Minimally Invasive Esophagectomy

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Outline

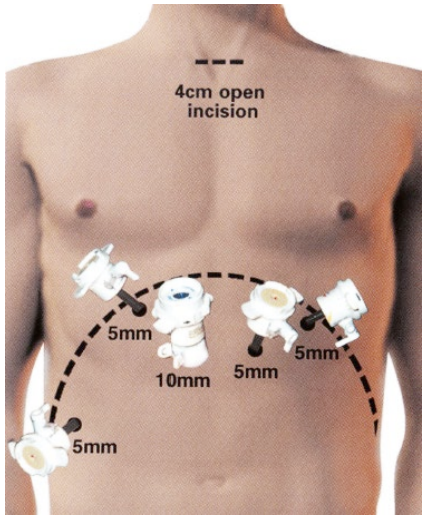
- Briefly review esophagectomy techniques
- Define minimally invasive esophagectomy (MIE)
- Endoscopic options to treat esophageal disease
- MIE technical details
  - Abdomen
  - Chest
  - Anastomosis
- Review Outcomes

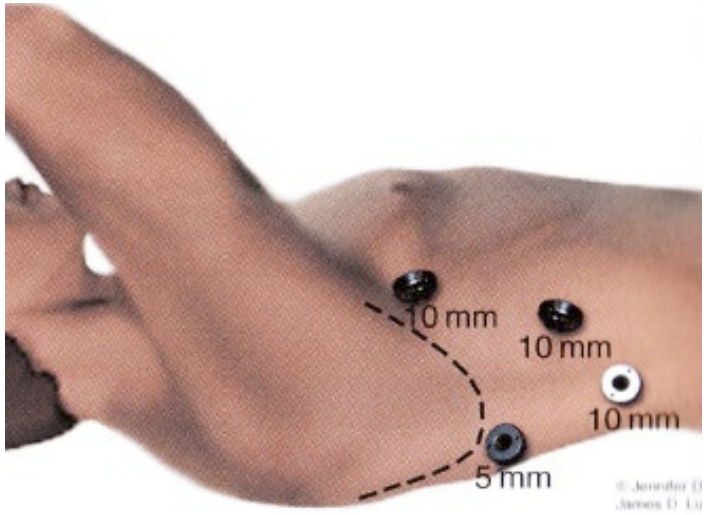
Esophagectomy Approaches

- Transhiatal
- Ivor-Lewis
- McKeown / 3-Incision
- Left Thoraco-Abdominal
- Left Thoracotomy
- Trans-Abdominal

What is a Minimally Invasive Esophagectomy (MIE)?

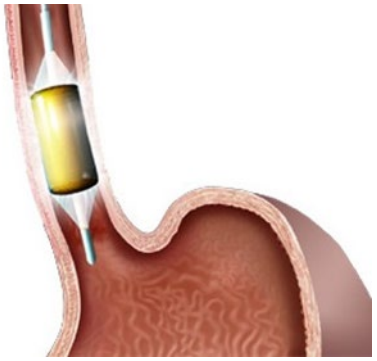
- Use minimally invasive techniques to replace a laparotomy and/or thoracotomy for dissection and anastomosis
  - Laparoscopy
  - Thoracoscopy
  - Robotic
- The goal: less pain, less morbidity, faster recovery, better outcomes

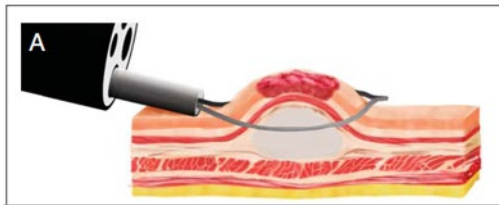


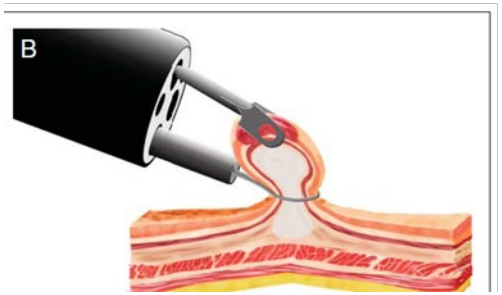


Really Minimally Invasive - Endoscopic Treatment

- Ablation of High Grade Dysplasia
  - › Photodynamic therapy (PDT)
    - Light activation of sensitizer porphyrin results in reactive O2 species
  - › Radiofrequency ablation (RFA)
    - High-frequency current delivers energy to cause directed necrosis
- Endoscopic Mucosal Resection (EMR) for T1a Cancers
  - › Local resection under visual guidance

