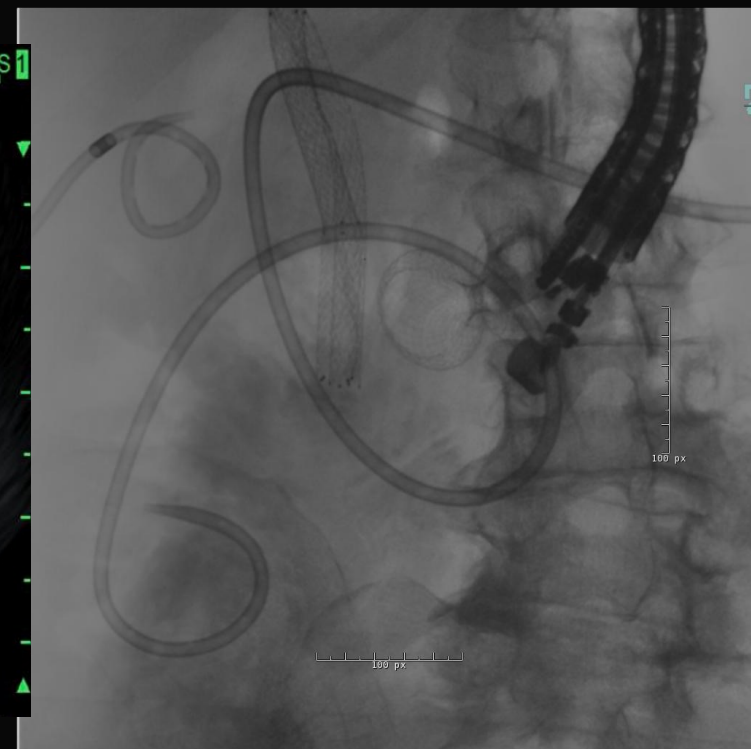


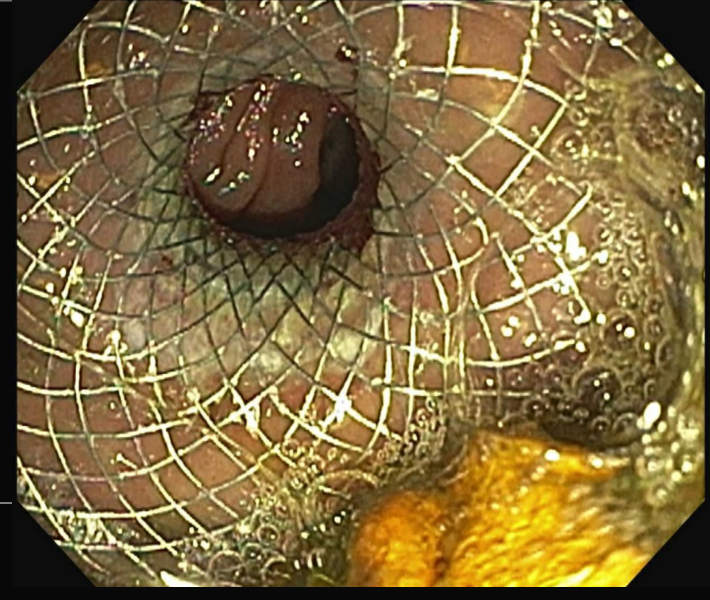
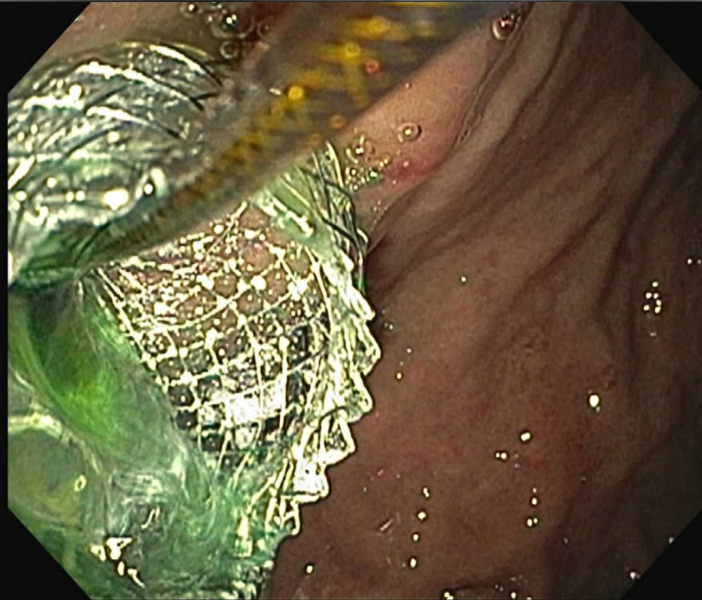
