Minimally Invasive Esophagectomy

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Outline

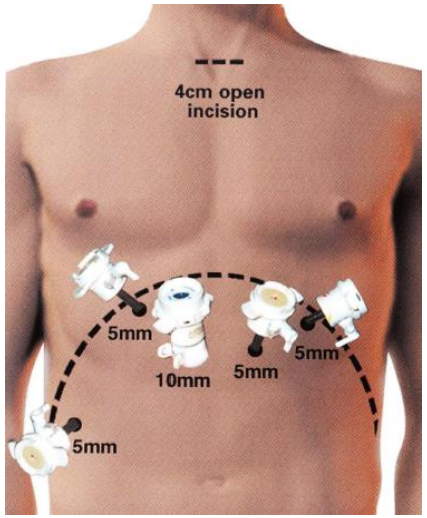
- Briefly review esophagectomy techniques
- Define minimally invasive esophagectomy (MIE)
- Endoscopic options to treat esophageal disease
- MIE technical details
  - Abdomen
  - Chest
  - Anastomosis
- Review Outcomes

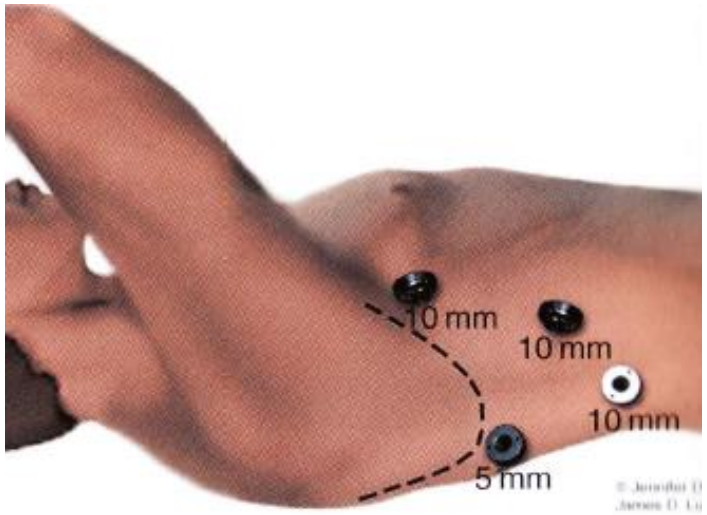
Esophagectomy Approaches

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

What is a Minimally Invasive Esophagectomy (MIE)?

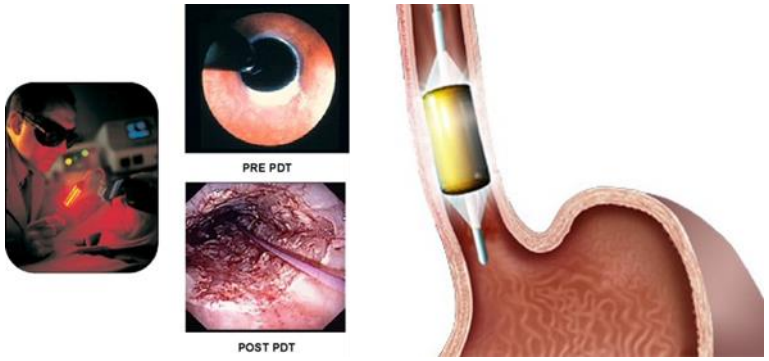
- Use minimally invasive techniques to replace a laparotomy and/or thoracotomy for dissection and anastomosis
  - Laparoscopy
  - Thoracoscopy
  - Robotic
- The goal: less pain, less morbidity, faster recovery, better outcomes

