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Technology and Improving Esophagectomy Outcomes

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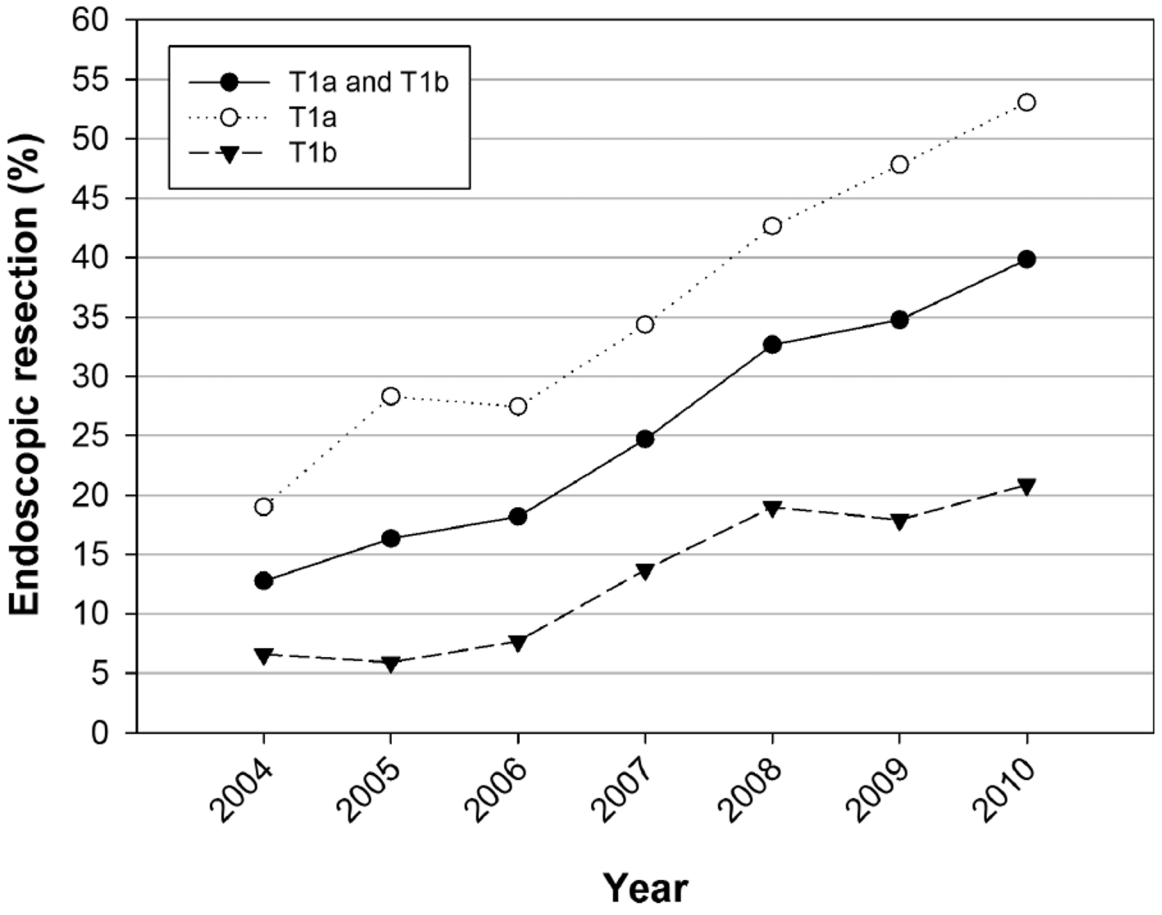
Disclosures

- Consultant for Johnson & Johnson, Boston Scientific, BMS, Merck
- Steering Committee AstraZeneca
- First in-person meeting since 01/2020!!

Technology and ultimate outcome

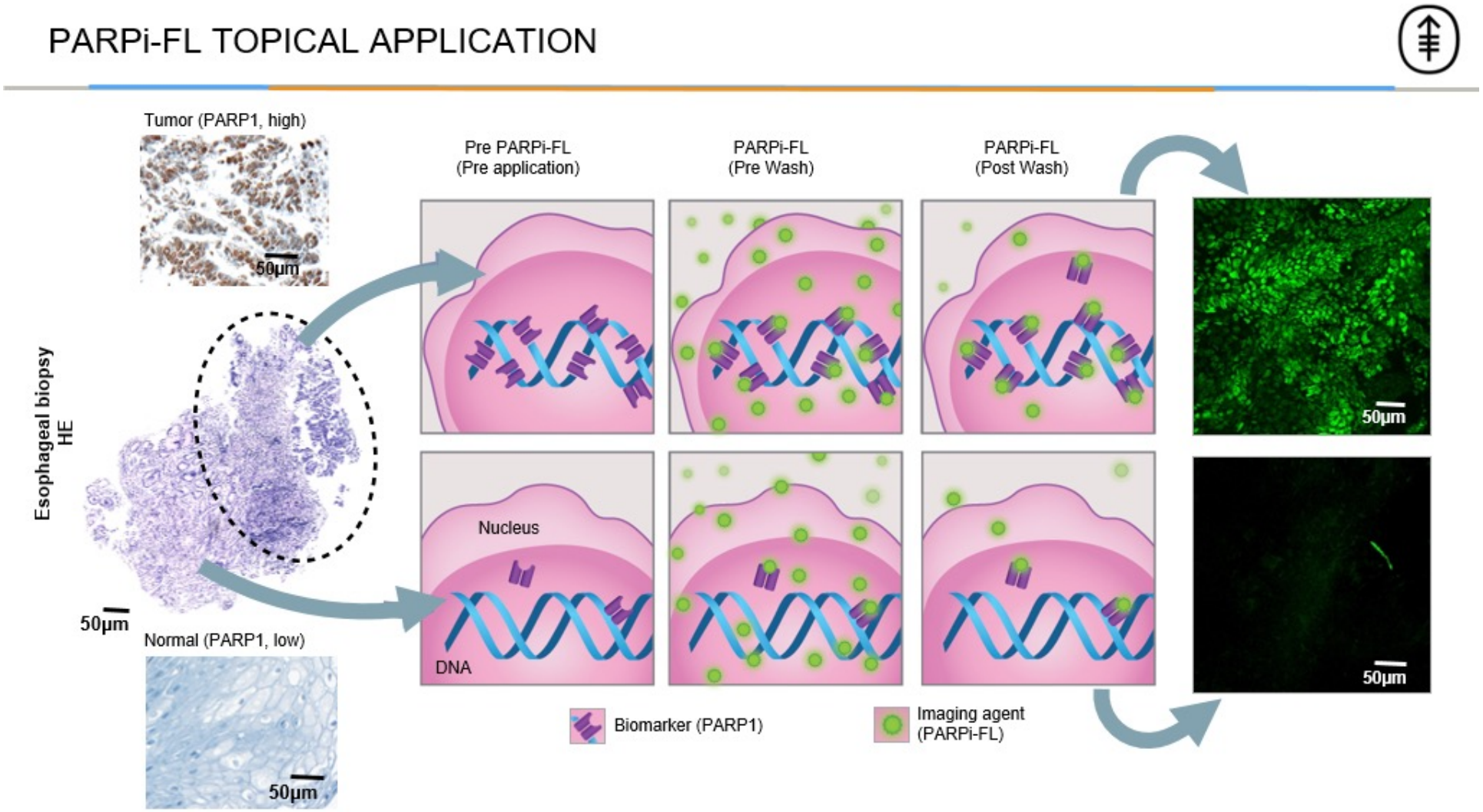
Use of ER for early esophageal cancer



- Improved diagnostic tools
- Advanced resection instruments
- Ablative techniques for prevention