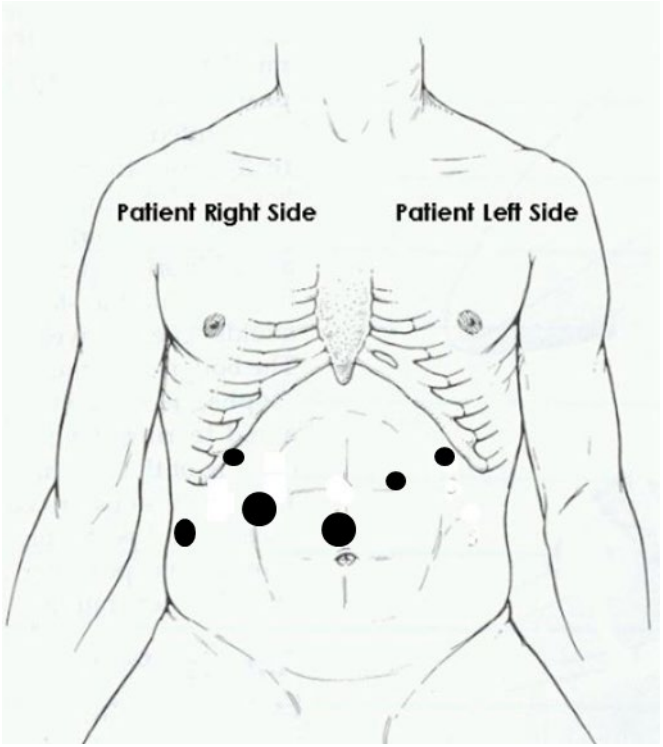






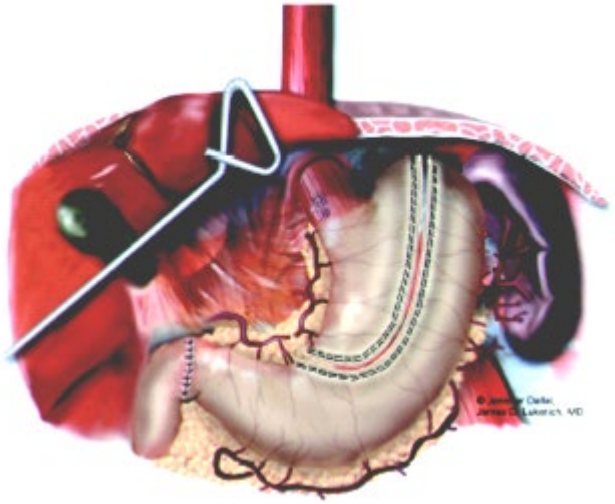
Laparoscopic Abdominal Port Placement

- Place camera port above the umbilicus
- Two 5 ports on the left
  - One will eventually be the j-tube site
- One 5 port on the right
- Another more lateral 5 port – liver retractor
  - Retract left lateral segment away from the hiatus
- A12 Step port on the patient's right side lateral to the umbilicus



Abdominal Dissection

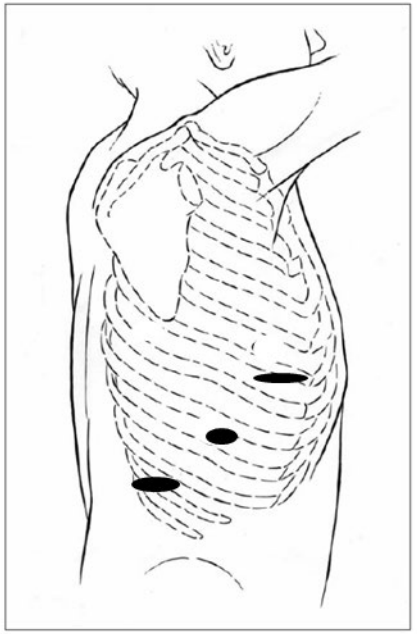
- Start dissection at the pars lucida and then perform hiatal dissection.
- Dissect greater curve of the stomach.
- Divide left gastric artery.
- Begin the esophagogastrectomy specimen.
- Place jejunostomy tube.