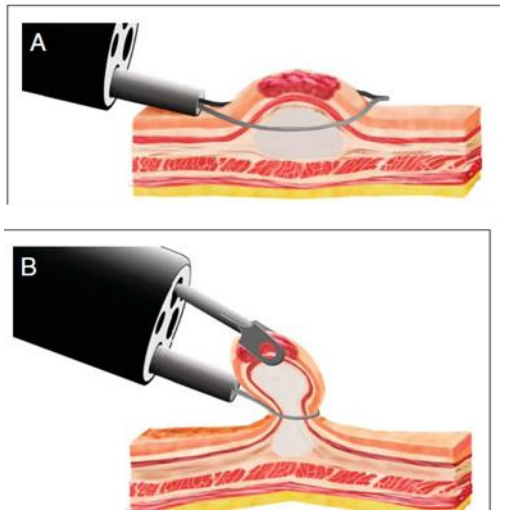




Really Minimally Invasive - Endoscopic Treatment

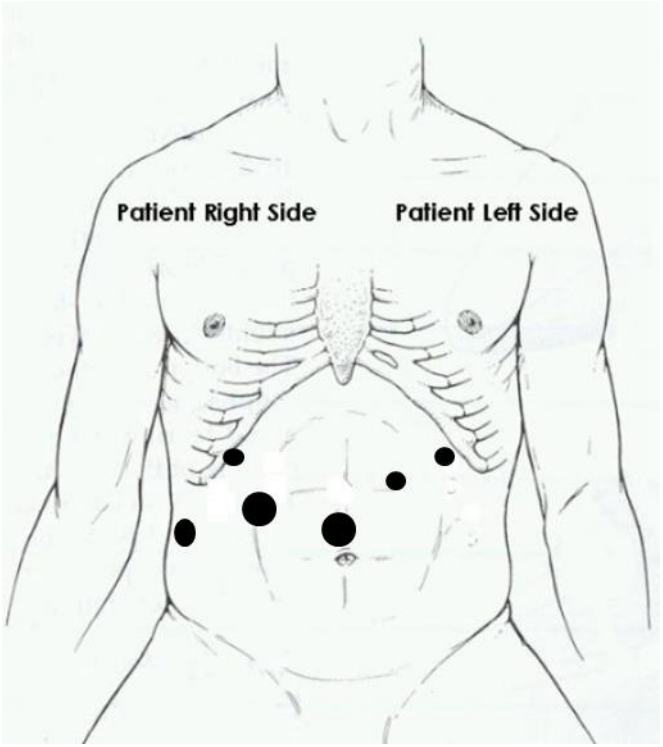
- Ablation of High Grade Dysplasia
  - Photodynamic therapy (PDT)
    - Light activation of sensitizer porphyrin results in reactive O2 species
  - Radiofrequency ablation (RFA)
    - High-frequency current delivers energy to cause directed necrosis
- Endoscopic Mucosal Resection (EMR) for T1a Cancers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





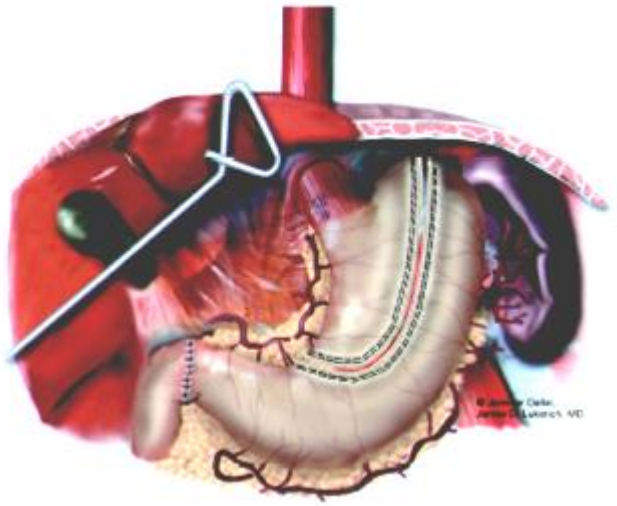
Laparoscopic Abdominal Port Placement

- 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

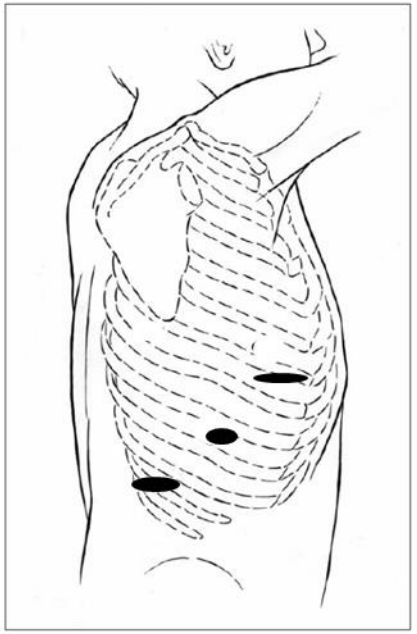
- Start dissection at the pars lucida and then perform hiatal dissection.
- Dissect greater curve of the stomach.
- Divide left gastric artery.
- Begin the esophagogastrectomy specimen.
- Place jejunostomy tube.