Merkow RP, et al. *J Natl Cancer Inst*, 2014

Investigating new imaging agents



Kossatz S. Nat Biomed Eng. 2020

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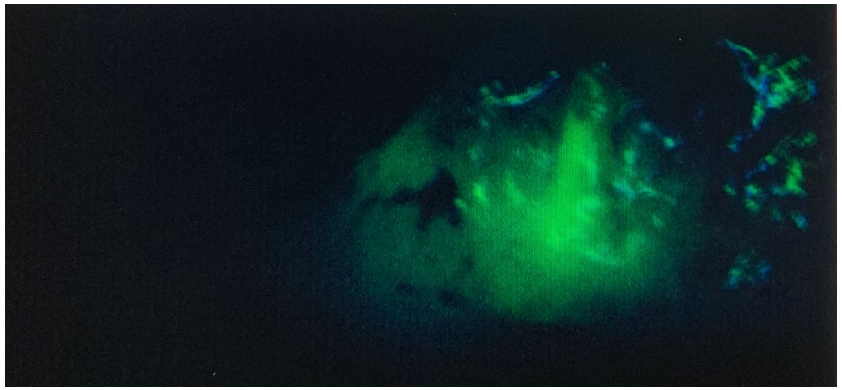
Targeted biopsies?



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N=12

Imaged 12 patients

Data analysis in progress

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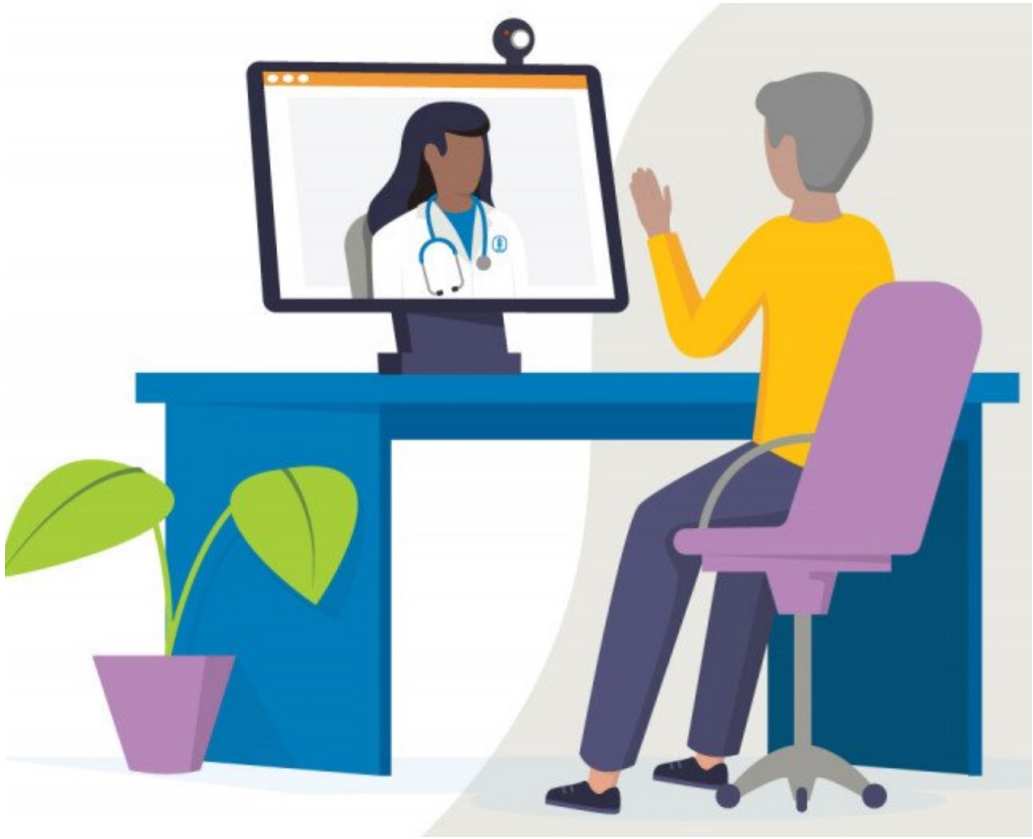
The Virtual World

- Telemedicine visits
- Pre-habilitation for surgery
- Recovery



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Technology in the Pre-operative Setting

- Telemedicine in thoracic surgery
  - 299 new patients seen between March-June 2020 (52% reduction in volume from previous year)
  - 45 % were seen via telemedicine
  - 60% patients would prefer to continue telemedicine visits after the pandemic

Characteristic	Telemedicine (n=65)	In person (n=68)	P[a]
Any complication			>0.999
No	42 (65)	43 (63)	
Yes	23 (35)	25 (37)	
Serious complication			0.326
No	62 (95)	61 (90)	
Yes	3 (5)	7 (10)	

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Technology in the Pre-operative Setting ç

Mind Body Prehab for Thoracic Cancer Surgery

119 patients referred to the program

100 patients approached and 66 patients enrolled after referral

66% participation rate

Quick Facts

- Launched in December of 2020
- **Free** virtual mind-body classes
- Classes available 2x per week
- Focus on **strength, relaxation**, and **breathing**

100% of participants are **extremely satisfied**

98% would **recommend** to friends and family.

94% agreed classes were **"very helpful"**

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Technology during Surgery

MIE and RAMIE

- Less traumatic
- Easier postoperative recovery
- Less postoperative pain
- Fewer wound and cardiopulmonary complications
- Enhanced visualization

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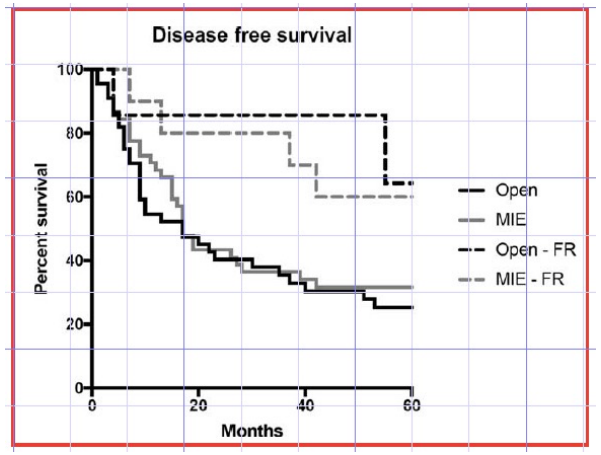
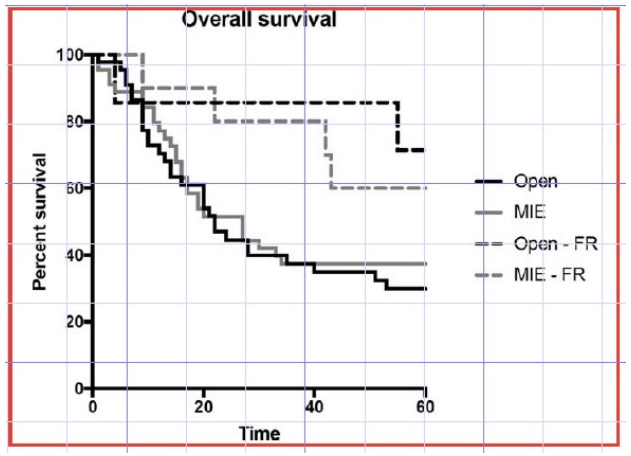
MIE vs OPEN: TIME Trial