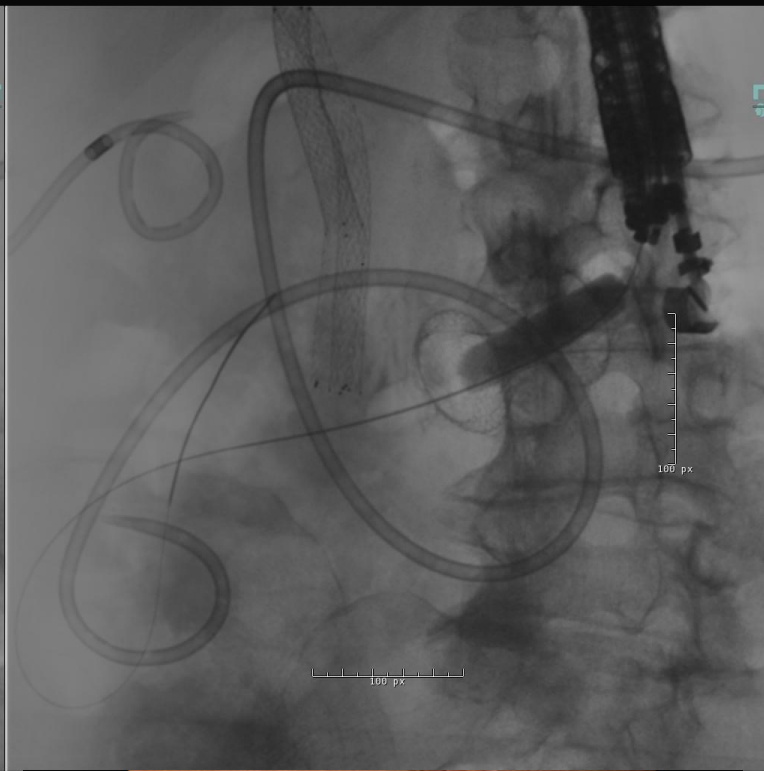
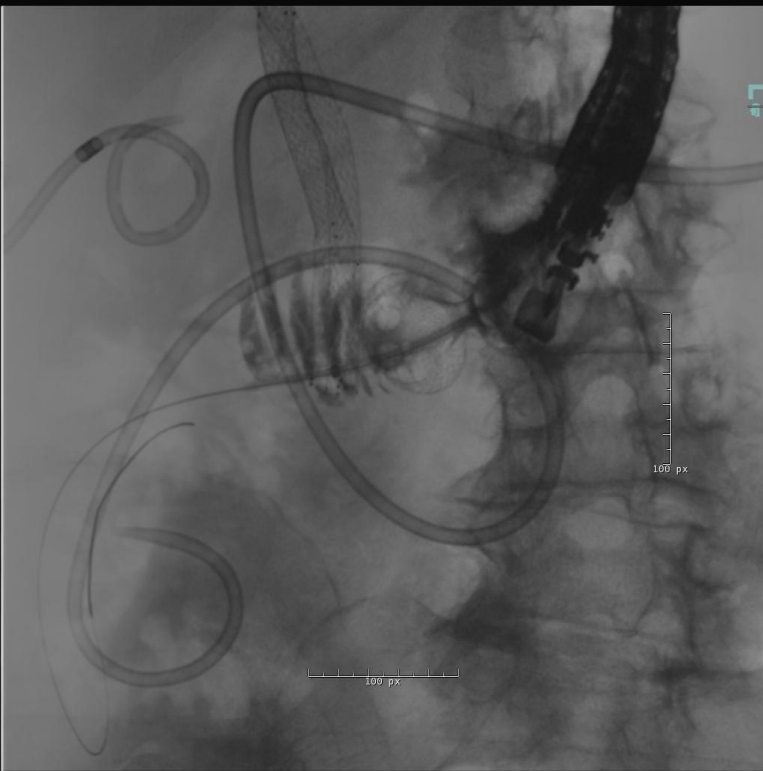
EUS guided gastroenterostomy