Abdominal Dissection

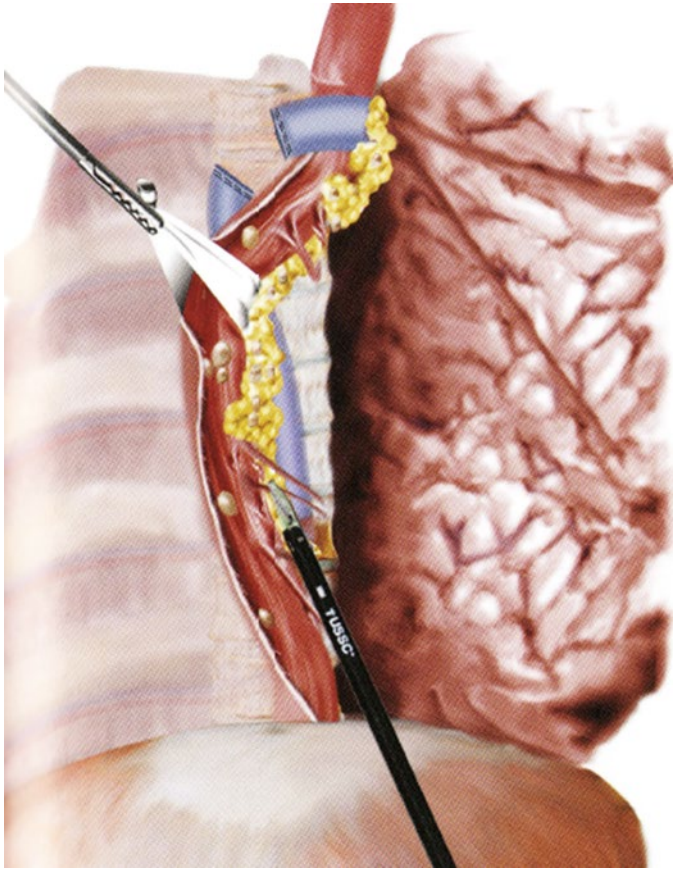
VATS Chest Port Placement

- Place camera port in the 8th intercostal space in the anterior axillary line.
- Anterior utility in the 5th intercostal space
- Posterior utility incision in the 10th intercostal space if performing an Ivor-Lewis and planning a chest anastomosis
  - Not necessary for McKeown, but can be helpful for mobilization



Chest Dissection

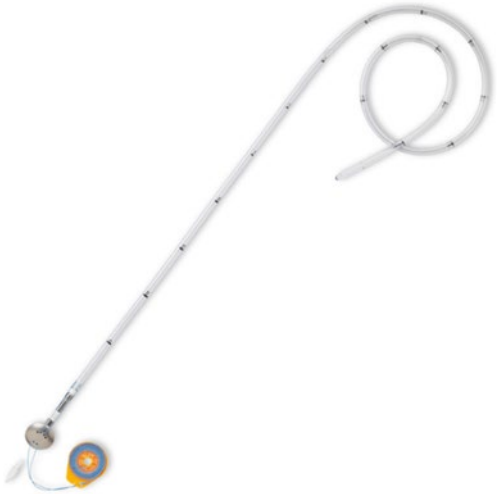
- Take down inferiorly pulmonary ligament, dissect Level 7, divide azygos vein
- Encircle esophagus and mobilize it from above the hiatus to:
  - above the azygos for an Ivor-Lewis
  - the thoracic inlet for a McKeown