	OO (N=56)	MIO (N=59)	p value
Primary outcomes			
Pulmonary infection within 2 weeks	16 (29%)	5 (9%)	0·005
Pulmonary infection in-hospital	19 (34%)	7 (12%)	0·005
Secondary outcomes			
Hospital stay (days)*	14 (1–120)	11 (7–80)	0·044
Short-term quality of life†			
SF 36†			
Physical component summary	36 (6; 34–39)	42 (8; 39–46)	0·007
Mental component summary	45 (11; 40–50)	46 (10; 41–50)	0·806
EORTC C30†			
Global health	51 (21; 44–58)	61 (18; 56–67)	0·020
OES 18‡			
Talking	37 (39; 25–49)	18 (26; 10–26)	0·008
Pain	19 (21; 13–26)	8 (11; 5–11)	0·002
Total lymph nodes retrieved*	21 (7–47)	20 (3–44)	0·852
Resection margin§			0·080
R0	47 (84%)	54 (92%)	..
R1	5 (9%)	1 (2%)	..
pStage¶			0·943
0	0 (0%)	1 (2%)	..
I	4 (7%)	4 (7%)	..
IIa	16 (29%)	17 (29%)	..
IIb	6 (11%)	9 (15%)	..
III	14 (25%)	11 (19%)	..
IV	5 (9%)	4 (7%)	..
No residual tumour or lymph-node metastasis	7 (13%)	9 (15%)	..
Mortality‖			0·590
30-day mortality	0 (0%)	1 (2%)	..
In-hospital mortality	1 (2%)	2 (3%)	..

Biere SS et al. Lancet 2012;379:1887-1892



Straatman J et al. Annals of Surgery 2017



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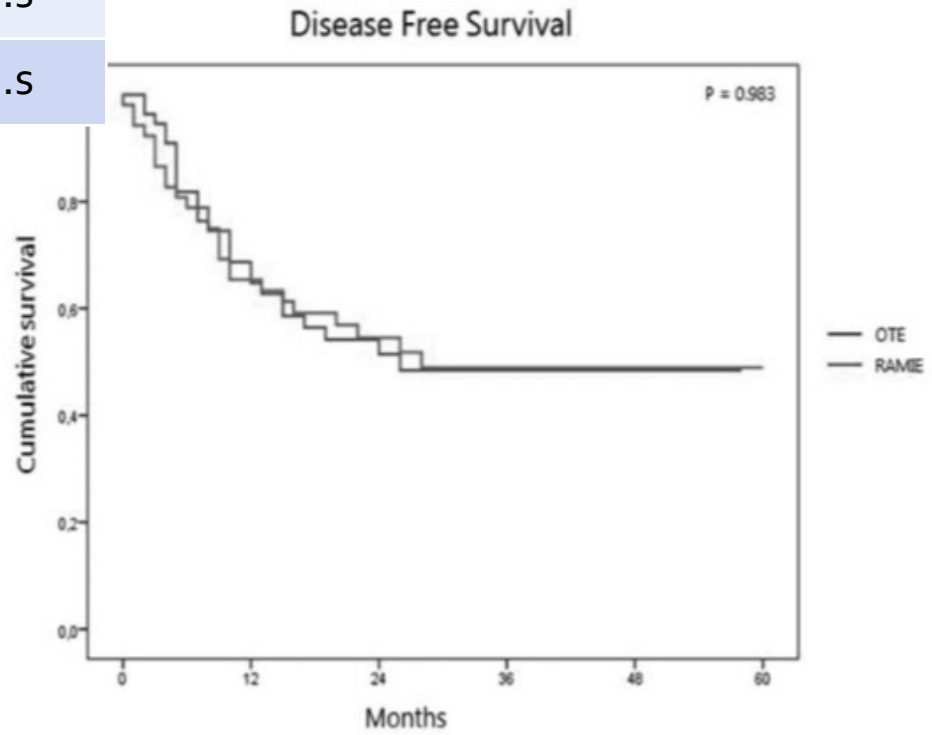
RAMIE vs OPEN: ROBO Trial

Trial Endpoints	RAMIE (54 pts)	OTE (55 pts)	P value
Related complication ≥ 2	59%	80%	0.02
Pulmonary	32%	58%	0.005
Cardiac	22%	46%	0.006
Leaks	24%	20%	n.s
30-day mortality	2%	0	n.s

RAMIE was associated with:

- Decreased overall complications
- Decreased blood loss
- Decreased pain
- Improved short term QoL