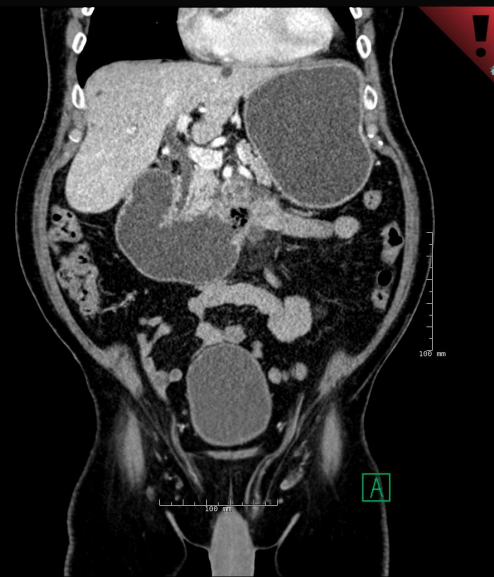
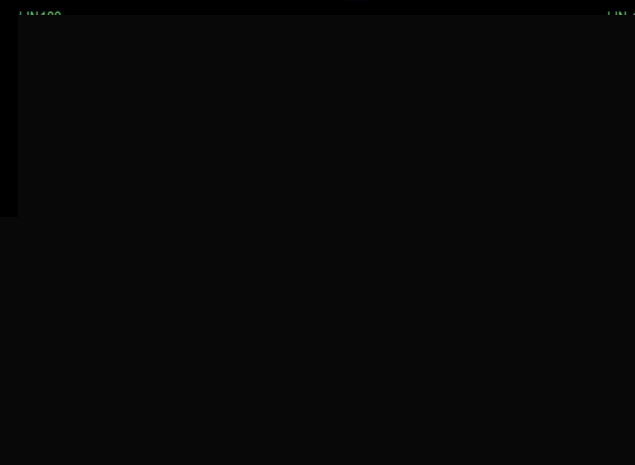
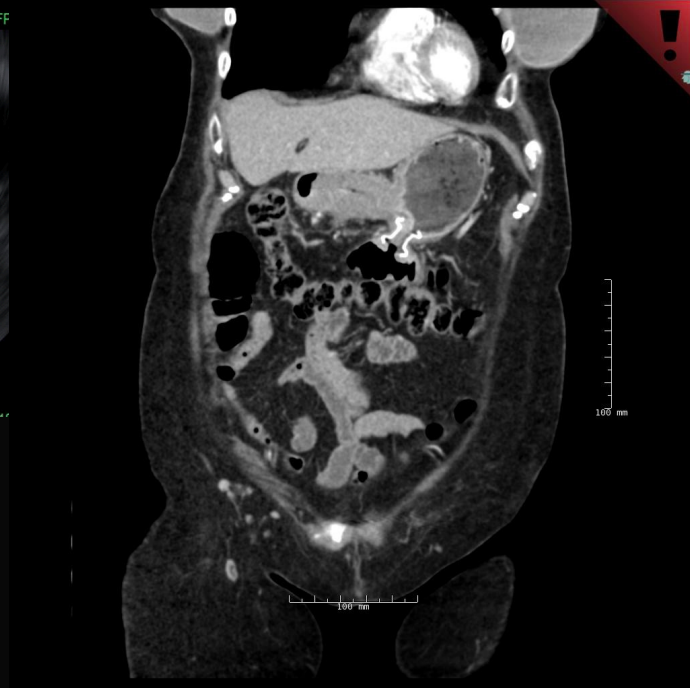
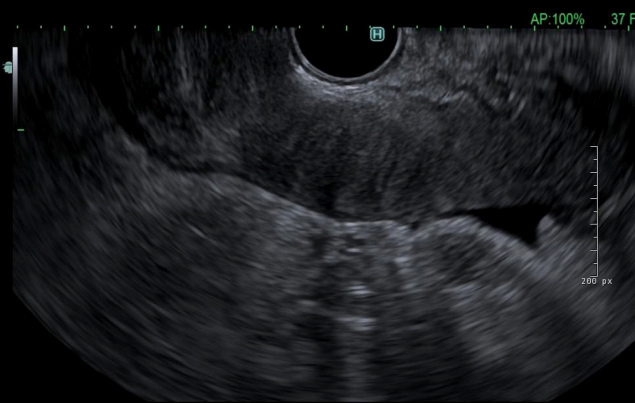
- Consent, surgical collaboration
- Anatomy, rule out ascites, make sure gastric mucosa healthy
- Approach
 - free hand, balloon assisted, jejunal drain assisted
- Glucagon, antibiotics
- Size of stent
- Surgical consult, surgeon available
- Back up plan....











Data starts coming in..... (2017)

International multicenter comparative trial of endoscopic ultrasonography-guided gastroenterostomy versus surgical gastrojejunostomy for the treatment of malignant gastric outlet obstruction

	EUS-GE (n=30), n(%)	Surgical GJ (n=63), n(%)	P value
Carcinomatosis	13 (43)	7 (11)	<0.001
Technical success	26 (87)	63 (100)	0.009
Clinical success	26 (87)	57 (90)	0.18
Recurrent GOO	1 (3)	9 (14)	0.08
Adverse events,	5 (16)	16 (25)	0.3
Mean LoS (days)	11.6±6.6	12±8.2	0.35 [*]

Khashab et al. Endoscopy 2017

Only predictor of success: absence of carcinomatosis

EUS-GE vs. Lap-GE

Retrospective study
International, multi-center study (Europe)

	EUS-GE (n = 77)	Lap-GE (n = 48)	P-value
Technical success	73 (94.8)	48 (100)	0.297
Clinical success	71 (92.2)	42 (87.5)	0.534
Time to oral intake, days	1 (0-1)	3 (1-5)	<.001
Time to full diet, days	2 (1-4)	8 (4-21)	<.001
Adverse events	5 (6.5)	15 (31.3)	<.001
Mild/moderate	3	6	1.000
Severe	2	9	0.007
Re-endoscopy	0	4	0.020
Surgical reintervention	N/A	3	N/A
Procedure duration, min	51	95	<0.001
Hospital stay, days	4	8	<0.001

Bronswijk et al. GIE 2021

How does it compare with enteral stenting ?

