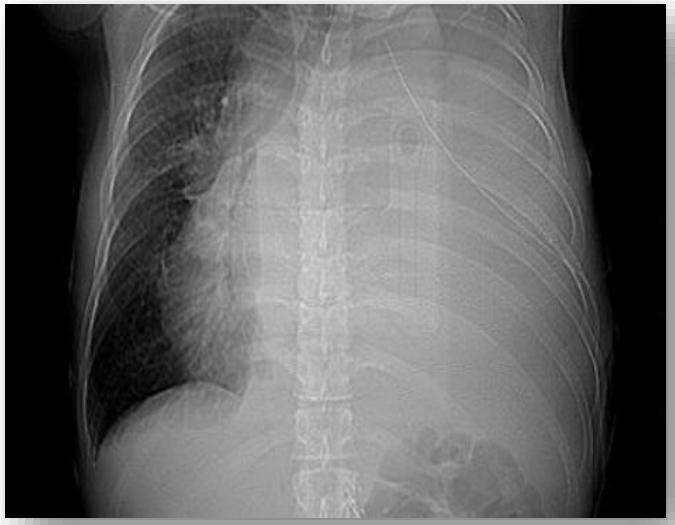
Doctors of Thoracic Surgery®

Update in Malignant Pleural Effusion Management



Kasia Czarnecka-Kujawa MD FRCPC MPH

Interventional Pulmonology

Division of Thoracic Surgery

Division of Respirology

University Health Network

Director RACE Program

Assistant Professor, University of Toronto

48th Annual Thoracic Refresher, Toronto, ON
Jun 7-8, 2024

Toronto General Hospital
University Health Network

Disclosures

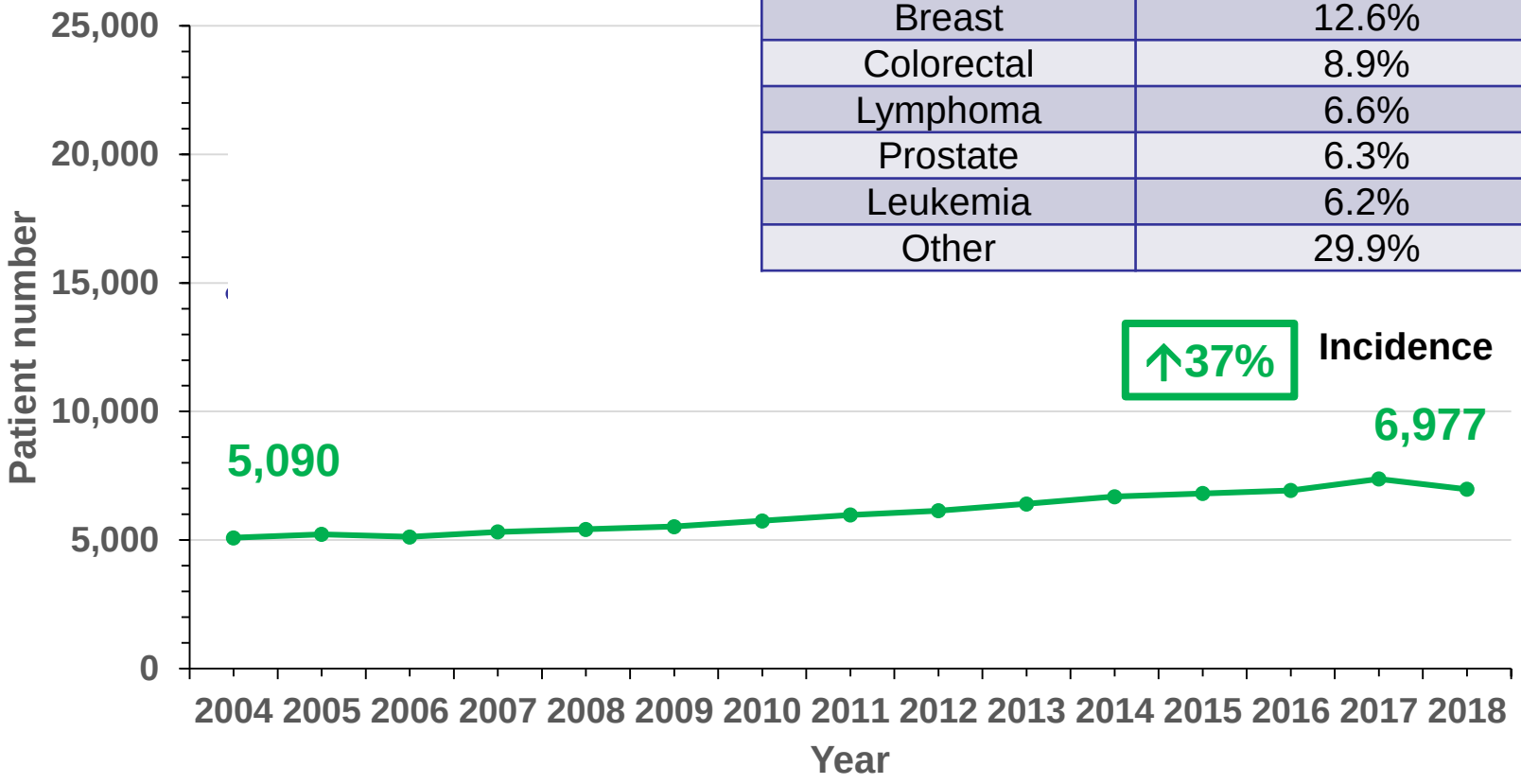
- Olympus America

Overview

- MPE epidemiology
- Health care utilization and cost
- Update on definitive treatment options
- MPE quality gaps

Incidence of Malignant Pleural Effusion in Ontario 2004-2018

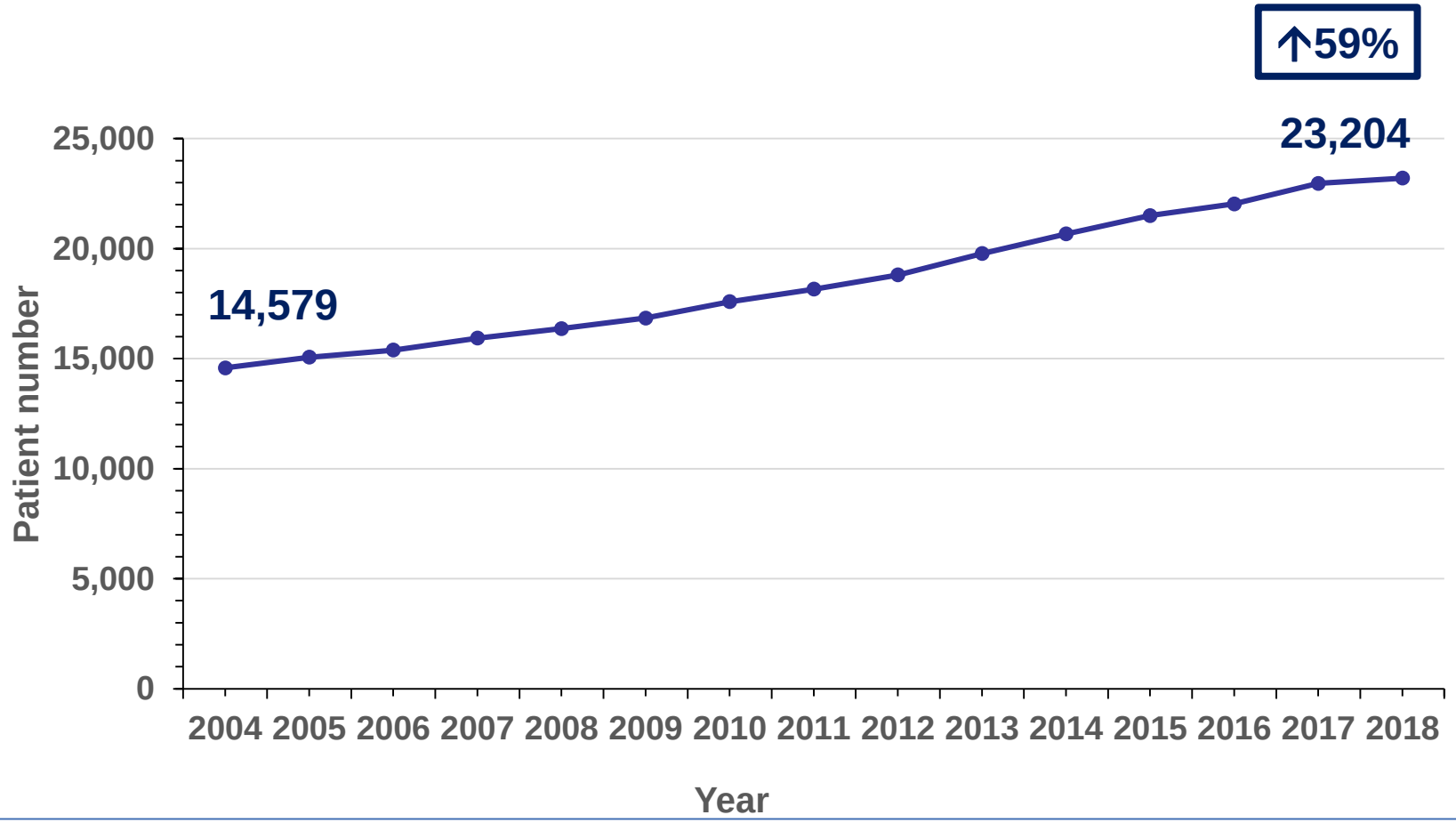
Lung & pleura	30.5%
Breast	12.6%
Colorectal	8.9%
Lymphoma	6.6%
Prostate	6.3%
Leukemia	6.2%
Other	29.9%