Abdominal Dissection

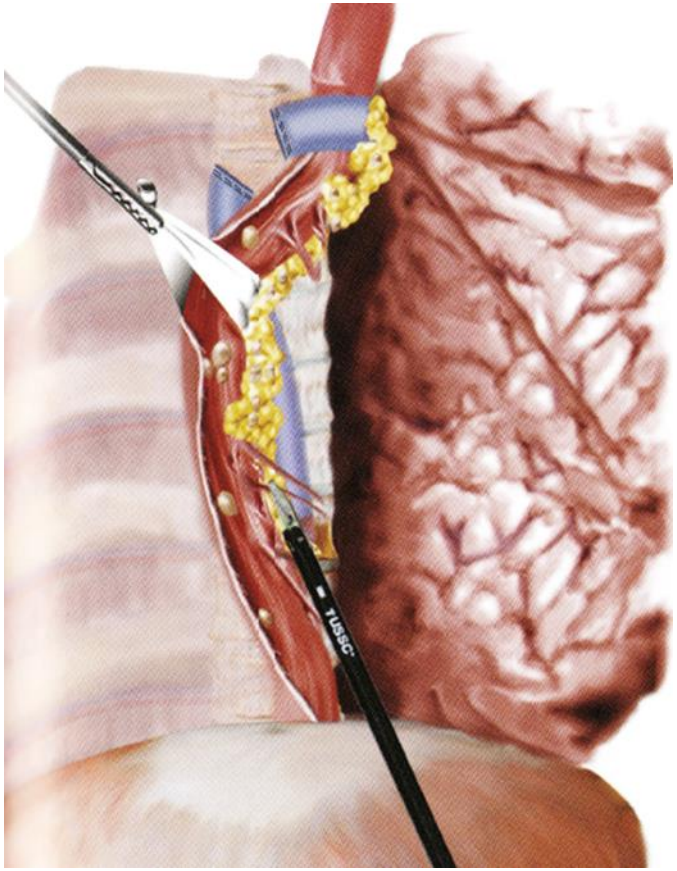
VATS Chest Port Placement

- 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

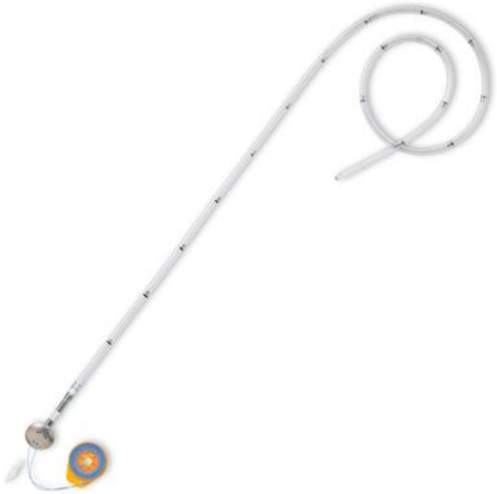
- Take down inferiorly pulmonary ligament, dissect Level 7, divide azygos vein
- Encircle esophagus and mobilize it from above the hiatus to:
  - above the azygos for an Ivor-Lewis
  - the thoracic inlet for a McKeown