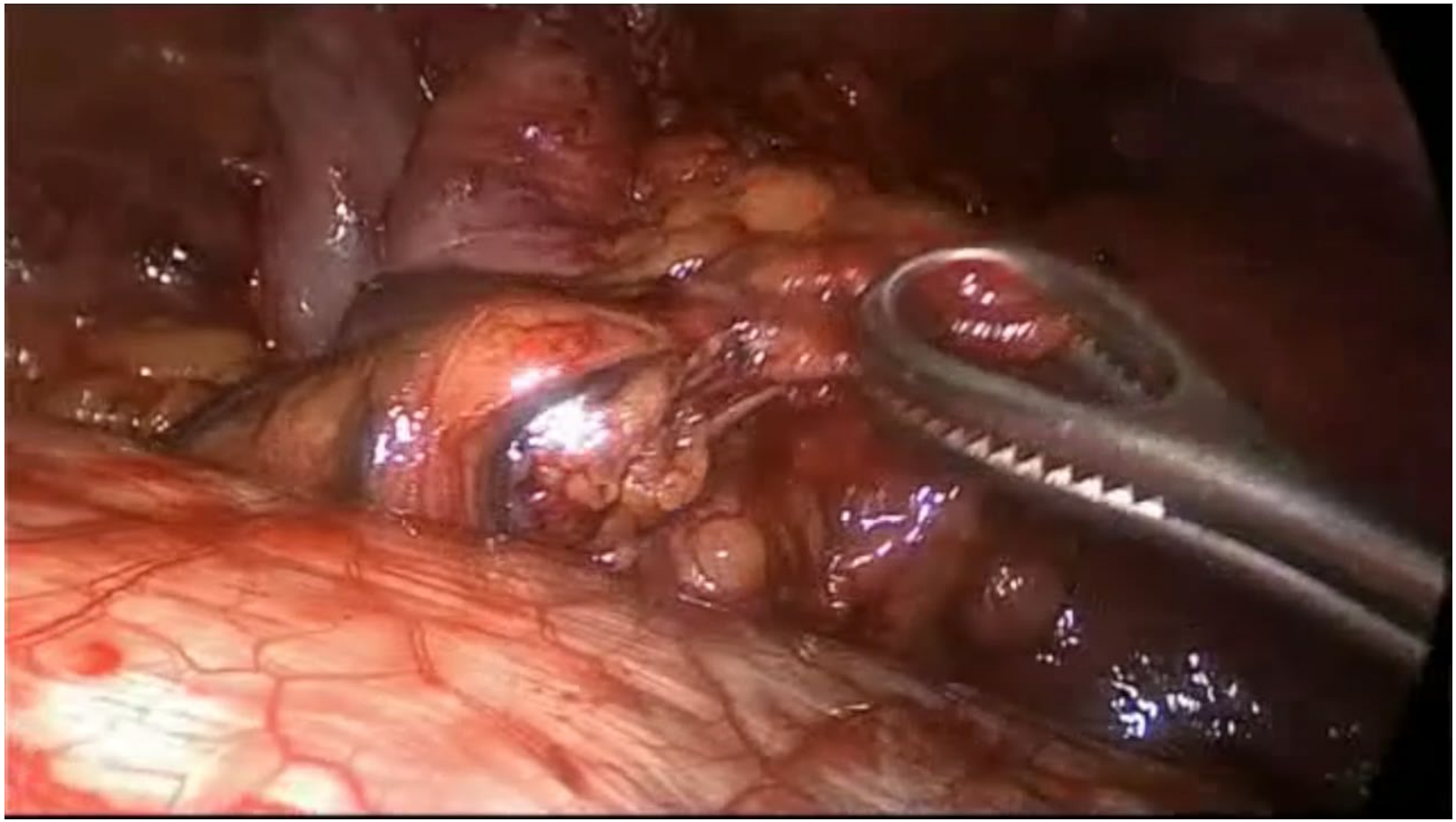
Chest Mobilization

Esophagogastric Anastomosis

- Divide esophagus
  - Just above the azygos vein in the chest
- Bring stomach up into the chest/neck
  - Complete the specimen in the abdomen for a cervical incision
  - Can complete the specimen in the chest for an Ivor-Lewis
- Create anastomosis
  - Circular Stapler (chest only)
  - Handsewn
  - Stapler/Handsewn
- Scope at the End
  - Make sure anastomosis is appropriately patent
  - Put anastomosis in pool of saline
  - Look for and address any areas where there is bubbling



Deliver and Create the Gastric Conduit



Anastomosis – Circular Stapler

Anastomosis – Stapled + Suture

Review

Minimally invasive esophagectomy for cancer☆

Georges Decker[a,b,*], Willy Coosemans[a], Paul De Leyn[a], Herbert Decaluwé[a], Philippe Nafteux[a], Dirk Van Raemdonck[a], Toni Lerut[a]