Czarnecka-Kujawa et al. ACCP. 2023

Doctors of Thoracic Surgery®

Prevalence of Malignant Pleural Effusion in Ontario 2004-2018

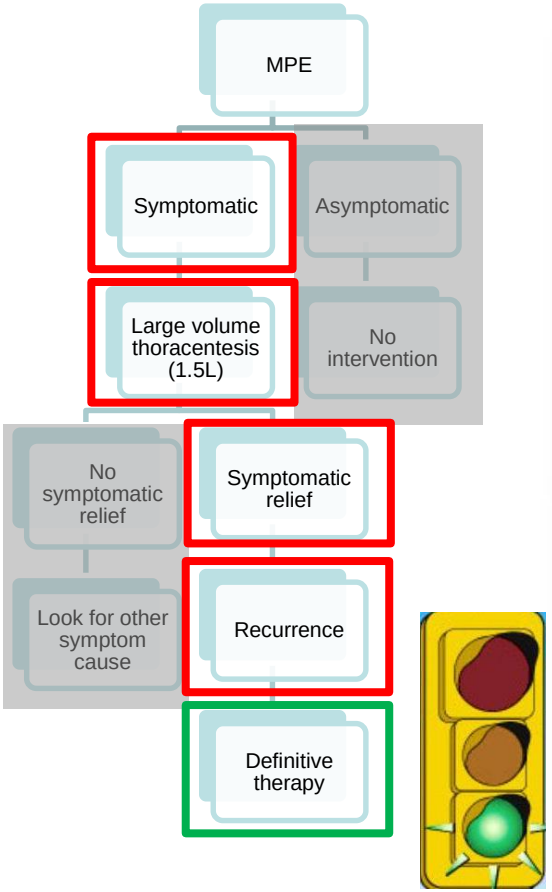


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines



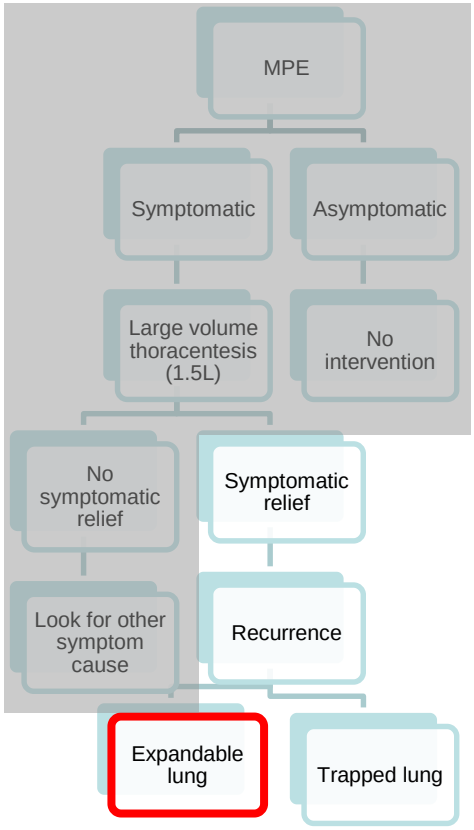
- > 50% effusions recur
- 58% recur rapidly (within 1 month)
- ? Plans for management at time of first drainage

Am J Respir Crit Care Med. 2018;198:839–849.
Ost et al. CHEST. 2018;153:438-52.
Am J Respir Crit Care Med. 2018;(198):839–849.
Thorax. 2023;78:1143-56.
Eur Respir J. 2018.52: 1800349.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines



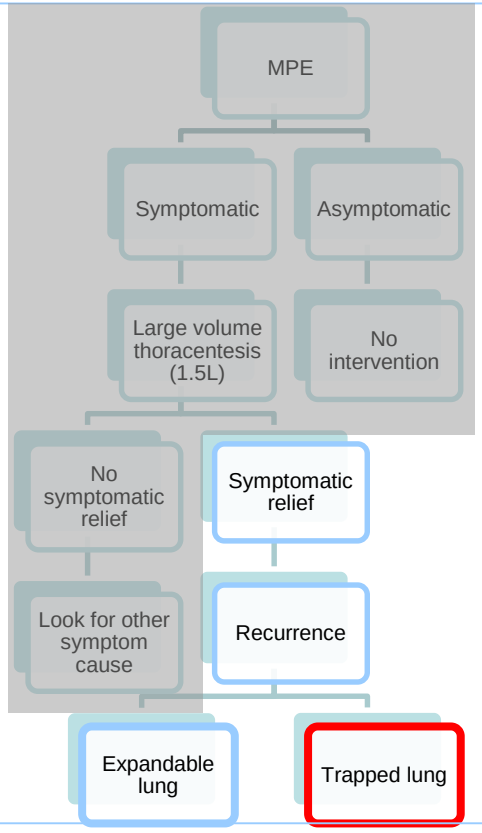
MPE management options	Expandable lung
Thoracentesis	X
Tunneled pleural catheter	X
Pleurodesis	X
VATS	X
Chest tube	X
Tunneled pleural catheter	X
Pleuroperitoneal shunt	X
Decortication/pleurectomy	X

Am J Respir Crit Care Med. 2018;198:839–849.
Ost et al. CHEST. 2018;153:438-52.
Am J Respir Crit Care Med. 2018;(198):839–849.
Thorax. 2023;78:1143-56.
Eur Respir J. 2018.52: 1800349.

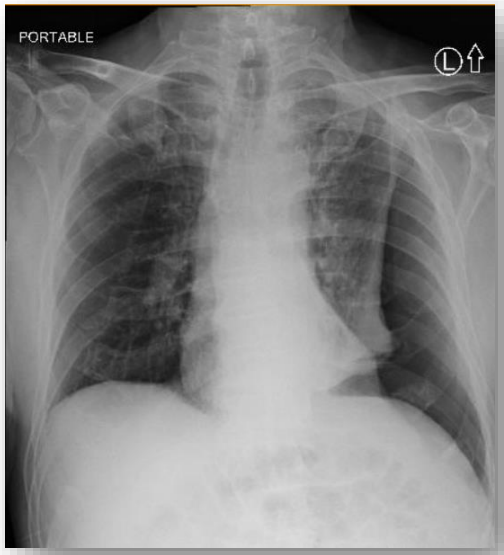
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines



MPE management options	Expandable lung
Thoracentesis	X
Tunneled pleural catheter	X
Pleurodesis	X
VATS	X
Chest tube	X
Tunneled pleural catheter	X
Pleuroperitoneal shunt	X
Decortication/pleurectomy	X



Am J Respir Crit Care Med. 2018;198:839–849.
Ost et al. CHEST. 2018;153:438-52.
Am J Respir Crit Care Med. 2018;(198):839–849.
Thorax. 2023;78:1143-56.
Eur Respir J. 2018.52: 1800349.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Tunneled Pleural Catheter (TPC) vs Talc in MPE management

Study	LOS		Additional procedures		Adverse events		QOL
	TPC	TP	TPC	TP	TPC	TP	
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6	6%	22%	40%	13%	TPC > TP (6 mth
Fysh et al CHEST 2012	7 IQR 4-13	18 IQR 8-26	14%	32%	19%	45%	TPC >.TP
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	4%	22%	30%	18%	TPC=TP
Boshuizen 2017	0	5	16%	35%	19%	16%	TPC=TP

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Tunneled Pleural Catheter (TPC) vs Talc in MPE management

Study	LOS		Additional procedures		Adverse events		QOL
	TPC	TP	TPC	TP	TPC	TP	
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6	6%	22%	40%	13%	TPC > TP (6 mth
Fysh et al CHEST 2012	7 IQR 4-13	18 IQR 8-26	14%	32%	19%	45%	TPC >.TP
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	4%	22%	30%	18%	TPC=TP
Boshuizen 2017	0	5	16%	35%	19%	16%	TPC=TP

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Tunneled Pleural Catheter (TPC) vs Talc in MPE management

Study	LOS		Additional procedures		Adverse events		QOL
	TPC	TP	TPC	TP	TPC	TP	
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6	6%	22%	40%	13%	TPC > TP (6 mth
Fysh et al CHEST 2012	7 IQR 4-13	18 IQR 8-26	14%	32%	19%	45%	TPC >.TP
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	4%	22%	30%	18%	TPC=TP
Boshuizen 2017	0	5	16%	35%	19%	16%	TPC=TP

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Tunneled Pleural Catheter (TPC) vs Talc in MPE management

Study	LOS		Additional procedures		Adverse events		QOL
	TPC	TP	TPC	TP	TPC	TP	
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6	6%	22%	40%	13%	TPC > TP (6 mth
Fysh et al CHEST 2012	7 IQR 4-13	18 IQR 8-26	14%	32%	19%	45%	TPC >.TP
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	4%	22%	30%	18%	TPC=TP
Boshuizen 2017	0	5	16%	35%	19%	16%	TPC=TP

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

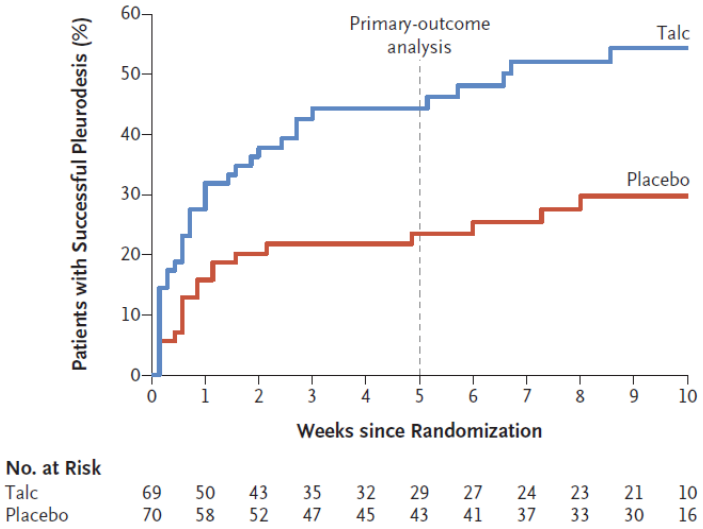
Tunneled Pleural Catheter (TPC) vs Talc in MPE management

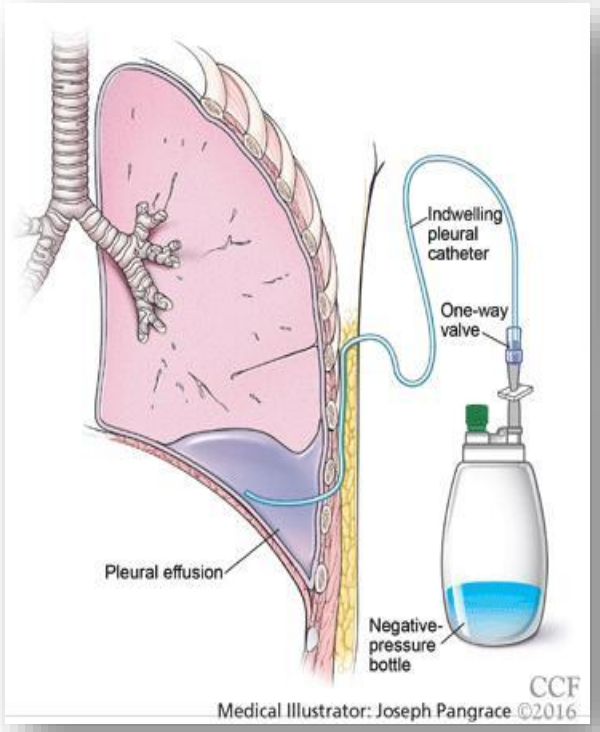
Study	LOS		Additional procedures		Adverse events		QOL
	TPC	TP	TPC	TP	TPC	TP	
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6	6%	22%	40%	13%	TPC > TP (6 mth
Fysh et al CHEST 2012	7 IQR 4-13	18 IQR 8-26	14%	32%	19%	45%	TPC >TP
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	4%	22%	30%	18%	TPC=TP
Boshuizen 2017	0	5	16%	35%	19%	16%	TPC=TP

Toronto General Hospital
University Health Network

TPC + Talc in MPE management

- TPC + PLUS
- Pleurodesis at 70 days (max f/u time)
  - Talc: 51%
  - Placebo 27%
- > 50% patients excluded