Meta-analysis
5 studies, 659 patients

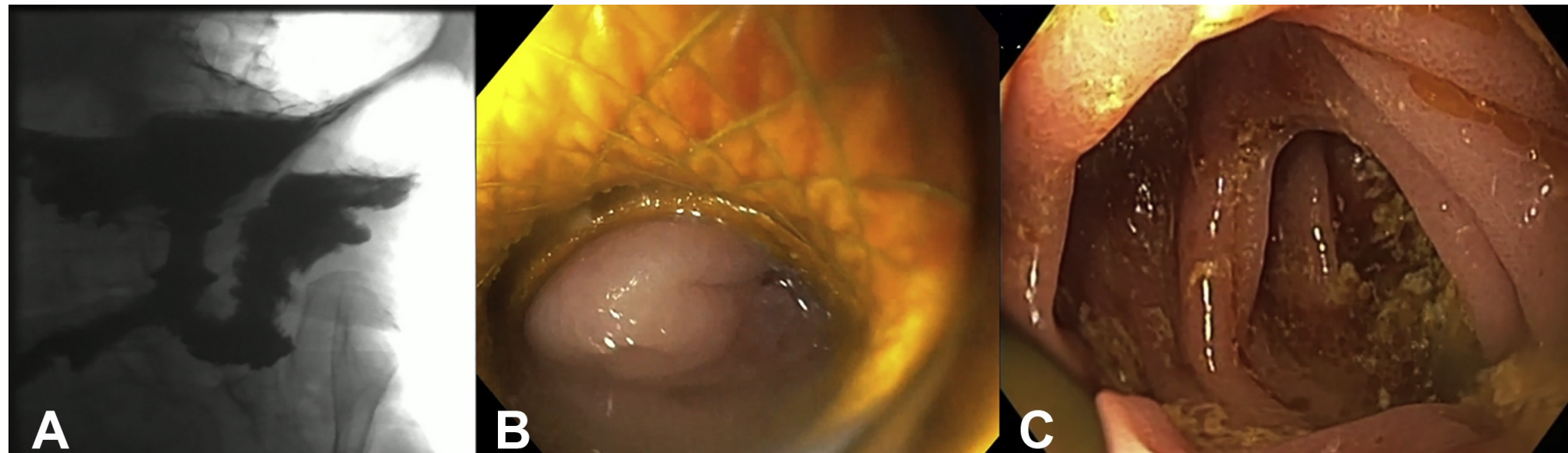
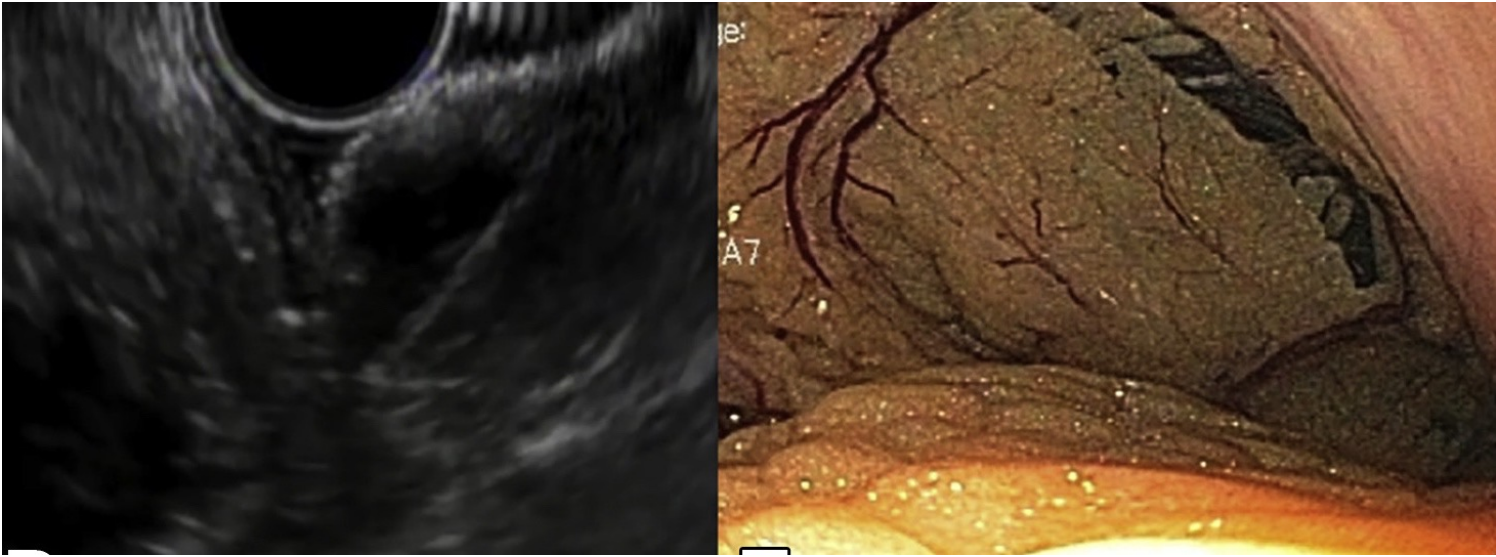
	EUS-GE (n=278)	ES (n=381)	P value
Technical success	95.2%	96.9%	0.6
Clinical success	93.3%	85.6%	0.2
Reintervention	4%	23.6%	0.001
Adverse events	10.7%	19.7%	0.3
Major AEs	3.7%	2.8%	0.8