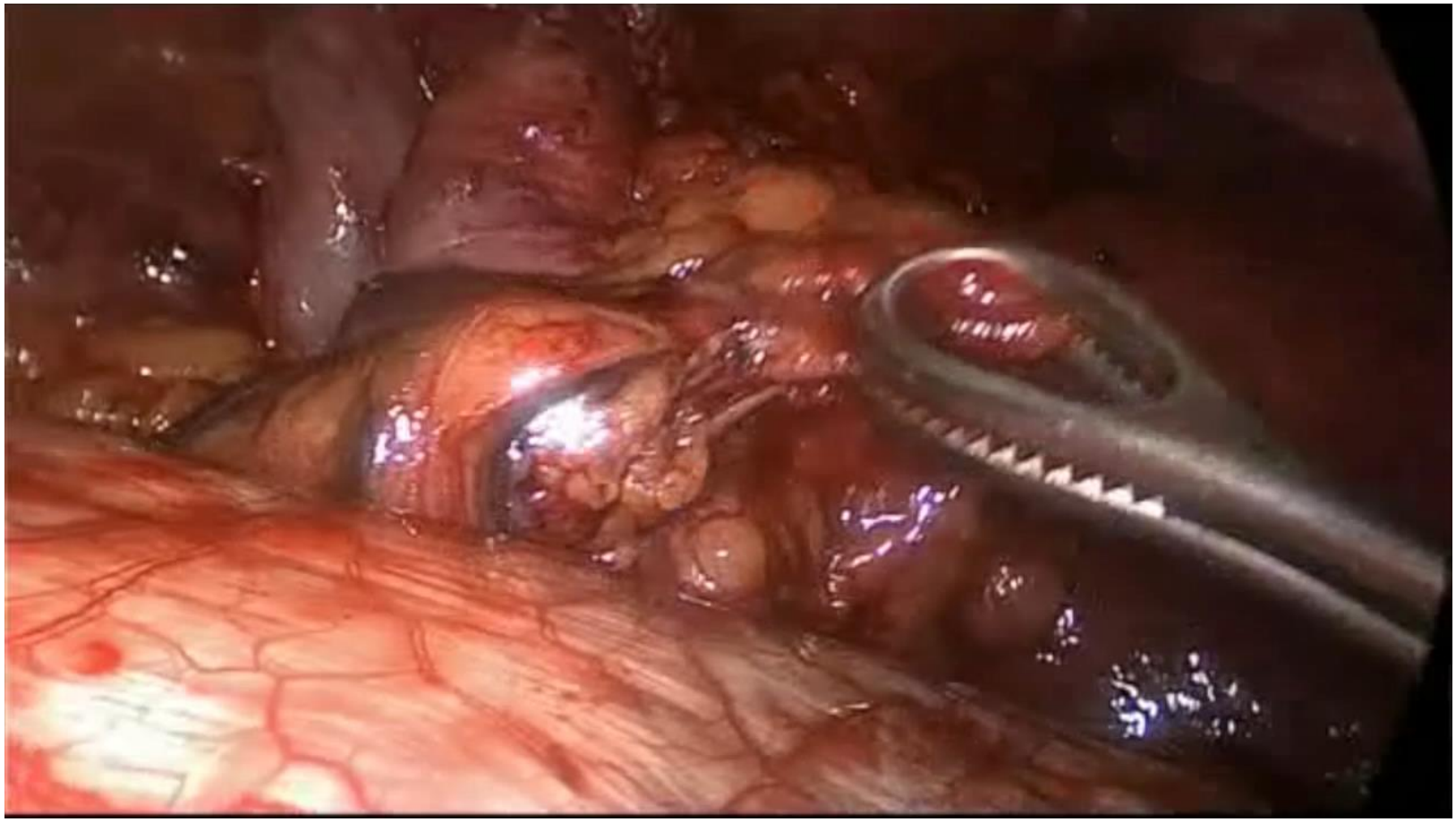
Chest Mobilization

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

Personal Experience
- 79 planned MIE chest anastomoses (1/15-3/18)
- 11 converted prior to anastomosis

- Linear Stapler (n=39)
  - Five Converted due to anastomosis problems (13%)
    - Three were too narrow after completed MIE
    - Two could not set up and be completed MIE
  - 34 Completed MIE (87%)
    - Any Leak: 2 (6%)
    - Need for Dilation: 2 (6%)

- Orvil (n=29)
  - One converted because of technical issues (3%)
    - No post-op anastomotic complications
  - 28 completed MIE (96%)
    - Any Leak: 3 (11%)
      - Two needed no intervention
      - One Stent
    - Need For Dilation: 5 (18%)

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.