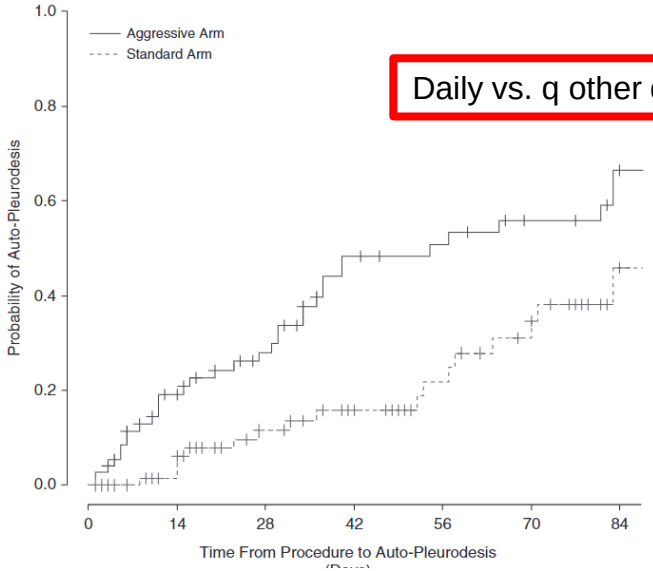




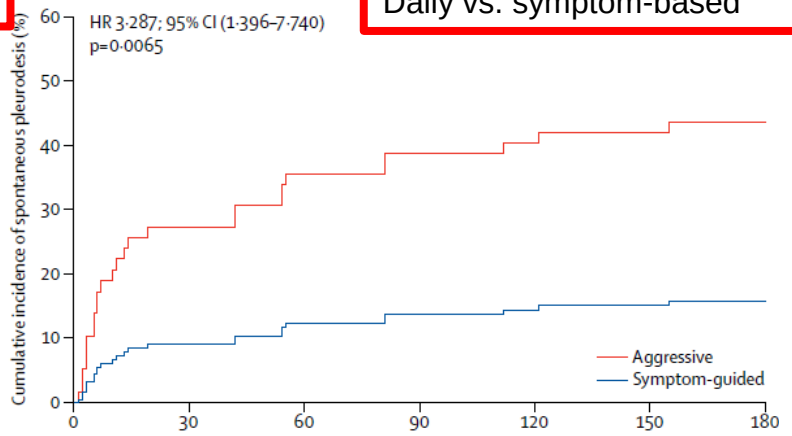
Bhatnagar et al. NEJM. 2018.378; 1313-22.

Doctors of Thoracic Surgery

Daily drainage and pleurodesis rate



Daily vs. q other day



Daily vs. symptom-based

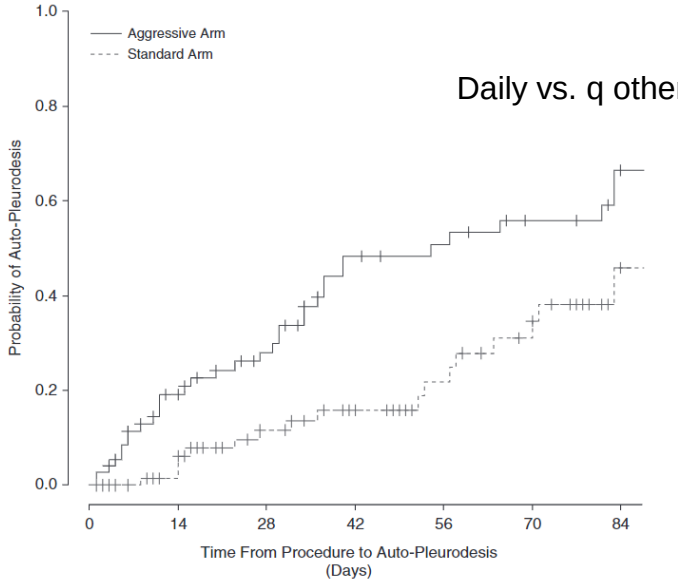
Wahidi et al.ASAP. Am J Respir Crit Care Med. 2017; 195:150-7.
Muruganandan et al. AMPLE2; Lancet Respir Med. 2018;6:671-80.

Toronto General Hospital
University Health Network

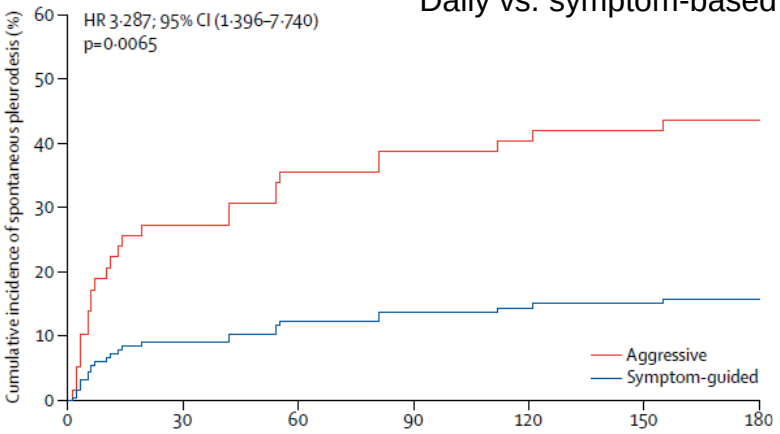
Doctors of Thoracic Surgery

Daily drainage and pleurodesis rate

Daily vs. q other day



Daily vs. symptom-based



Pleurodesis rate: 47% vs. 24%
Time to pleurodesis:
54 d 95% CI 34-83
90 d 95% CI 70 – non-estimable

Pleurodesis rate
60d daily - 37%
prn - 11%
6mth daily - 44%
prn - 16%

Wahidi et al.ASAP. Am J Respir Crit Care Med. 2017; 195:150-7.
Muruganandan et al. AMPLE2; Lancet Respir Med. 2018;6:671-80.

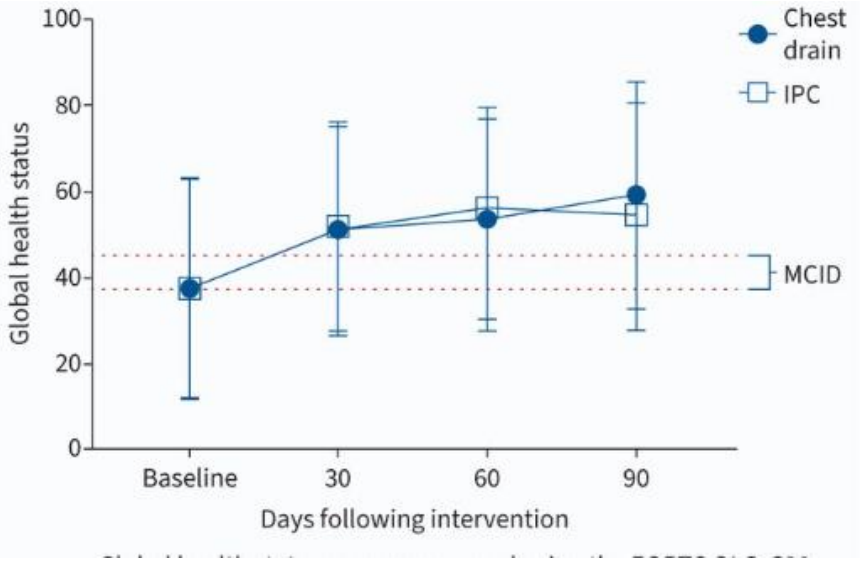
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

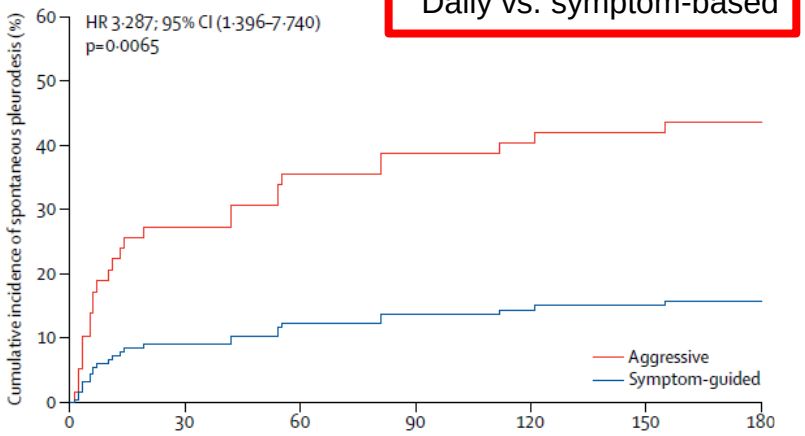
Symptom control

Pleurodesis: Tunneled pleural catheter vs. Chest drain

Global health status
Chest drain = TPC



Daily vs. symptom-based



Dyspnea: Daily = prn

Pleurodesis rate

60d daily - 37% prn - 11%

6mth daily - 44% prn - 16%

Wahidi et al. ASAP. Am J Respir Crit Care Med. 2017; 195:150-7.
Muruganandan et al. AMPLE2; Lancet Respir Med. 2018;6:671-80.
Sivakumar et al. OPTIMUM. Eur Respir J. 2024.

Toronto General Hospital
University Health Network

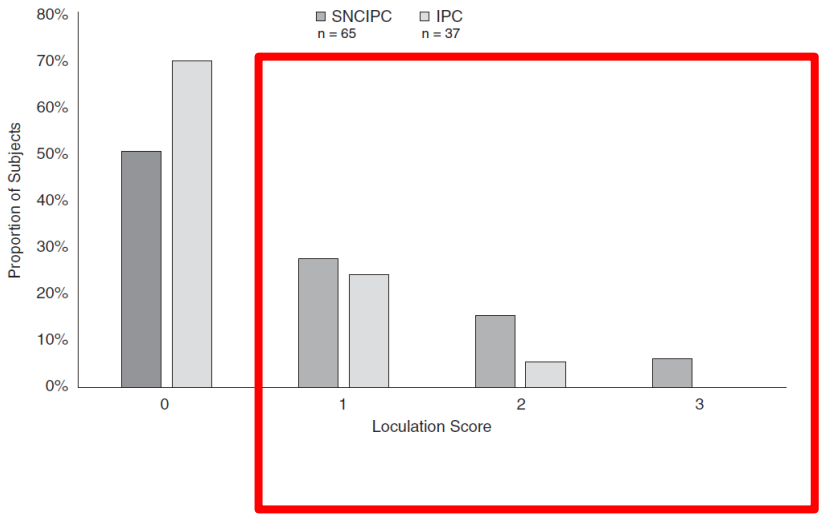
Doctors of Thoracic Surgery

Silver nitrate-coated TPC?

- 20 Centers UK, US
- MPE (predominantly lung and breast cancer)
- Primary outcome : pleurodesis at 30 days
- Followed for 3 mths

	SNTPC (n= 77)	TPC (n= 37)
Pleurodesis by 30 days n (%)	**17 (22.1%)**	**12 (32.4%)**
Rate difference 95%CI	**- 0.10 (-0.30 - -0.09)**	

Adverse events	SNTPC N (%)	TPC N (%)
Effusion	19 (24.7%)	3 (8.1%)
Loculated effusion	44 (49%)	11 (30%)
Anemia	11 (14.3%)	4 (10.8%)
Dyspnea	12 (15.6%)	4 (10.8%)
Pneumonia	11 (14.3%)	4 (10.8%)
Empyema	1 (1.3%)	1 (2.7%)
Total	No difference	



Shrager et al. Ann Am Thor Soc. 2022;19:1722-29.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Intrapleural chemotherapy?