Mohan et al. Endosc Intl Open 2021

EUS guided gastroenterostomy

	EUS-GE (n=232)	ES (n=131)	Surgical- GE (n=73)	Overall P-value	EUS-GE vs. ES †	EUS-GE vs. surgical-GE 1
Technical success	228 (98.3)	130 (99.2)	73 (100.0)	0.58	0.66	0.58
Clinical success	228 (98.3)	120 (91.6)	66 (90.4)	0.002*	0.002*	0.005*
Length of stay	2 (1–3)	3 (1–10)	5 (2–9)	<0.0001*	<0.0001*	0.018
Reintervention	2 (0.9)	16 (12.2)	10 (13.7)	<0.0001*	<0.0001*	<0.0001*
Adverse events	20 (8.6)	51 (38.9)	20 (27.4)	<0.0001*	<0.0001*	<0.0001*

Jaruvongvanich et al. Endosc Int Open 2023

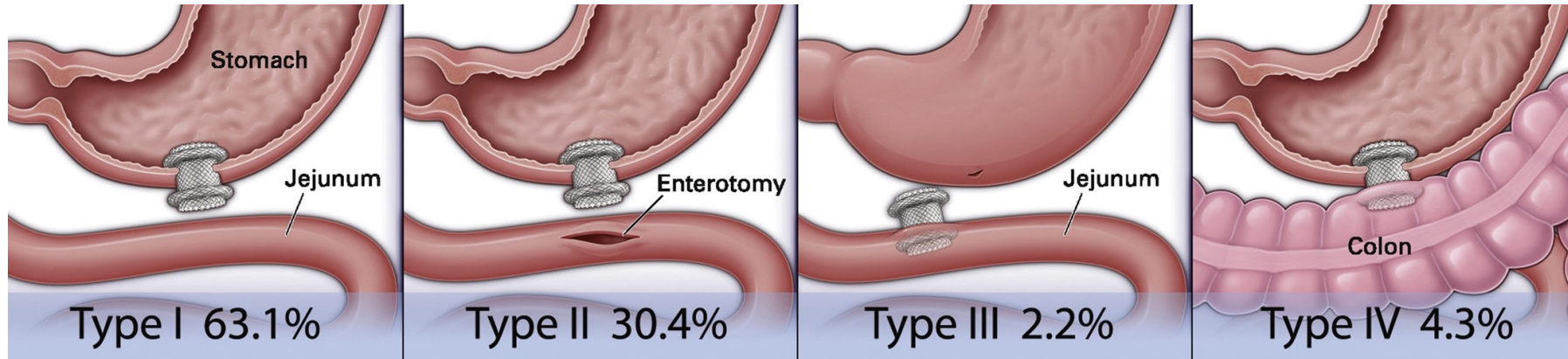


EUS-GE: still not a walk in the park...

Retrospective, multi-center, international study

467 patients

Stent misdeployment: 10% (46 patients)



- Expert centers
- Animal studies
- Surgical back up
- Off label use of LAMS
- Studies: 6-27% misdeployment rate