European Journal of Cardio-thoracic Surgery 35 (2009) 13–21

- Review of 1932 MIE patients from 1992-2007
  - Retrospective reviews, highly selected patients
- 2.9% mortality, 46% morbidity
  - 5.9% conversion rate
  - 8.8% leaks, 22% respiratory complications, 7.1% vocal cord palsy
- Lymph node retrieval appeared worse than open procedures
  - Long-term oncologic data not available
- 54 procedures done robotically
  - 5.5% conversion rate, 14 day hospital stay, 2.6% mortality
  - 23% leaks, 31% respiratory complications, 10% vocal cord palsy

Outcomes After Minimally Invasive Esophagectomy

Review of Over 1000 Patients

Ann Surg 2012;256:95–103

1011 Elective MIE Procedures

5% conversion rate

481 (48%) had a cervical anastomosis

530 (52%) Ivor-Lewis

Median length of stay – 8 days

Leak requiring surgery – 5%

Vocal cord issues more common after neck incision

- 8% versus 1%

1.7% operative mortality

- 0.9% after Ivor-Lewis

Minimally Invasive Esophagectomy (MIE)

Studies from high-volume centers show that MIE:

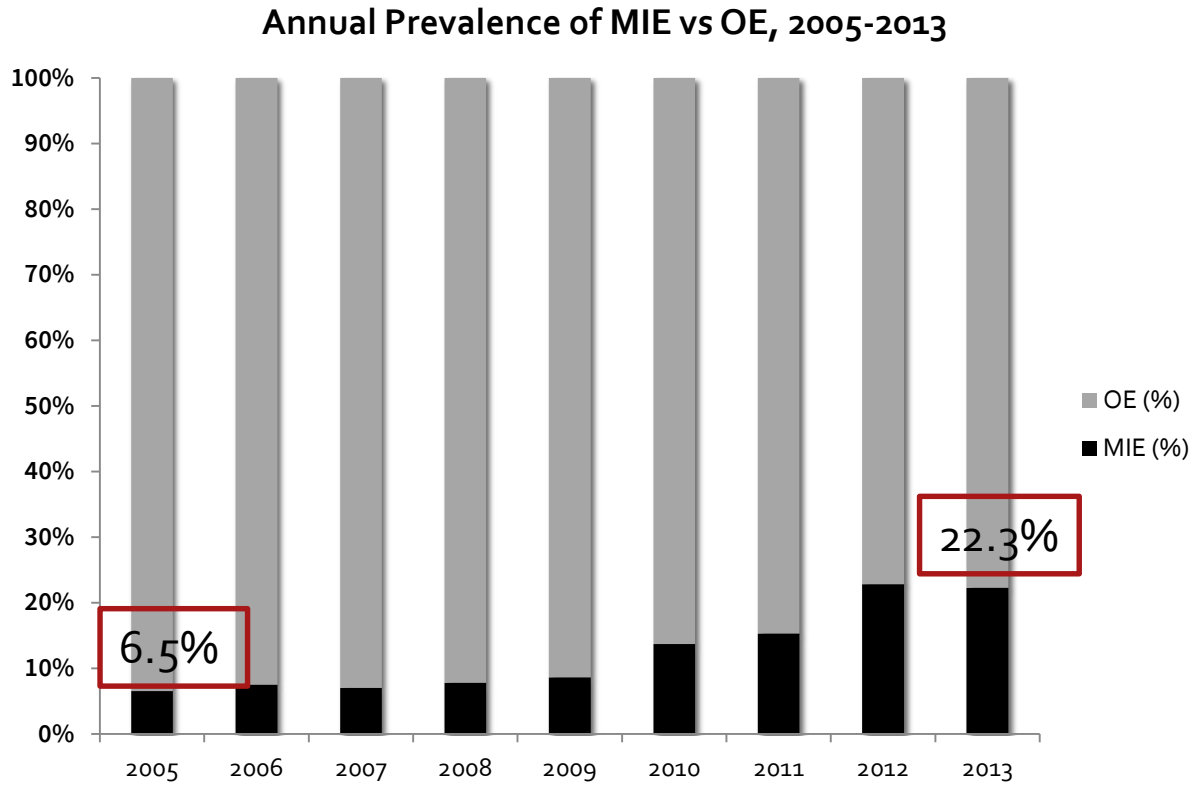
- reduces length of stay (LOS).
- reduces postoperative major morbidity.
- yields equivalent or slightly reduced mortality.