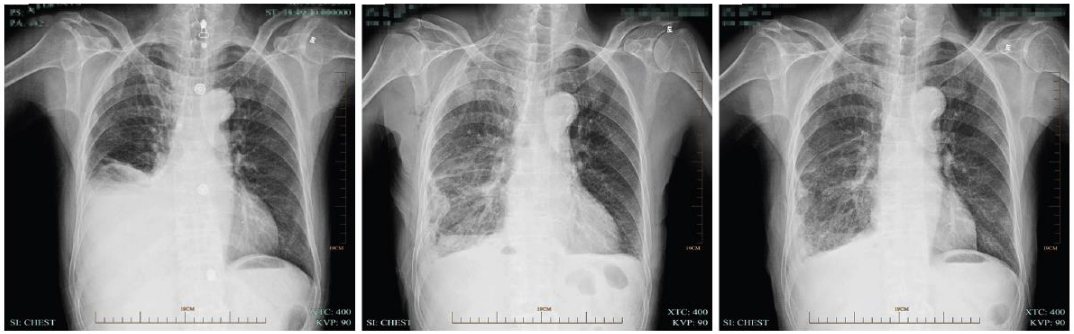
Original Article

Intrapleural perfusion thermo-chemotherapy for pleural effusion caused by lung carcinoma under VATS

Runlei Hu[1], Hong Jiang[1], Hu Li[1], Dongshan Wei[1], Guoqing Wang[1], Shenglin Ma[2] **JTD. 2017**

- 54 patients with NSCLC
- VATS Intrapleural thermo/chemotherapy cisplatin 200mg/m^2 @ 43^{o}C
- Apoptosis in all specimens
- 1y survival 74.1 % (median 21.7 mth)
- No adverse events

- Effusion control: >1 mth
- Complete response: 52/54
- Partial Response 2/54



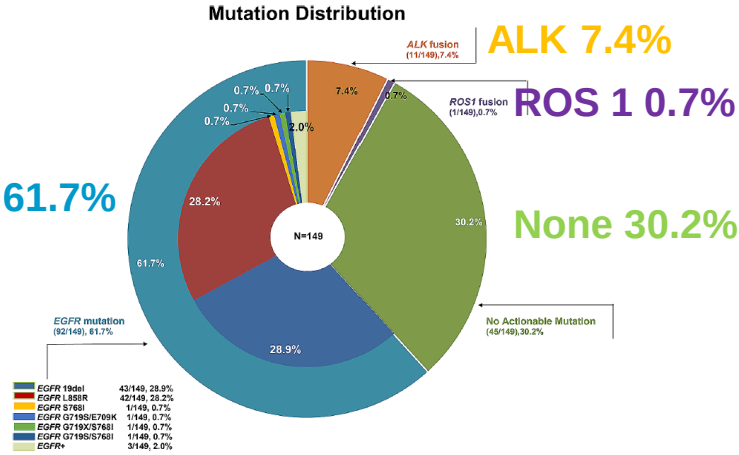
Toronto General Hospital
University Health Network

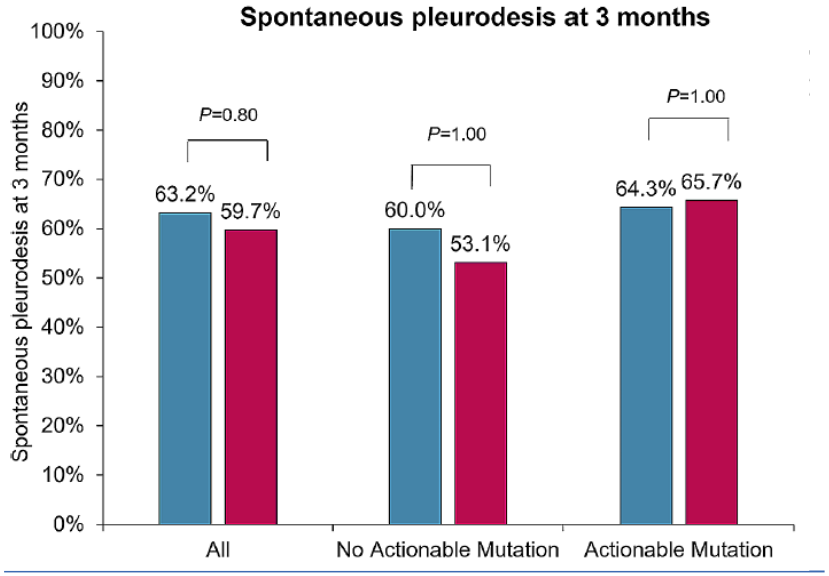
Doctors of Thoracic Surgery

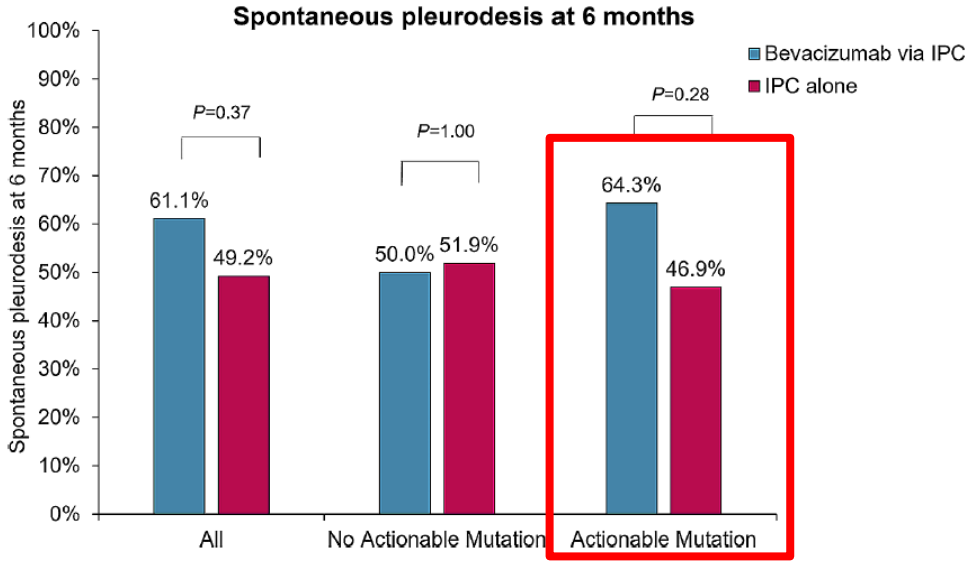
Intrapleural chemotherapy?

- Bevacizumab + TPC vs. TPC for MPE in NSCLC
- 149 patients, 69% with actionable mutations
- Intervention: TPC vs. TPC + bevacizumab
- No difference in adverse events

Pleurodesis: TPC = TPC+ bevacizumab







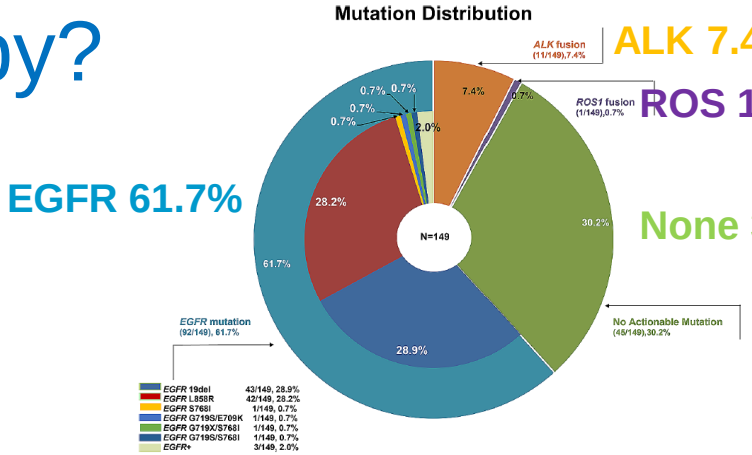
Zeng et al. BMC Pulm Med 2024;24:89.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Intrapleural chemotherapy?

- Bevacizumab + TPC vs. TPC for MPE in NSCLC
- 149 patients, 69% with actionable mutations
- Intervention: TPC vs. TPC + bevacizumab
- No difference in adverse events