Severity

Mild: 61%

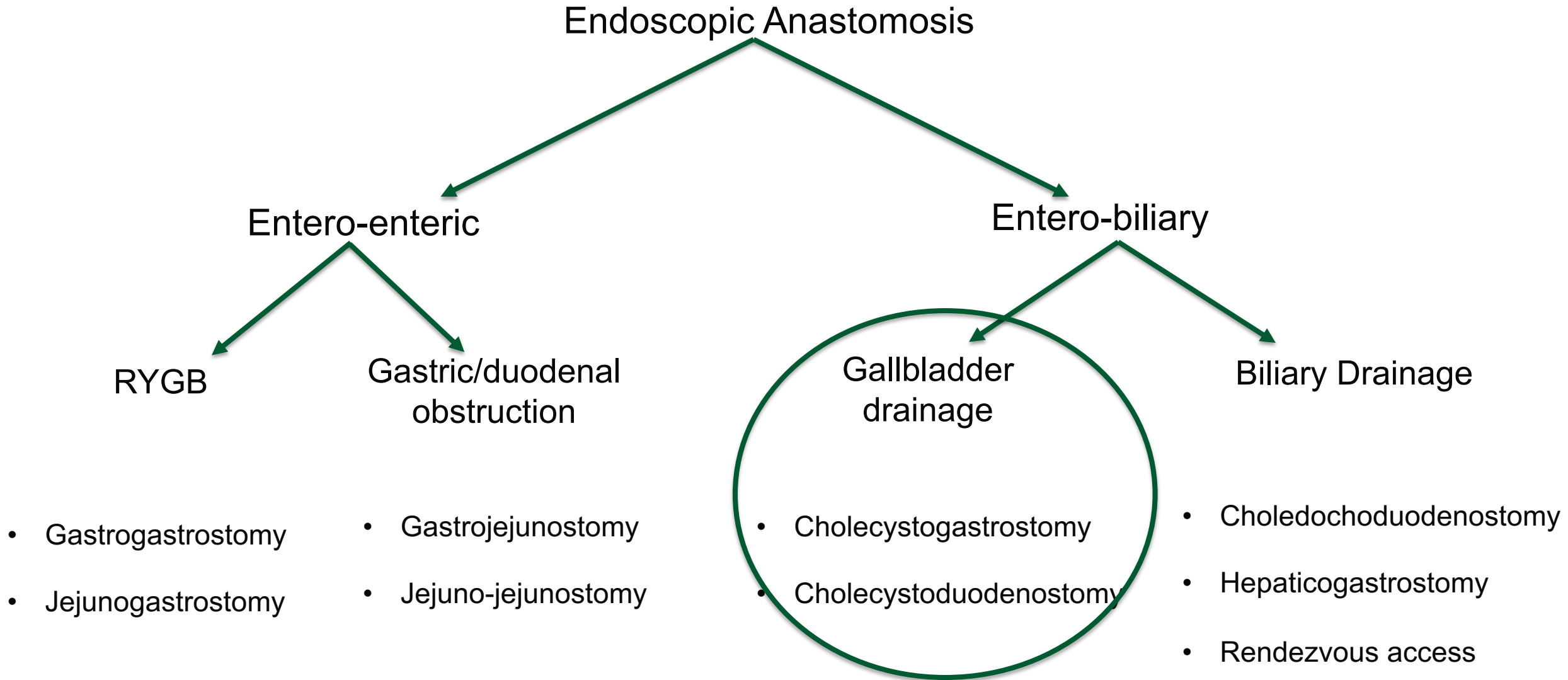
Moderate: 24%

Severe: 13%

Fatal: 2%

Surgery: 11% (5/46)

Entero-biliary anastomoses

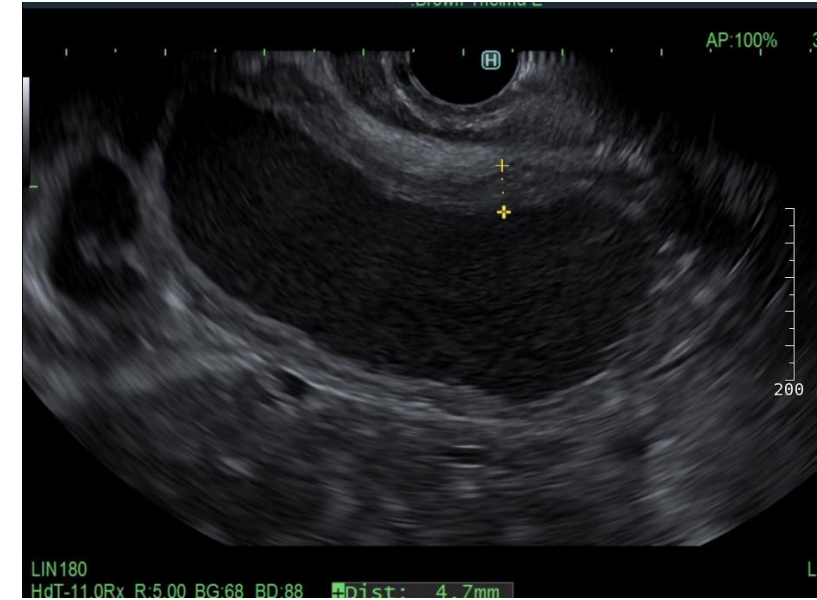


EUS guided gallbladder drainage

Cholecystoduodenostomy / cholecystogastrostomy

Approach to non-surgical management of cholecystitis

- Percutaneous drainage
- Trans-papillary drainage (ERCP)
- EUS guided drainage
 - Cholecystoduodenostomy
 - Cholecystogastrostomy



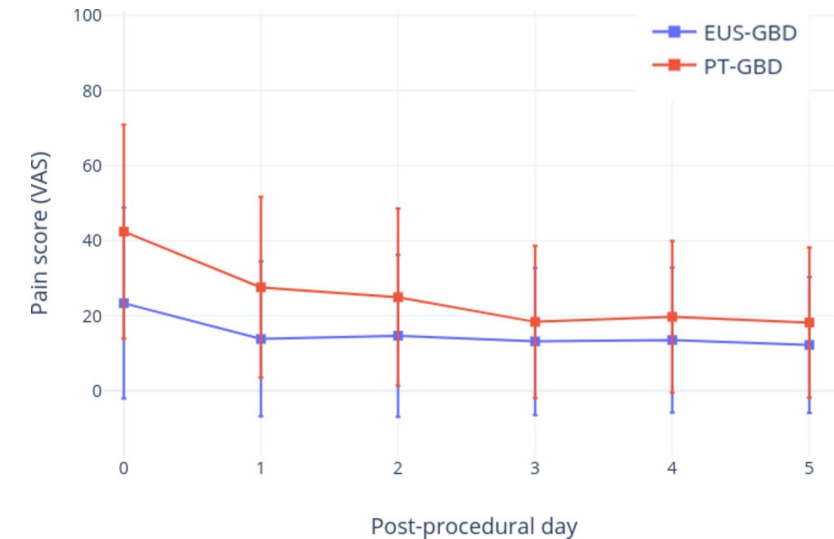
EUS guided GB drainage: Technique

- Proficient in use of LAMS and interventional EUS
- Correct indication (surgery, IR teams on board)
- Appropriate window
- Tap ascites if needed pre-procedure
- Stent size
- Antibiotics