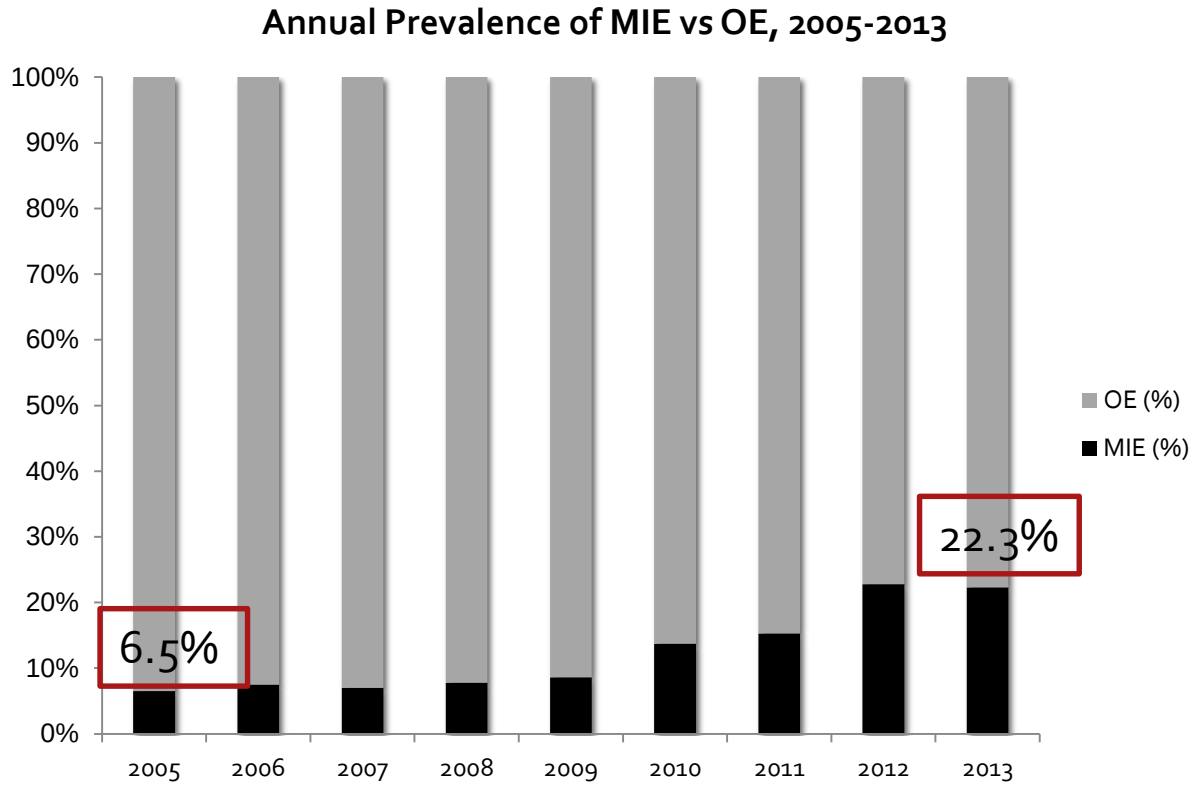
Evidence of MIE benefits' generalizability outside of specialized centers is limited.

Two analyses of national datasets have shown that MIE yields comparable results to open esophagectomies (OE).

Lazzarino AI. *Ann Surg* (2010).
Nagpal K. *Surg Endosc* (2010).
Biere S. *Lancet* (2012).
Dantoc M. *Arch Surg* (2012).
Luketich JD. *Ann Surg* (2012).
Mamidanna R. *Ann Surg* (2012).
Luketich JD. *Ann Surg* (2015).
Palazzo F. *J Am Coll Surg* (2015).
Sihag S. *Eur J Cardiothorac Surg* (2012).
Sihag S. *Ann Thorac Surg* (2016).
Yerokun BA. *Ann Thorac Surg* (2016).

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

A Propensity Score Matched Analysis of Open Versus Minimally Invasive Transthoracic Esophagectomy in the Netherlands

Ann Surg 2017;266:839–846

Propensity matching of 1727 esophagectomy patients from 2011-15

	Open (n=433)	MIE (n=433)	p-value
Any morbidity	62.6%	60.2%	0.5
Pulmonary complication	34.2%	35.6%	0.7
Leak	15.5%	21.2%	0.03
Re-Intervention	21.1%	28.2%	0.02
Mortality	3.0%	4.7%	0.2
Hospital Stay	14 days	13 days	0.001
Lymph Nodes	18	20	0.001

Summary

- Minimally invasive techniques can be used to perform most esophagectomy procedures
- The procedure is still an esophagectomy
- Evidence of patient benefit is starting 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