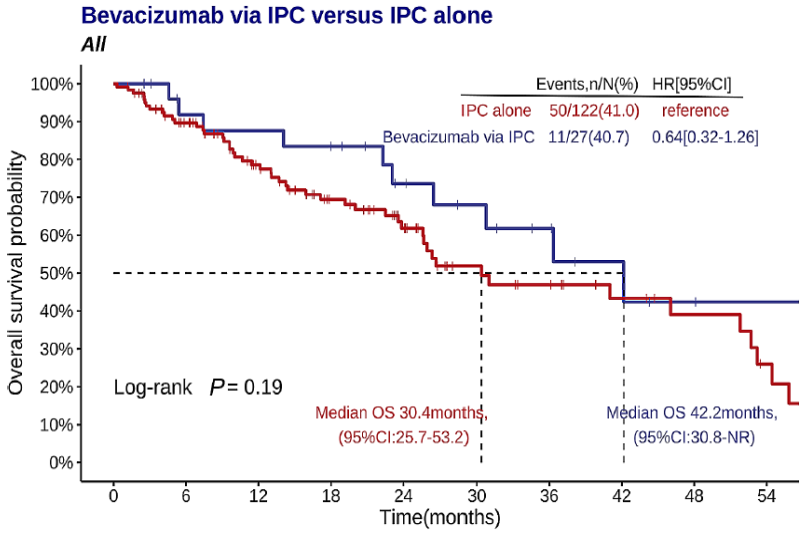
ALK 7.4%

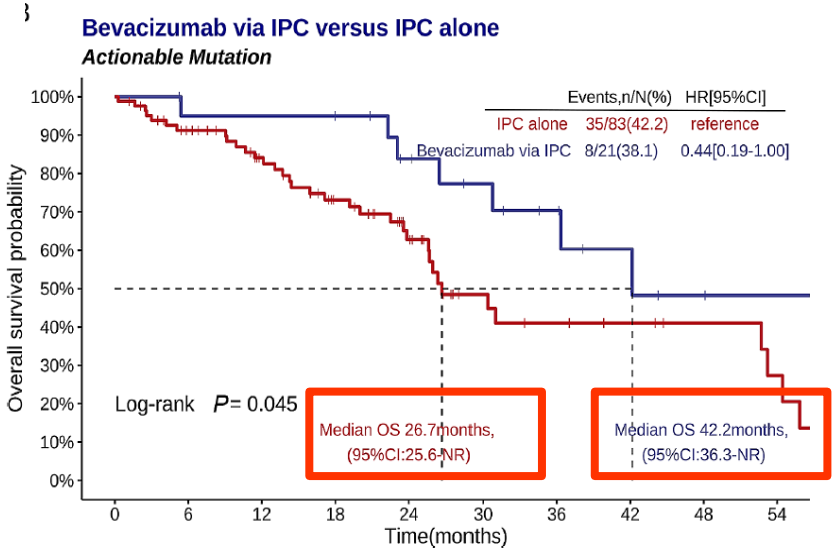
ROS 1 0.7%

EGFR 61.7%

None 30.2%

Survival: Bevacizumab + TPC vs. TPC



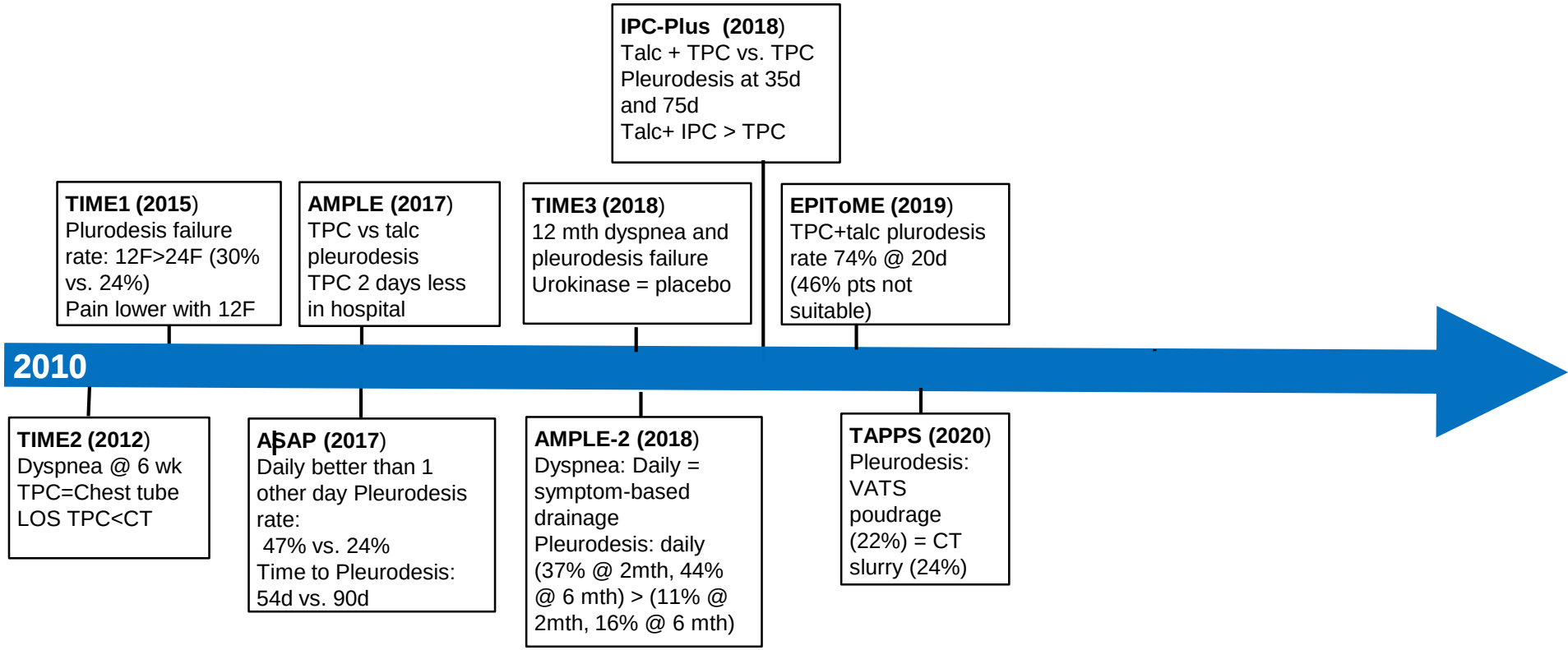


Zeng et al. BMC Pulm Med 2024;24:89.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

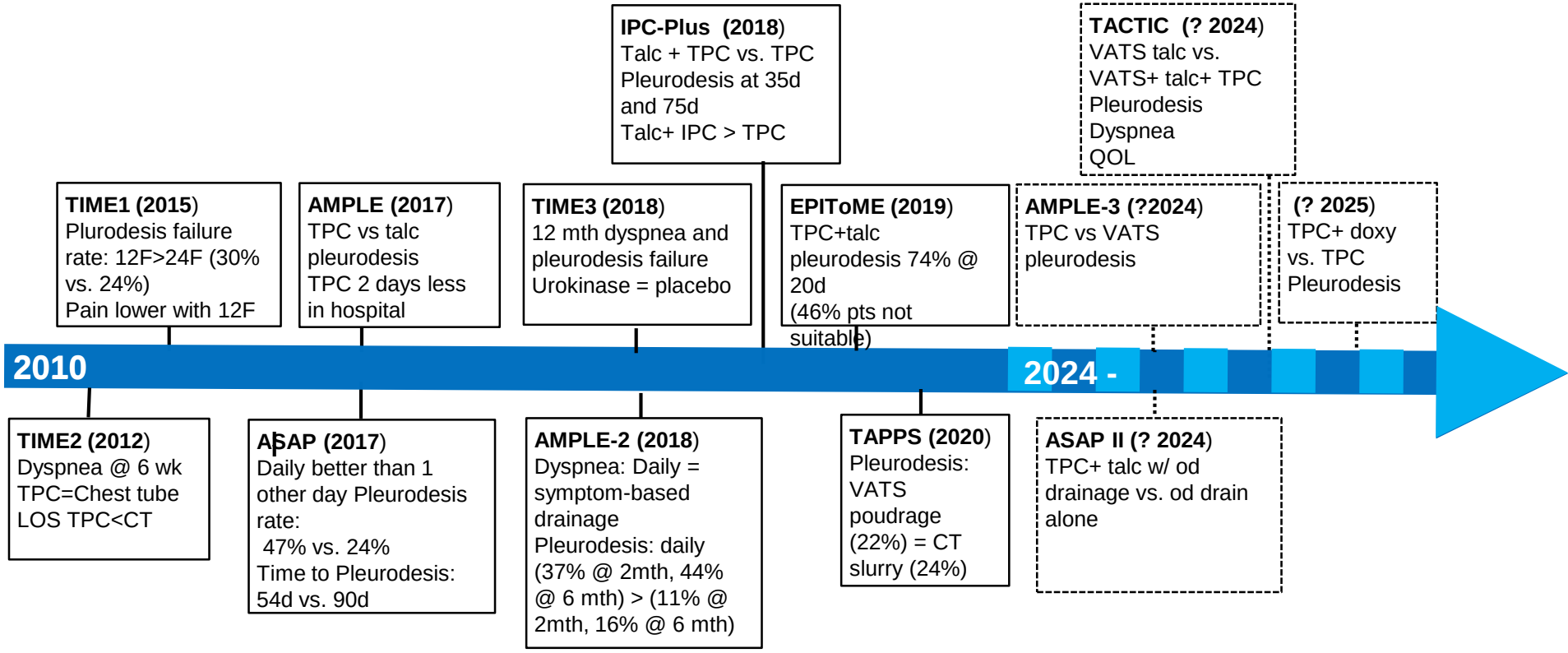
MPE studies 2010-2025



Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

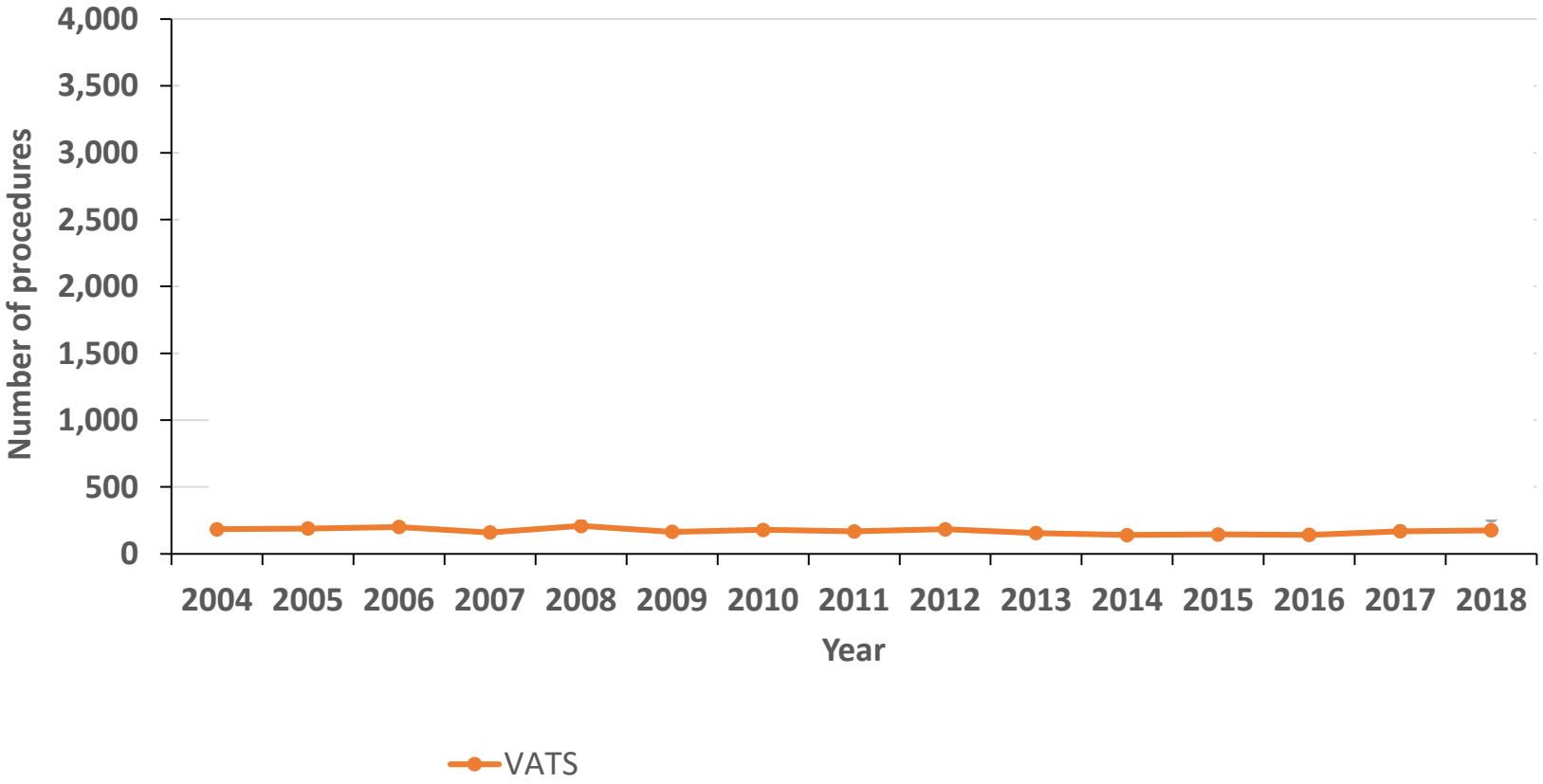
MPE studies 2010-2025



Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Procedures in Ontario MPE patients 2004-2018