EUS-GBD vs. PC-GBD (*DRAC 1 trial*)

	EUS-GBD (39)	PTC-GBD (40)	<i>p</i> -value
Technical success	38 (97.4)	40 (100)	.494
Clinical success	36 (92.3)	37 (92.5)	1
Procedure time (mins)	22.7	27.4	.108
Hospital stay (days)	8 (4-13)	9 (7-14)	.181
30-d mortality	3 (7.7)	4 (10)	1
→ 30-d adverse events	5 (12.8)	19 (47.5)	.001
→ Unplanned admissions	6 (15.4)	20 (50)	.002
→ 30-d reinterventions	1 (2.6)	12 (30)	.029
1-year AEs	10 (25.6)	31 (77.5)	<.001
Recurrent AC	1 (2.6)	8 (20)	.029



Teoh et al. Gut 2020

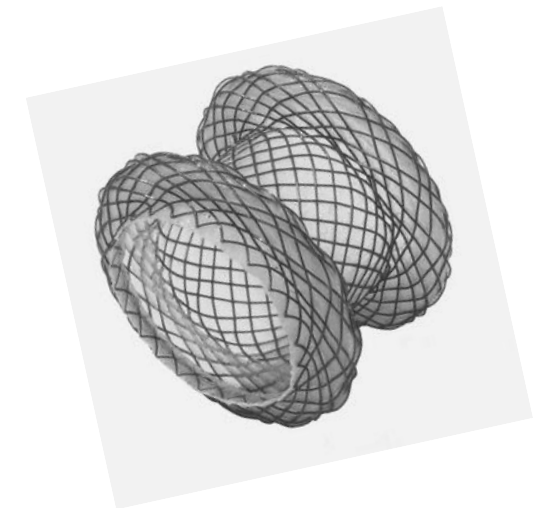
EUS-GBD (only LAMS) vs. PC-GBD

Meta-analysis

5 studies

647 patients (278/369)

Outcome	EUS (%)	PC (%)	Risk difference	P value
Technical success	95.9%	99.6%	-0.03	0.1
Clinical success	91%	94.8%	0.04	0.1
Adverse events	19%	45.2%	-0.33	0.006
Recurrent cholecystitis	2%	6.8%	-0.05	0.02
Reintervention	1.7%	34.8%	-0.35	0.013
Readmission	7.3%	37.1%	-0.36	0.03



Candido Hemerly et al. Surgical Endoscopy 2022

Why not ERCP and trans-papillary drainage ?

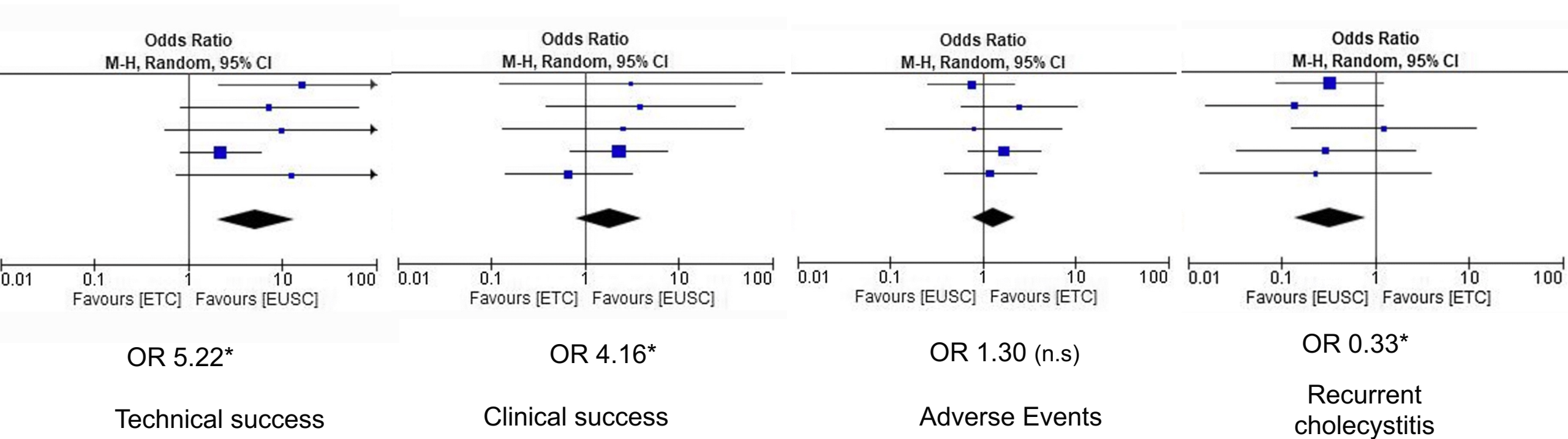
- **Technically difficult**
 - Cystic duct cannulation, tortuous cystic duct, duct obstruction
- **Stent occlusion**
 - Two side by side stents
- **Stent removal, risk of recurrence**
- **Risk of pancreatitis**