Van der Sluis PC. Ann Surg 2019;269:621-630



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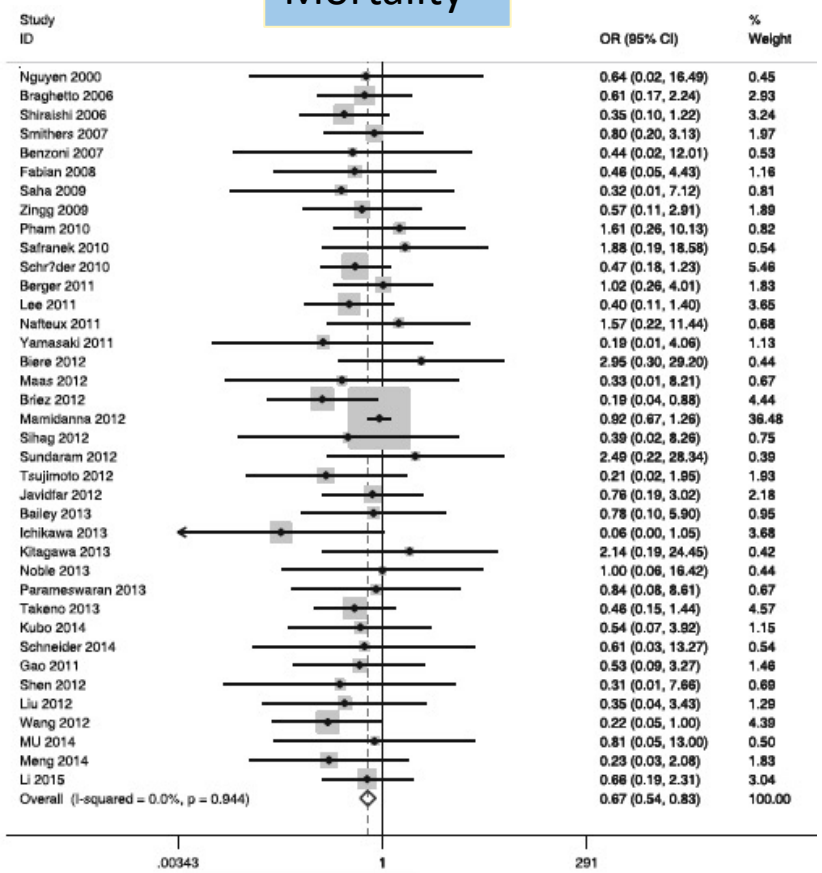
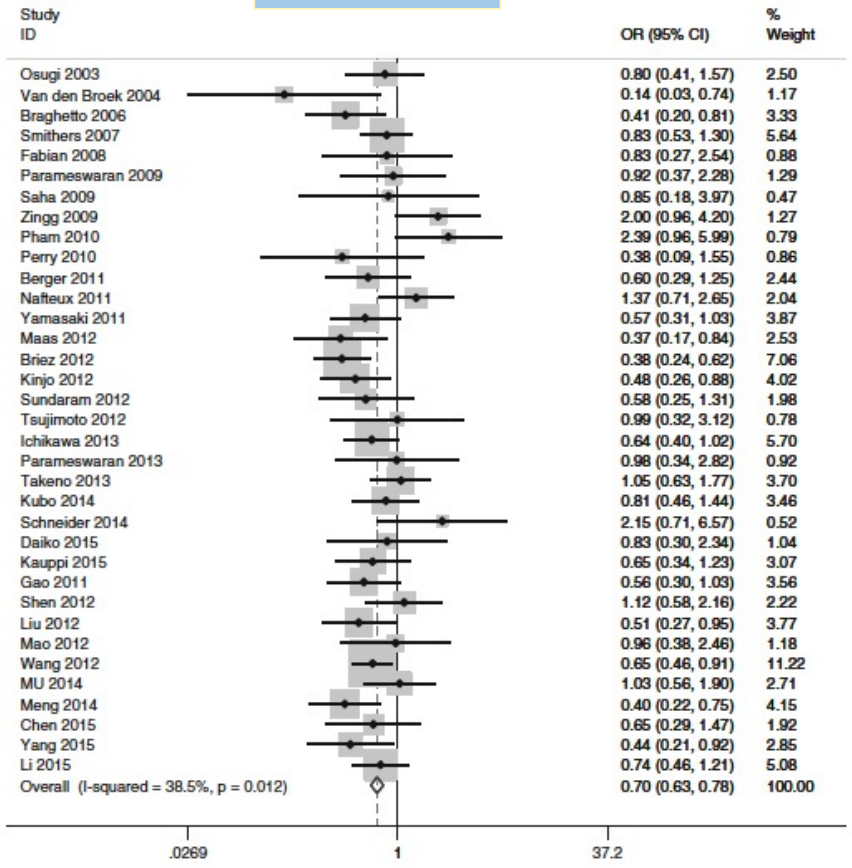
MIE vs OPEN: Meta-analysis

Mortality



3.8% (124/4379) MIE vs 4.5% (437/9753) OE
OR=0.668, 95%CI=0.5-0.8, p< 0.05

Morbidity



41% (1206/2907) MIE vs 48% (1486/3084) OE
OR=0.7, 95%CI=0.6-0.8, p< 0.05

Yibulayin W et al. World Journal of Surgical Oncology 2016

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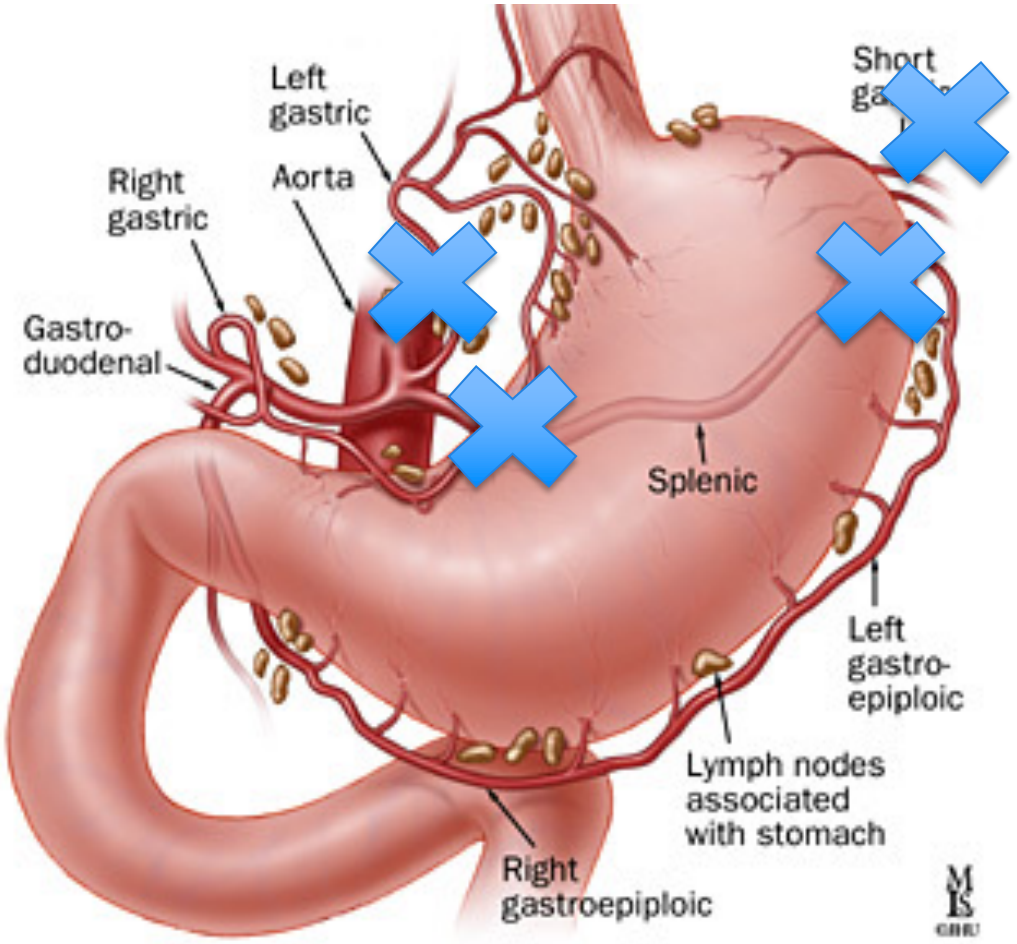
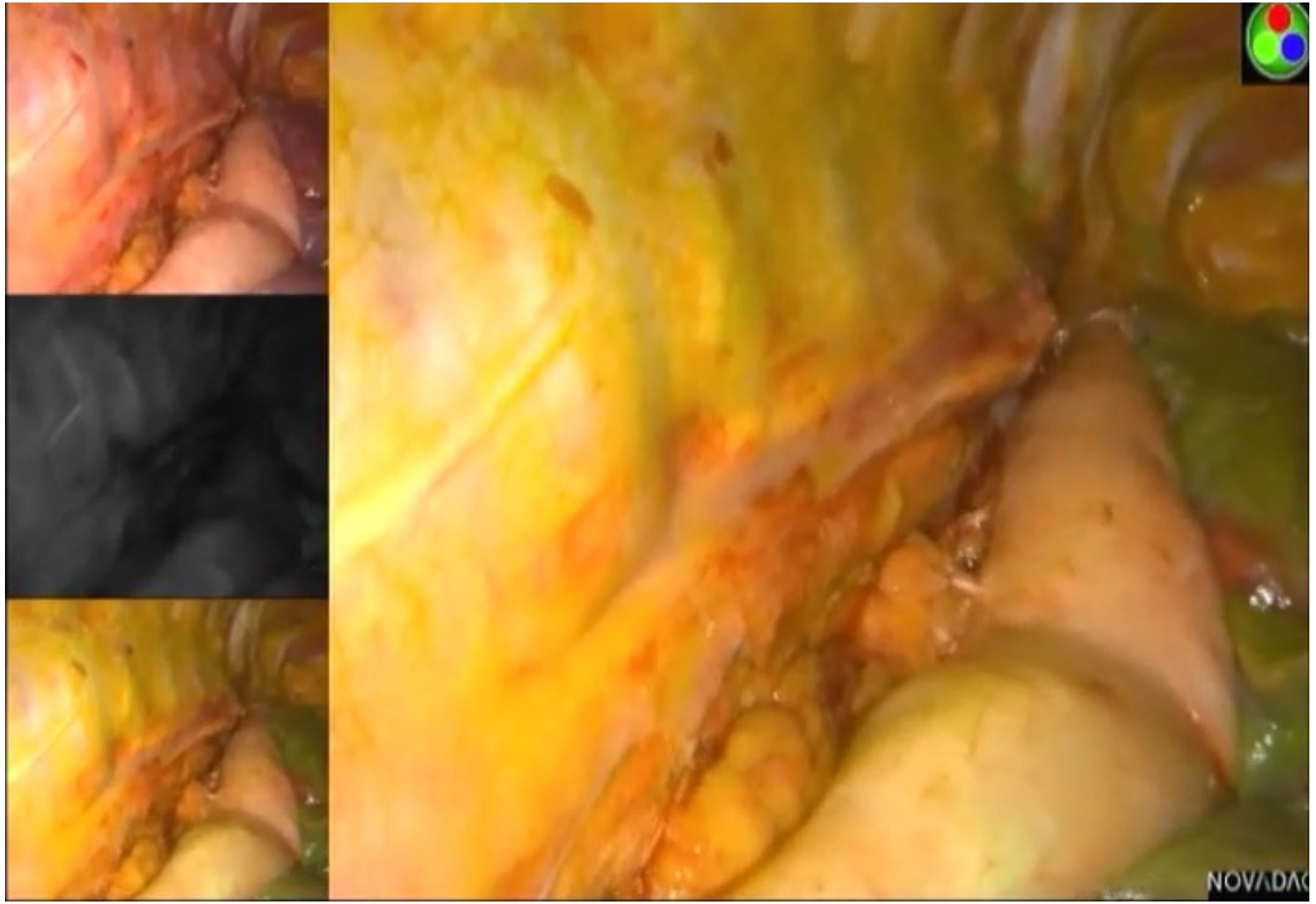
Gastric Perfusion