Evidence of MIE benefits' generalizability outside of specialized centers is limited.

Studies showing at least comparable results between MIEs and open esophagectomies are accumulating

MIE Utilization – ACS National Surgical Quality Improvement Program

3263 open; 638 MIE



Approach	Transhiatal	Ivor Lewis	Three-Field
MIE (n, %)	105 (9.0%)	279 (18.1%)	193 (26.6%)
OE (n, %)	1059 (90.1%)	1266 (81.9%)	532 (73.4%)

MIE vs Open Procedures

Shorter Length of Stay

- 9 versus 10 day median length of stay for MIE ($p<0.001$)

No Differences in:

- Peri-Operative Mortality - 2.2% versus 2.5%
- Readmissions – 11.1% versus 11.0%
- Re-Operations – 14.7% versus 13.6%

Less Major Morbidity for MIE Approach (36.1% versus 40.5%)

- Odds Ratio 0.83 ($p=0.049$)
- This overall improvement was mainly driven by fewer blood transfusions
  - 10.8% versus 16.7%
- Other Complication Rates were Similar
  - Deep Organ Space Infection (7.7% versus 6.7%)
  - Pneumonia (13.2% versus 14.7%)
  - Reintubation (11.9% versus 12.9%)

Minimally Invasive Versus Open Esophageal Resection

Three-year Follow-up of the Previously Reported Randomized Controlled Trial: the TIME Trial

Ann Surg 2017;266:232–236

115 patients randomized to open (n=56) or MIE (n=59) in 5 European centers

	Open (n=56)	MIE (n=59)	p-value
OR Time	295 minutes	326 minutes	0.02
Blood Loss	475 cc	200 cc	<0.001
Conversion		8 (14%)	
Pulmonary Complications	19 (34%)	7 (12%)	0.005
Leak	4 (7%)	7 (12%)	0.4
Reoperations	6 (11%)	8 (14%)	0.6
30-day Mortality	0	1 (2%)	0.3
Overall Survival	41.2%	42.9%	0.6
Disease Free Survival	37.3%	42.9%	0.6

Hybrid Minimally Invasive Esophagectomy for Esophageal Cancer

N ENGL J MED 380;2 NEJM.ORG JANUARY 10, 2019

- Multicenter, open-label, randomized, controlled trial of transthoracic open esophagectomy (open procedure, n=104) or hybrid minimally invasive esophagectomy (hybrid procedure, n=103) for resectable cancer of the middle or lower third of the esophagus.
- A total of 37 patients (36%) in the hybrid-procedure group had a major intraoperative or postoperative complication, as compared with 67 (64%) in the open-procedure group (odds ratio, 0.31; 95% confidence interval [CI], 0.18 to 0.55; P<0.001).
- A total of 18 of 102 patients (18%) in the hybrid-procedure group had a major pulmonary complication, as compared with 31 of 103 (30%) in the open-procedure group.
- At 3 years, overall survival was 67% (95% CI, 57 to 75) in the hybrid-procedure group, as compared with 55% (95% CI, 45 to 64) in the open-procedure group; disease-free survival was 57% (95% CI, 47 to 66) and 48% (95% CI, 38 to 57), respectively.