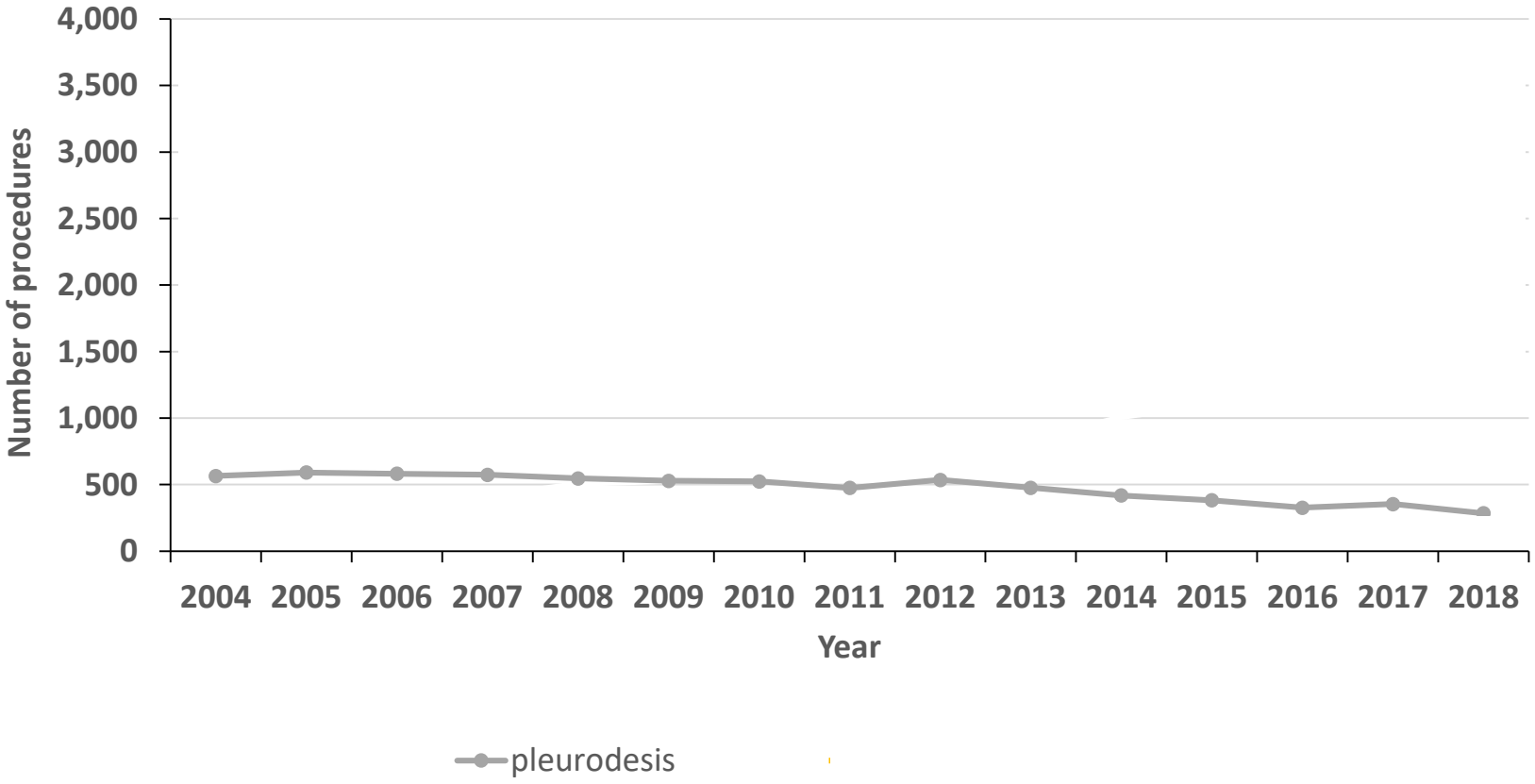


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Procedures in Ontario MPE patients 2004-2018

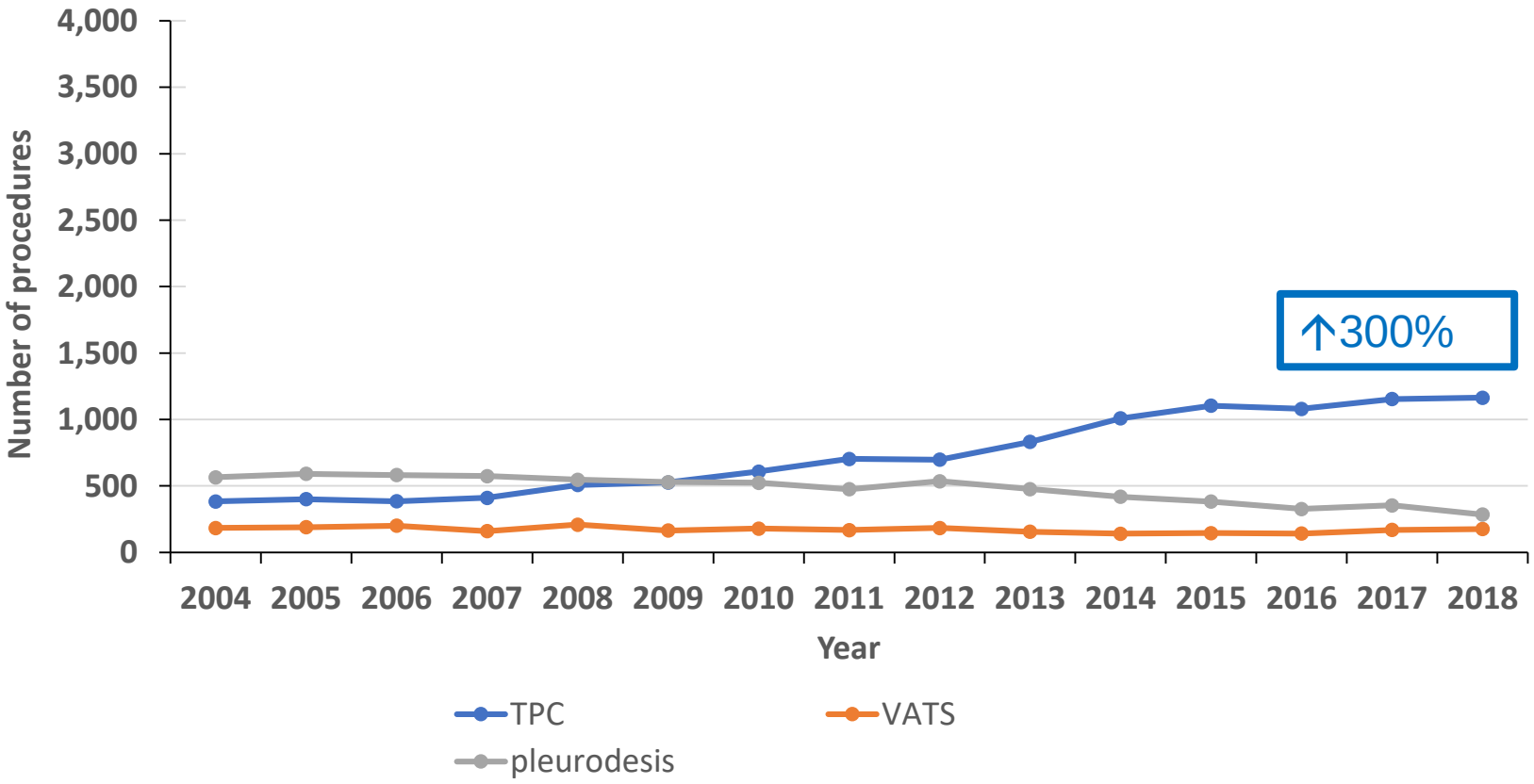


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Procedures in Ontario MPE patients 2004-2018

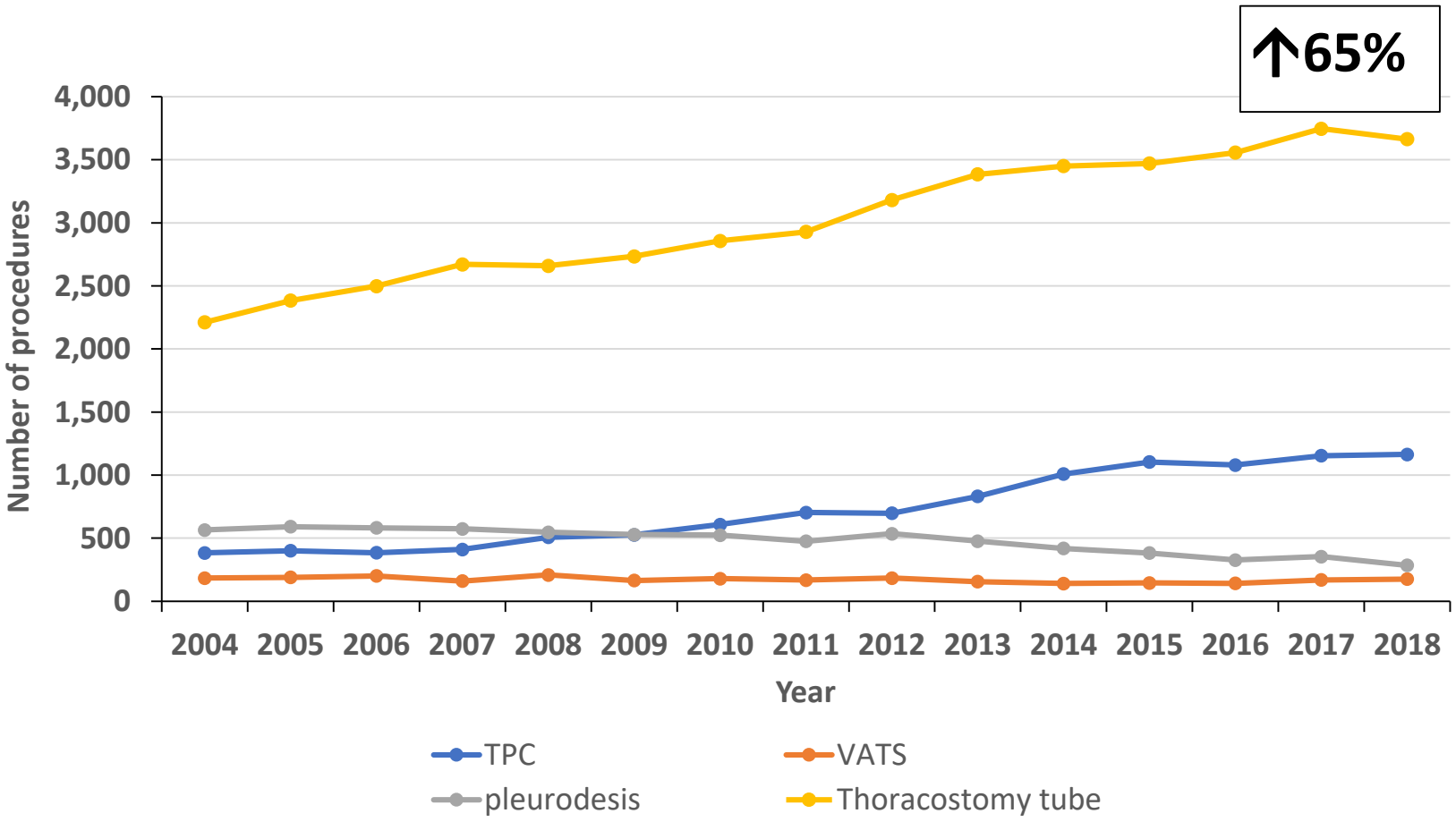


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Procedures in Ontario MPE patients 2004-2018



Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Inpatient days/procedures in MPE patients

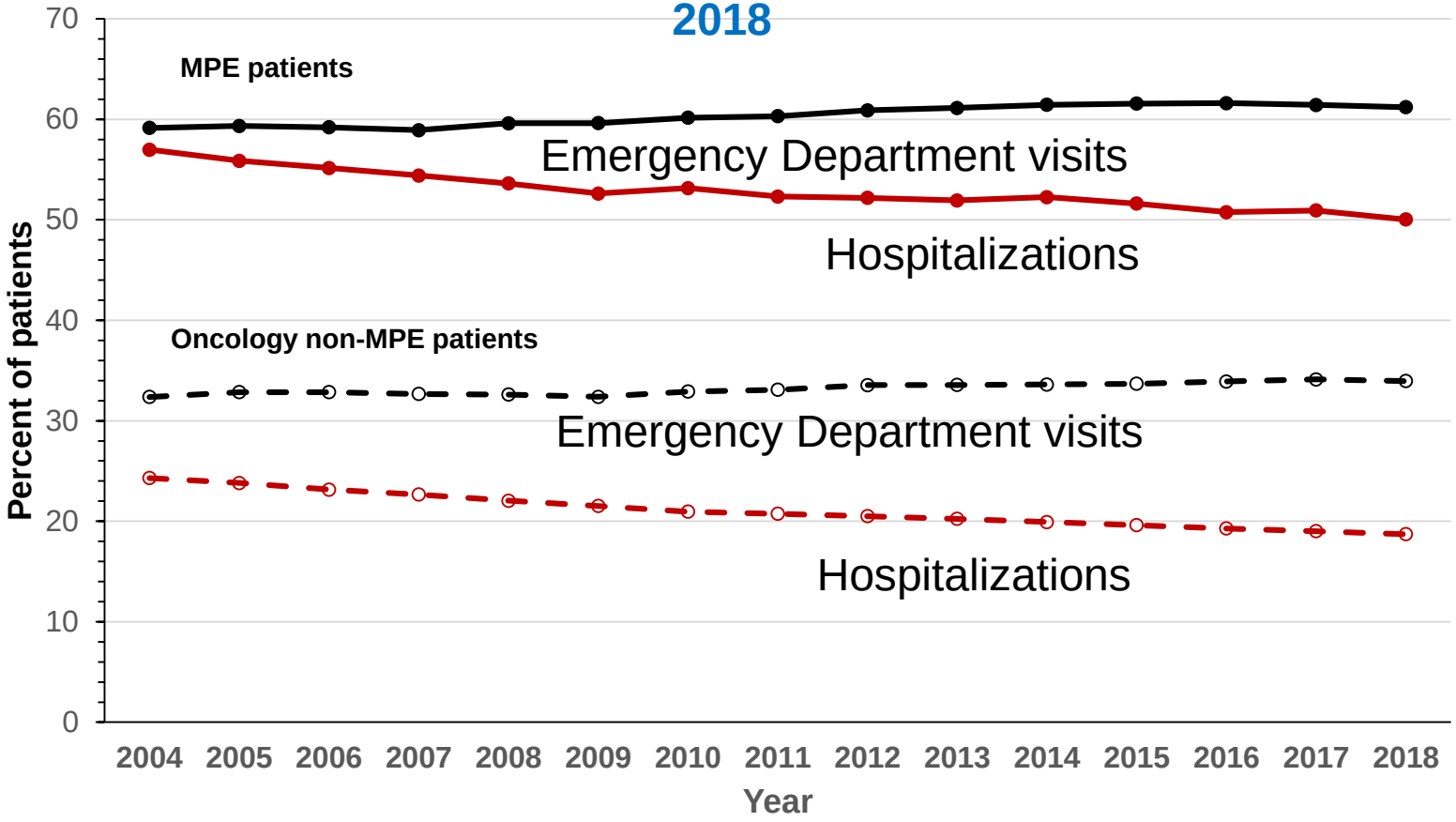
Pleural procedure used for MPE recurrence	No (%)	Total inpatient days Median (IQR)	Additional pleural procedures
Thoracentesis	10,019 (77)	31 (15-67)	17
TPC	496 (4)	23 (12-52)	<1
Thoracoscopic pleurodesis	673 (5)	25 (15-42)	<1
Chest tube pleurodesis	1,779 (14)	34 (18-68)	1

Ost et al. CHEST. 2018;153(2):438-52.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Percent of MPE and non-MPE oncology patients in Ontario who had ≥ 1 hospitalization or ED visit in 2004-2018

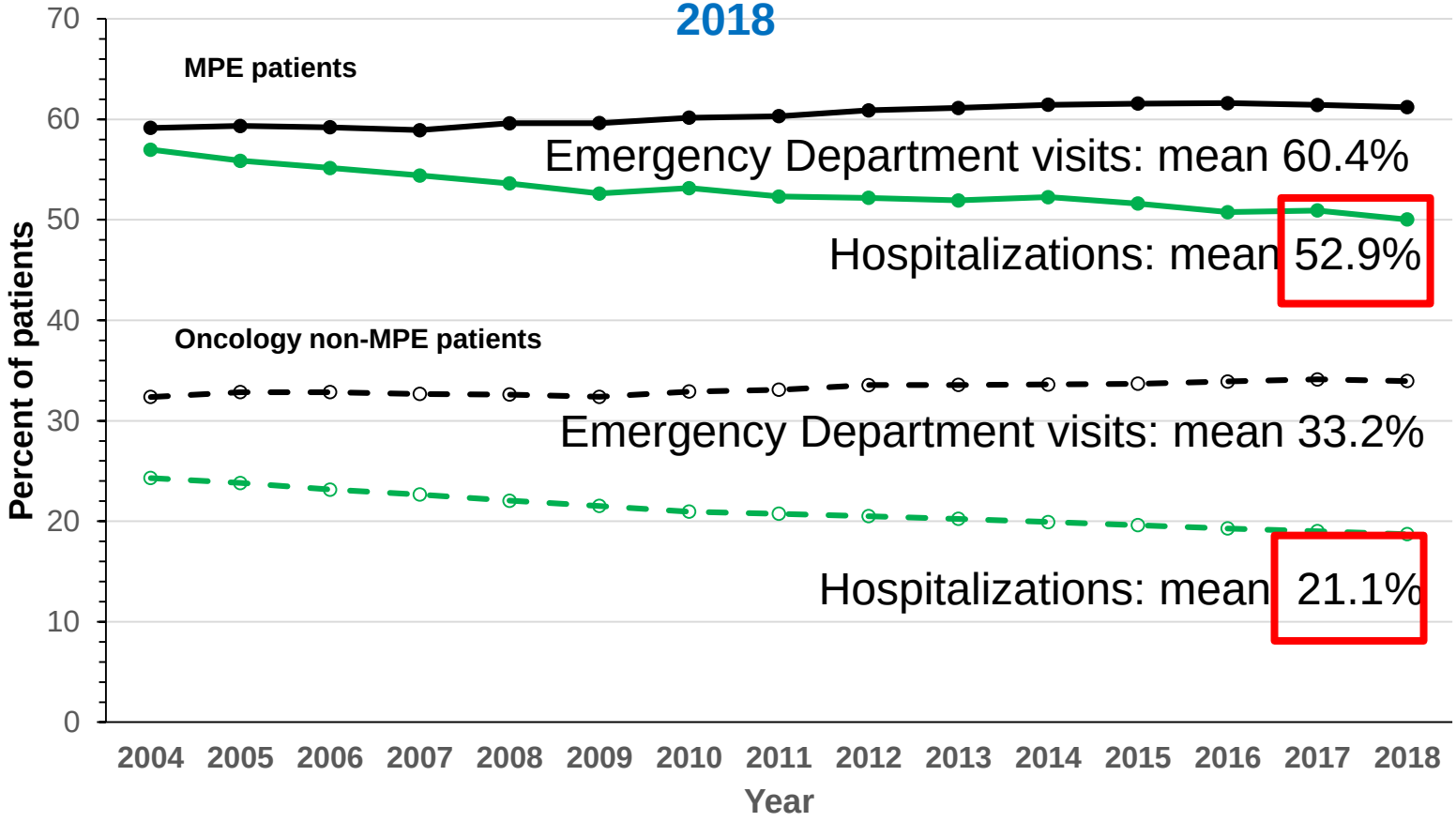


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Percent of MPE and non-MPE oncology patients in Ontario who had ≥ 1 hospitalization or ED visit in 2004-2018