- Critical for healing of any anastomosis
- Acutely impaired during esophagectomy
- Lacking reliable assessment tools

No demarcation



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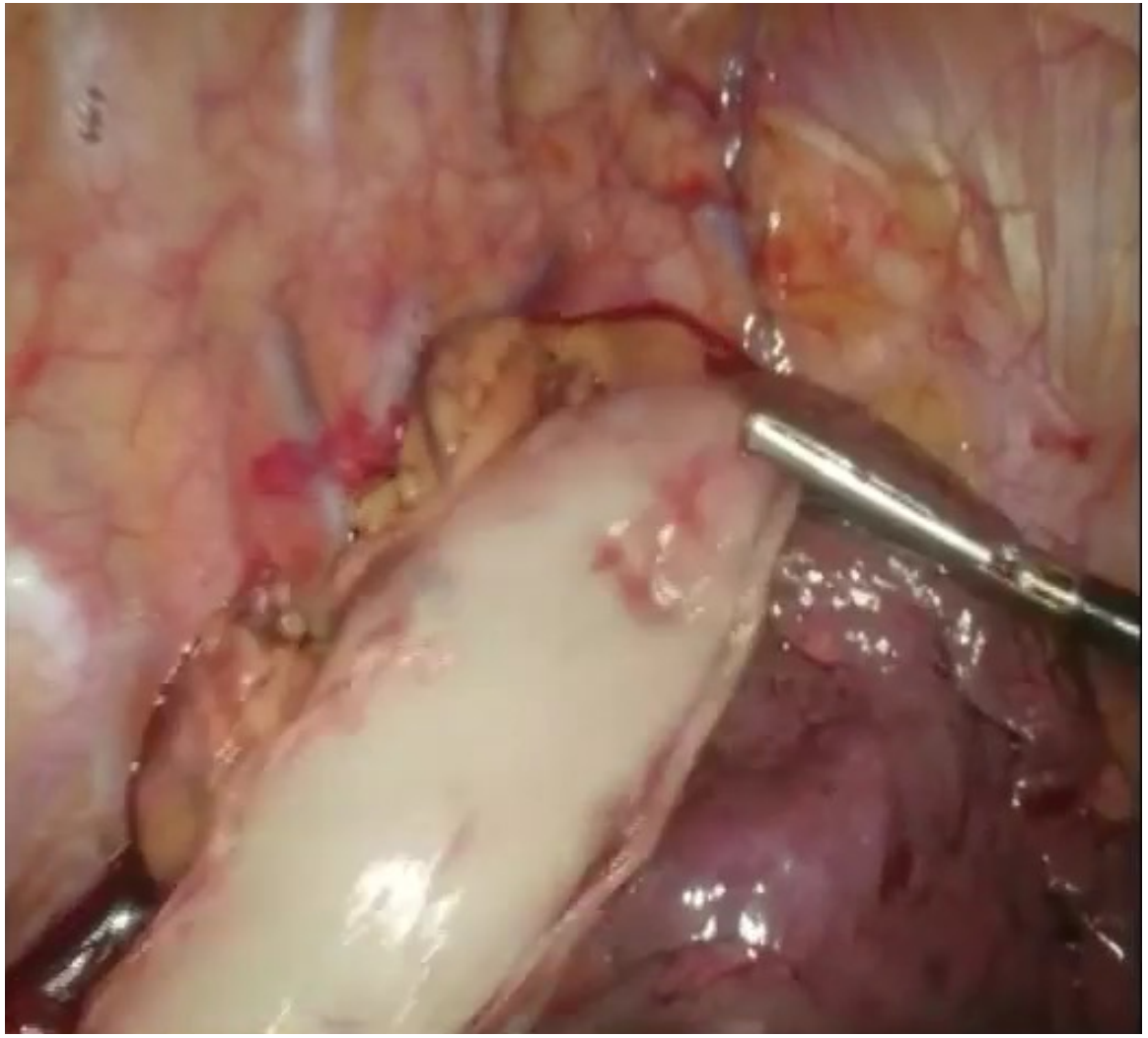
Tip demarcation