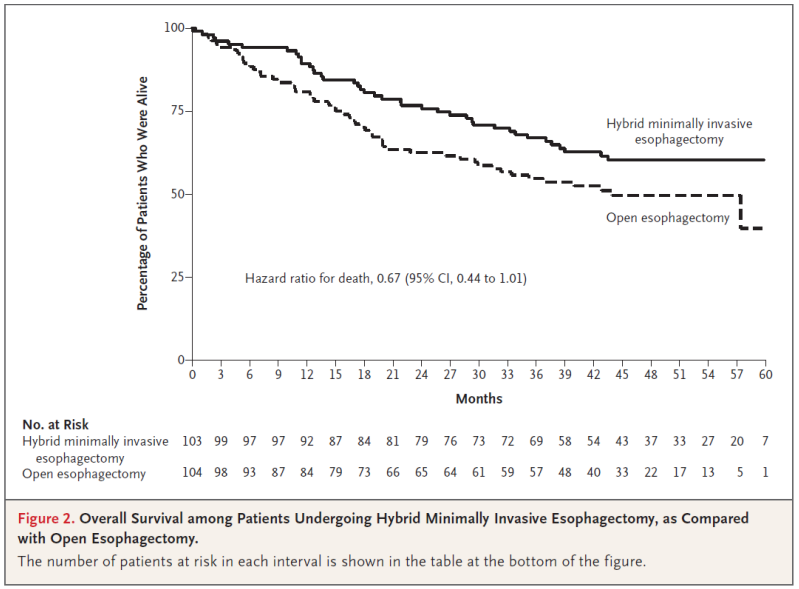


Figure 2. Overall Survival among Patients Undergoing Hybrid Minimally Invasive Esophagectomy, as Compared with Open Esophagectomy.
The number of patients at risk in each interval is shown in the table at the bottom of the figure.

Long-term Survival in Esophageal Cancer After Minimally Invasive Compared to Open Esophagectomy

A Systematic Review and Meta-analysis

Eivind Gottlieb-Vedi, MD, Joonas H. Kauppila, PhD,*† George Malietzis, PhD,‡ Magnus Nilsson, PhD,§ Sheraz R. Markar, PhD,*‡ and Jesper Lagergren, PhD*¶*

Annals of Surgery • Volume XX, Number XX, Month 2019

- A random-effects meta-analysis of 55 relevant studies with adjustment for age, physical status, tumor stage, and neoadjuvant or adjuvant therapy.
- Among all 14,592 patients, 7358 (50.4%) underwent MIE and 7234 (49.6%) underwent OE.
- Pooled analysis revealed 18% lower 5-year all-cause mortality after MIE compared with OE (HR 0.82, 95% CI 0.76-0.88).
- The long-term survival after MIE compares well with OE and may even be better. Thus, MIE can be recommended as a standard surgical approach for esophageal cancer.

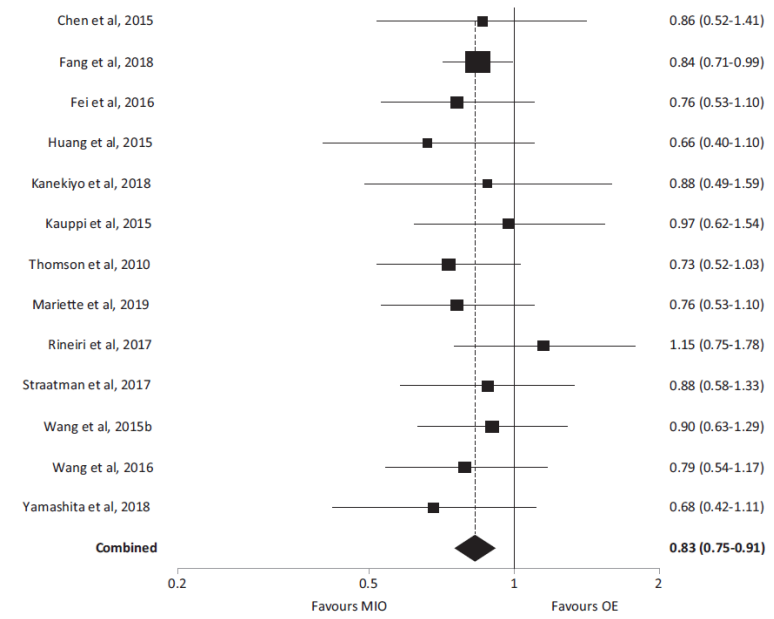


FIGURE 4. Meta-analysis of disease-specific 5-year mortality.

Summary

- Minimally invasive techniques can be used to perform most esophagectomy procedures
- The procedure is still an esophagectomy
- Evidence of patient benefit is continuing to accumulate in both retrospective single-center studies and prospective, multi-center trials
  - Lower rates of major morbidity
  - Less chance of pulmonary morbidity
  - Shorter hospitalization
  - No compromise in long-term oncologic outcomes