EUS-GBD vs. ERCP-GBD

Meta-analysis

5 studies, 857 patients



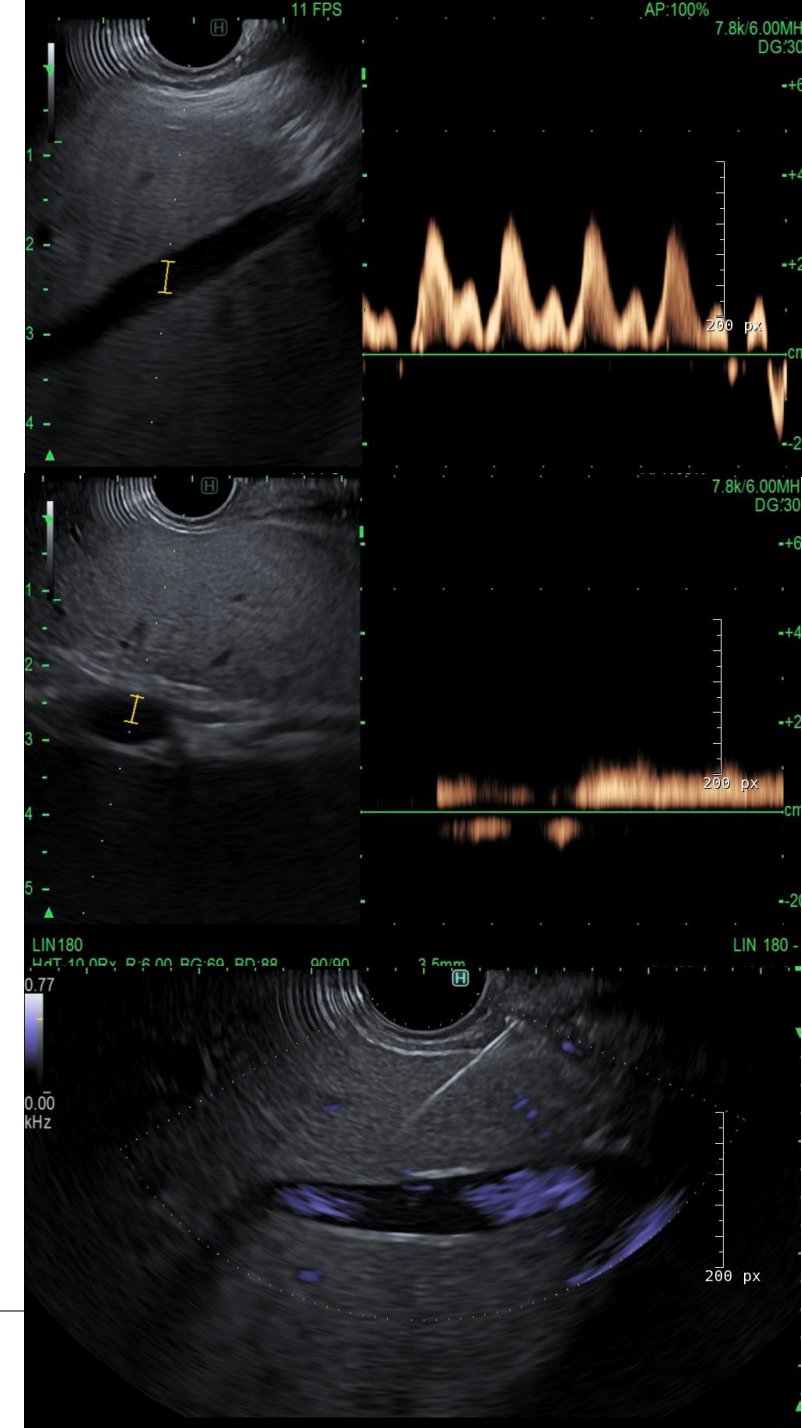
Krishanmoorthi et al. Surgical Endoscopy 2020

EUS GB drainage: issues

- **Transgastric vs. transduodenal**
 - depends on the optimal position
 - less food impaction with duodenal
- **Size of LAMS**
- **Double pigtail or not**
- **Stent removal/exchange**
- **Cholecystectomy after LAMS**

Just getting started !!

- Endo-hepatology
- Oncotherapy
 - sclerotherapy
 - chemotherapy
 - immunotherapy
 - gene therapy
- Vascular interventions
 - PPG measurement
 - pseudo-aneurysms
 - gastric variceal bleeding
 - CTCs sampling



Conclusion

- Endoscopic anastomoses using lumen apposing metal stents are feasible, durable and safe in the right hands
- In patients with RYGB
 - EDGE/EDGI should be preferred over laparoscopic approaches in malignant disease
 - In benign disease, consider EDGI if no need for surgery
 - Lap CCY + CBDE and lap CCY with lap assisted ERCP still a reasonable option
- In malignant GOO, EUS-GE should be done by expert endosonographers with adequate surgical back up. Consider enteral stent if expertise not available or short expected survival
- EUS guided GB drainage should be considered over percutaneous drainage in patients who are too high risk for surgery
- Future device development which minimizes risk will lead to wider adoption

Don't work alone !!!!

Thank You

ajaypal_singh@rush.edu
205-919-8942 (cell)



“We need practice to get good at what we do. There is one difference in medicine, though: it is people we practice upon.”

— Atul Gawande