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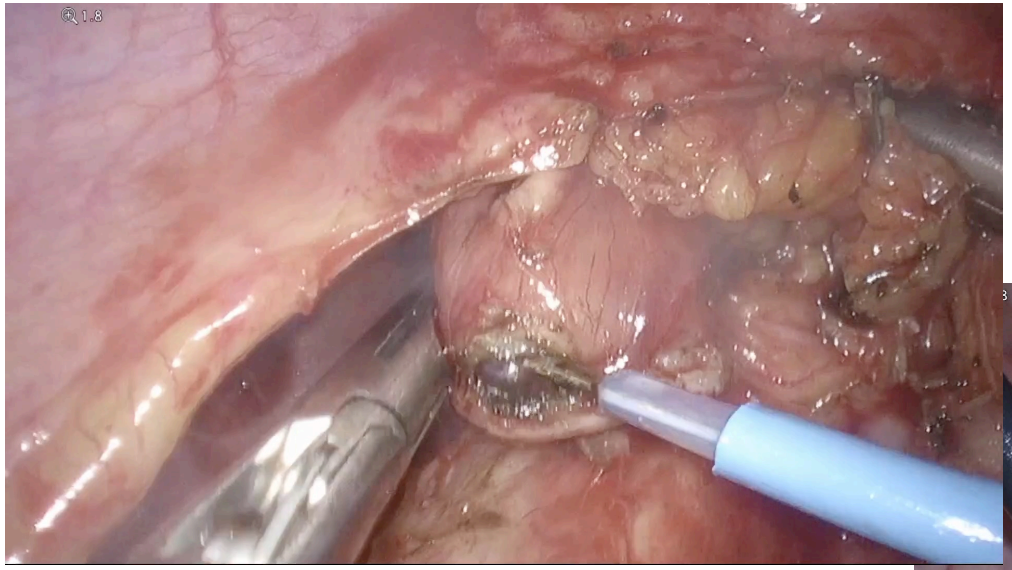
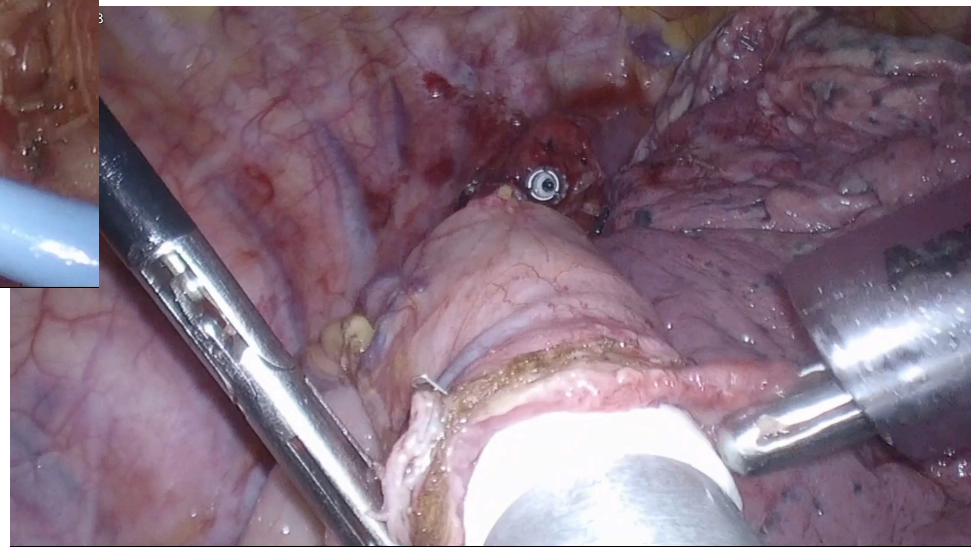
Minimally invasive Ivor Lewis esophagectomy in 10 steps

Caitlin Harrington, MD • Daniela Molena, MD

JTCVS TECHNIQUES

Open Access • Published: August 05, 2021 • DOI: https://doi.org/10.1016/j.xjtc.2021.04.038





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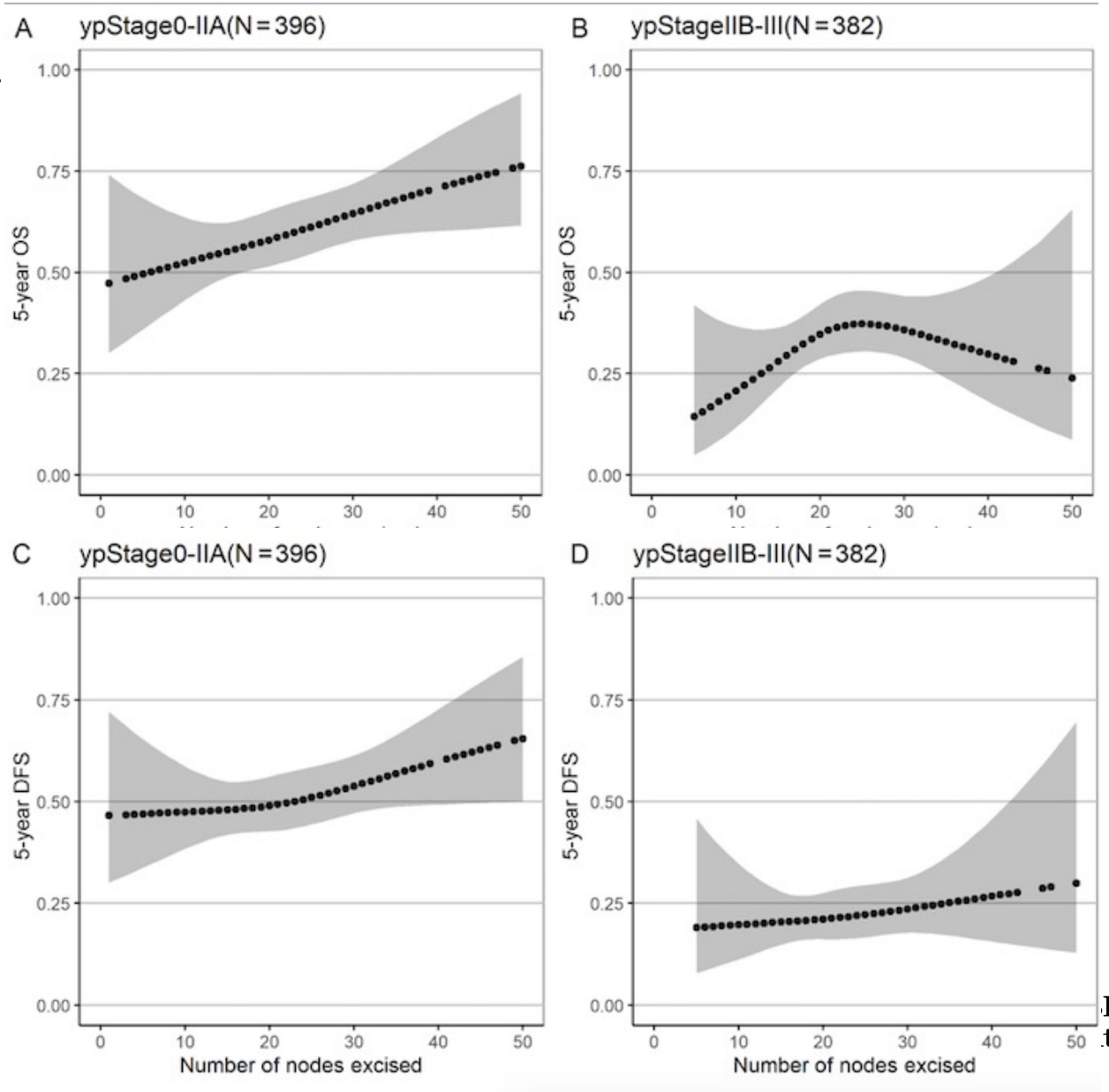
MSK data on 778 patients after trimodality

- Better OS and DFS with higher number of nodes removed, especially in downstaged patients
- For patients with minimal response the improvement peaked with 20-25 nodes removed



Sihag S et al, Ann Surg 2021

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Number and location of lymph nodes

Patterns and Impact of Nodal Metastasis After Neoadjuvant Chemoradiation and R0 Resection in Esophageal Adenocarcinoma

STUDY POPULATION

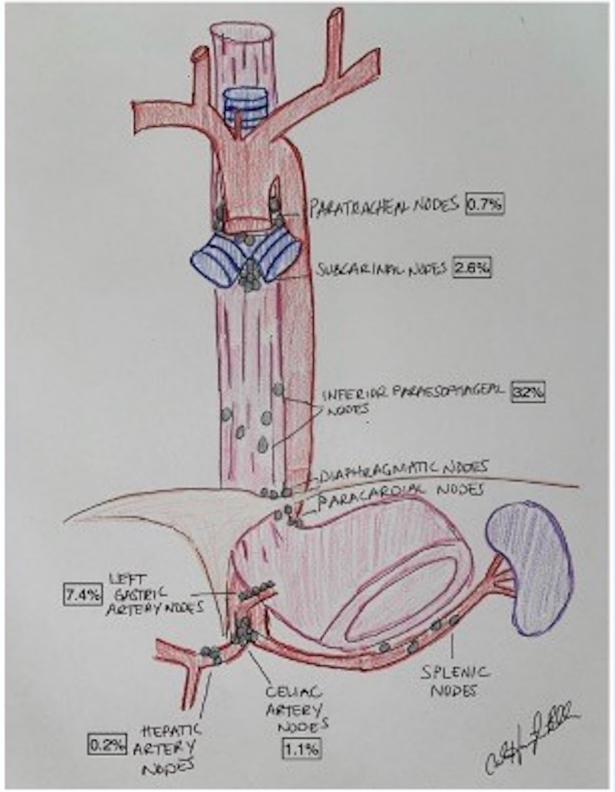
537 Patients

Dx: Esophageal Adenocarcinoma

Tx: Neoadjuvant Chemoradiation, R0 Resection

Time Period: 2010-2018

PATTERNS OF RECURRENCE



RISK OF RECURRENCE

Does **number of stations** with positive nodes matter? → **YES**

Does **number of positive lymph nodes** matter? → **YES**

Does **location** of positive nodes matter? → **YES**

- Paraesophageal Nodes
- Subcarinal Nodes

Our findings suggest that the number and location of stations with positive lymph nodes affects prognosis. Larger studies are needed to verify this relationship.

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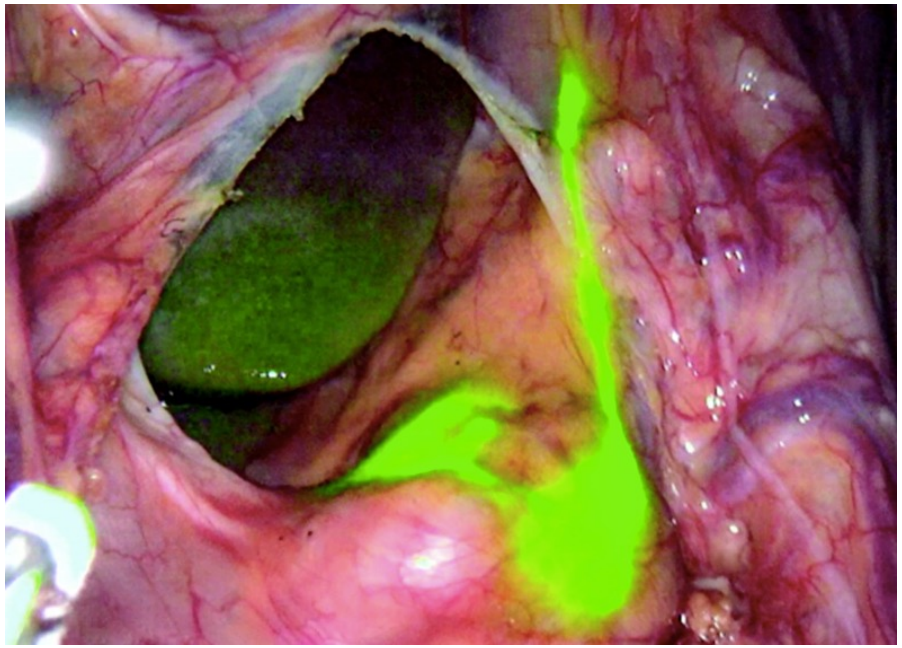
Can we predict lymphatic drainage?

- 9 patients
- ICG injected at 4 quadrants around tumor
- 88.9% left gastric a.
- 11.1% diaphragmatic nodes
- 33.3% positive nodes all identified within first basin



Schlottman F, et al. *JLAST,* 2017

ERAS Program

https://www.mskcc.org/pdf/cancer-care/patient-education/minimally-invasive-esophagectomy-pathway

Minimally Invasive Esophagectomy Pathway

These are goals for your recovery. Your experience may not follow this pathway exactly. Your doctor or nurse will tell you what to expect.

Surgery date: _____ Expected discharge date: _____

	Before Surgery	Day of Surgery	Day 1 After Surgery
What should I do?	• Buy a wedge pillow. • From now until surgery, exercise 30 minutes (such as walking 1 mile) every day. • Brush your teeth after you eat. • Stop smoking 2 or more weeks before surgery. • Plan your ride home after surgery. **The night before surgery:** • Wash with Hibiclens®	• Wash with Hibiclens in the morning. • Brush your teeth.	• Raise the head of your bed to 30 degrees. • Use your incentive spirometer 10 times each hour you're awake. • Do coughing & deep breathing exercises. • Sit up in your chair. • Walk 5 laps around the nursing unit. • Brush your teeth and use mouth rinses 3 or more times a day. • Learn about caring for your incisions and feeding tube.
What tests, procedures, and medical devices should I expect?	**Presurgical testing appointment:** • Bring a list of all medications you take. • Your nurse practitioner may order more tests or appointments.	**Placed before surgery:** • Intravenous (IV) line • Compression boots **Placed during surgery:** • Chest tubes • Feeding tube • Urinary (Foley®) catheter • Nasogastric (NG) tube	• Chest tubes • NG tube • Fluids in your IV line • Chest x-ray • Blood tests • Weight measurement • Urinary catheter may be removed

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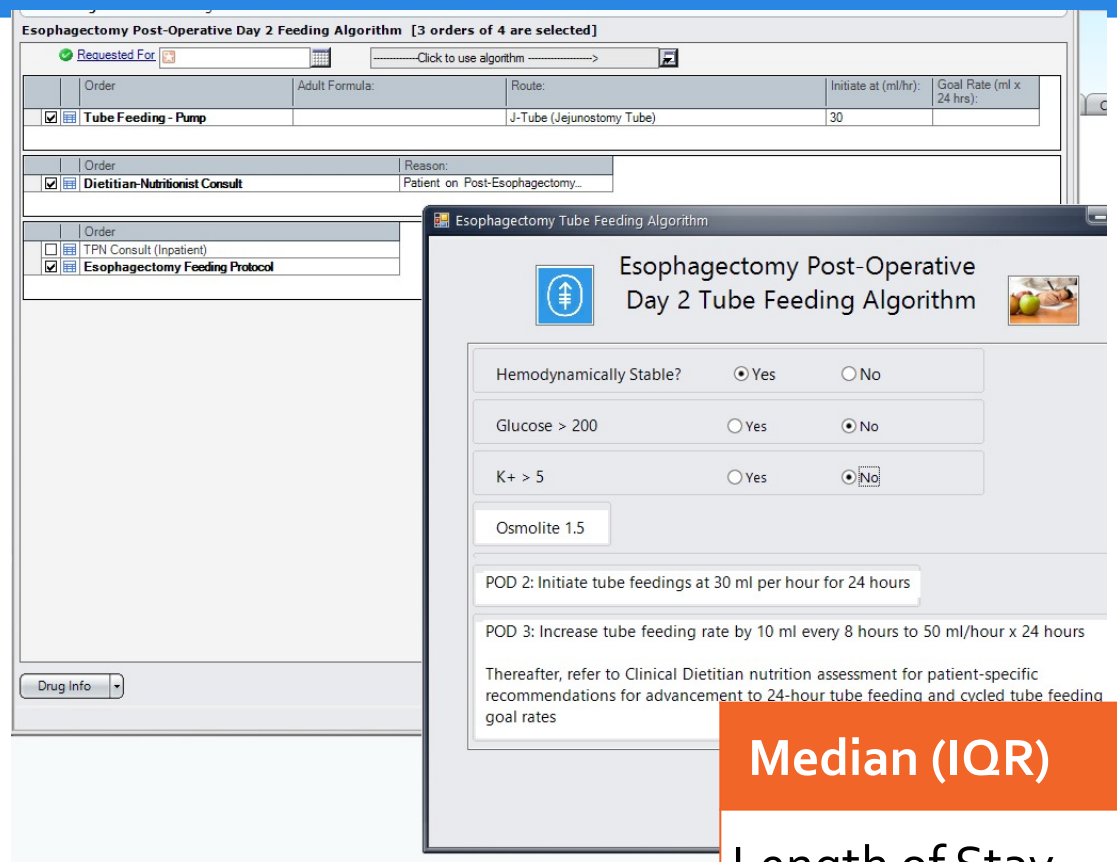
Nutrition Optimization



Carr R, Molena D. Cancer Medicine. In Press

Median (IQR)	Pre	Post	p-value
Length of Stay	10 (8-13)	8 (7-11)	0.003
Wt Loss at FU	4 (0.8-6.6)	3 (0.2-4.9)	0.014
Days to CLD	8 (6-11)	7 (6-8)	0.001
Days to Feeding Tube Removal	29 (21-48)	25 (19-39)	0.03

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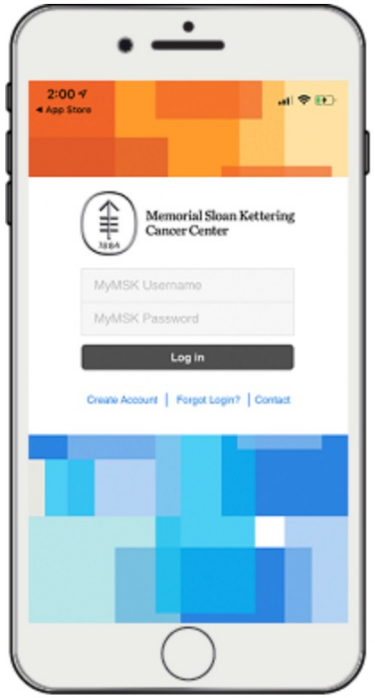
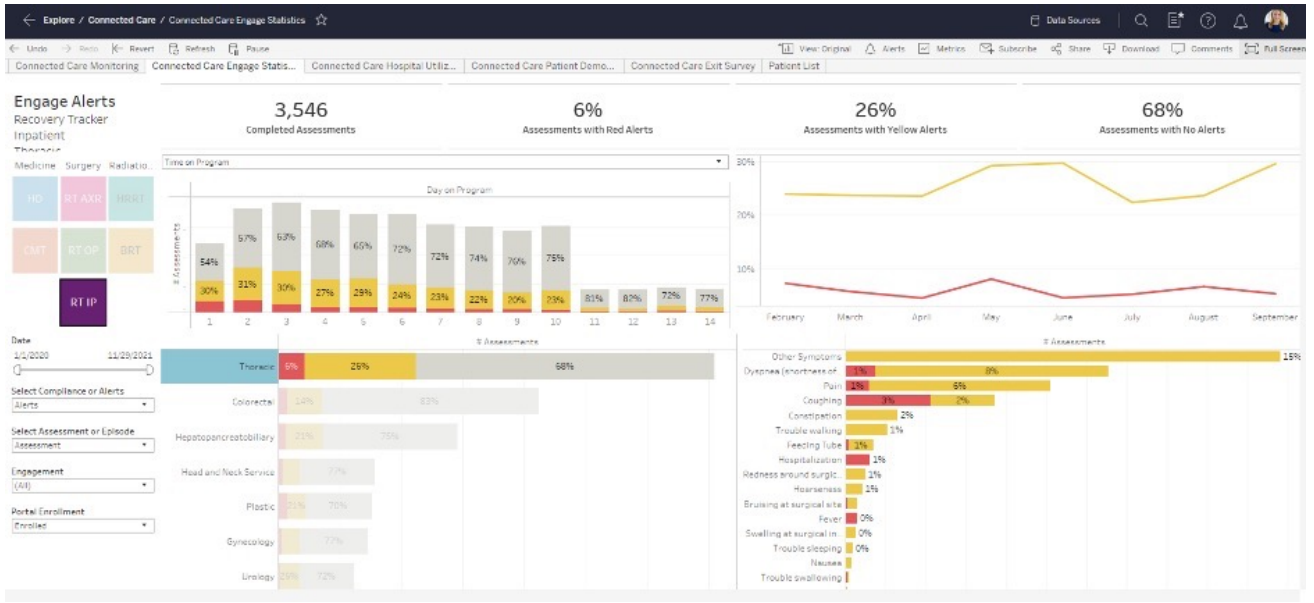
Post-operative Recovery Tracker





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Conclusions

- Technology has been integral part of surgery
- Pre- and post-operative tools for patients' engagement can form a winning partnership
- Tools for intra-operative imaging need to be further developed
- Partnership with industry can help improve the outcomes of surgery

Thank you!

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