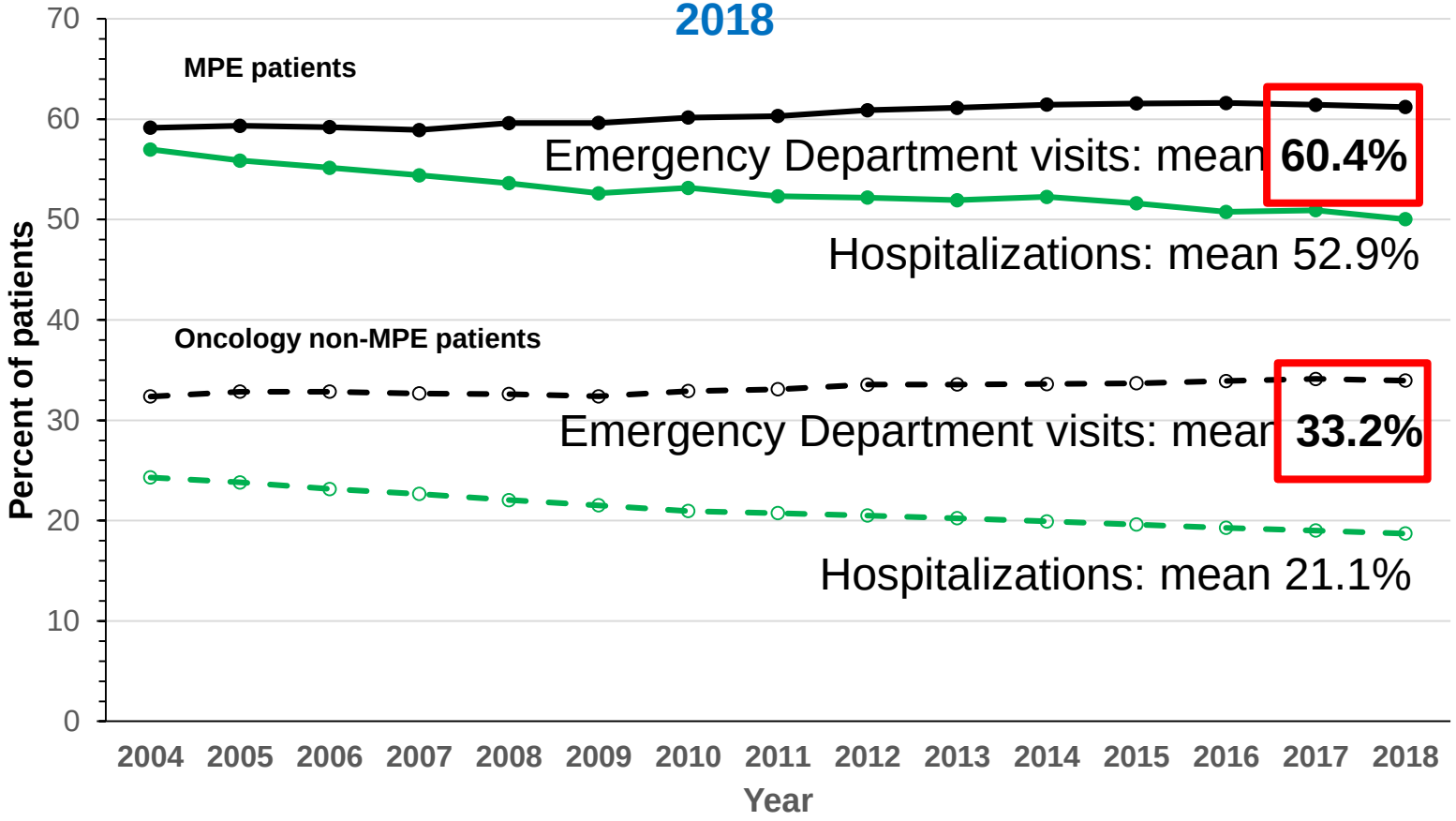


Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Percent of MPE and non-MPE oncology patients in Ontario who had ≥ 1 hospitalization or ED visit in 2004-2018



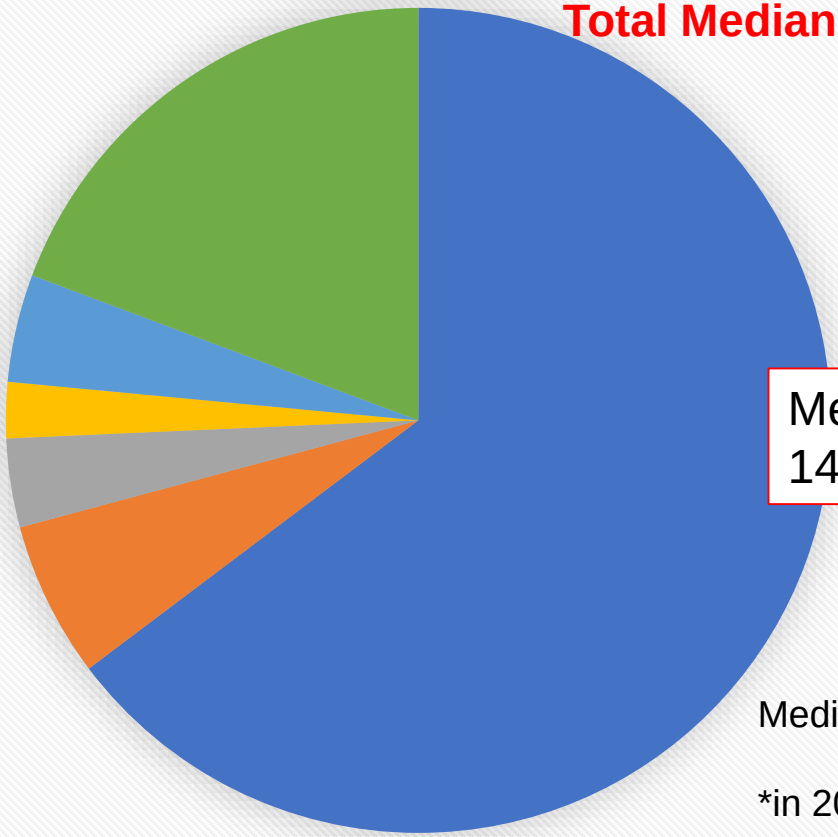
Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE patient health care costs - Canada

Total Median: $47,150 (24,005-89,566)*



Median survival
145 d (34-730)

Median 2-year costs

*in 2018 $CDN [$1CDN=$1.46US])

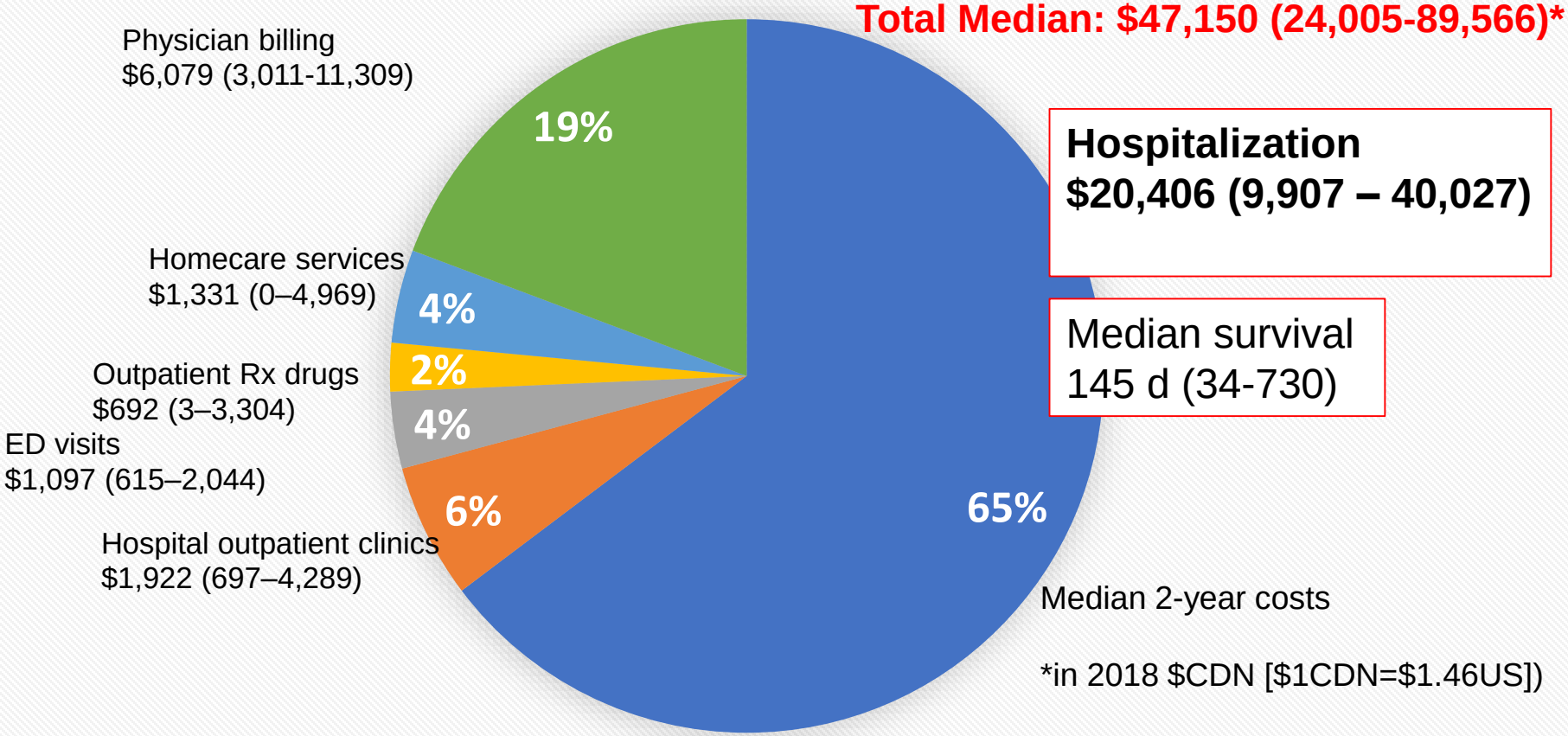
Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE patient health care costs - Canada

Total Median: $47,150 (24,005-89,566)*



Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Management of MPE?

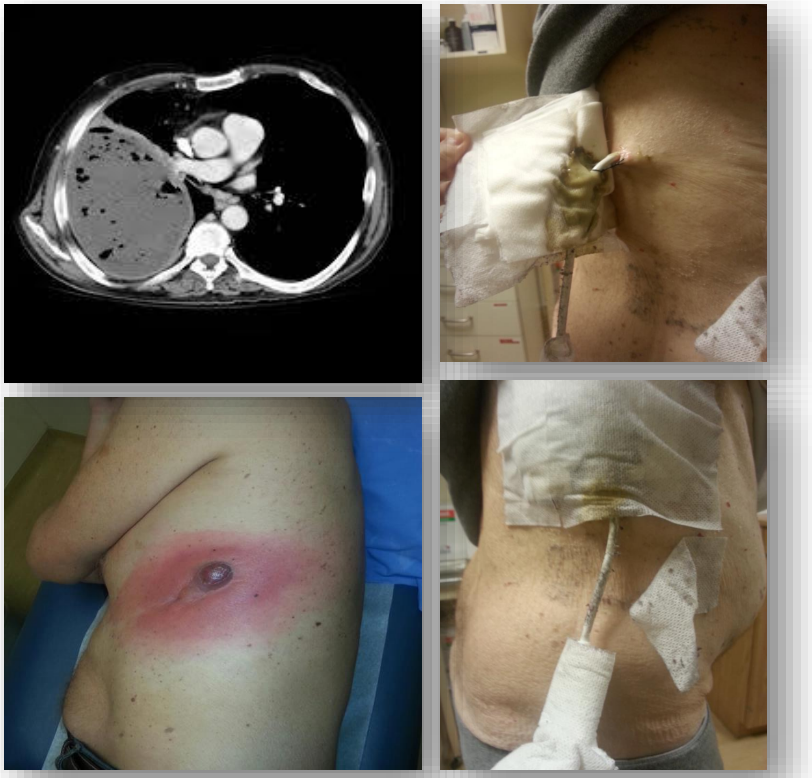
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Patients managed with TPC need ongoing outpatient support

- **TPC complications**
  - Blockage ~ 10%
    - 3-5% bleeding post TPA
  - Infection 1.9-25%
    - (empyema) 1-8%
    - Cellulitis 0.4-4%
  - Pneumothorax up to 4%
  - Tract metastasis < 1%

- **Catheter removal/trouble-shooting**
  - Malfunction ~ 8-10%
  - 45% pleurodesis rate



Jacobs et al. Diagnostics. 2022;12: 1016.
Ost el al. CHEST . 2014; 145: 1347-56.
Meter et al. J Gen Int Med. 2011; 1: 70-6.
Wahidi et al.ASAP. Am J Respir Crit Care Med. 2017; 195:150-7.
Muruganandan et al. AMPLE2; Lancet Respir Med. 2018;6:671-80.

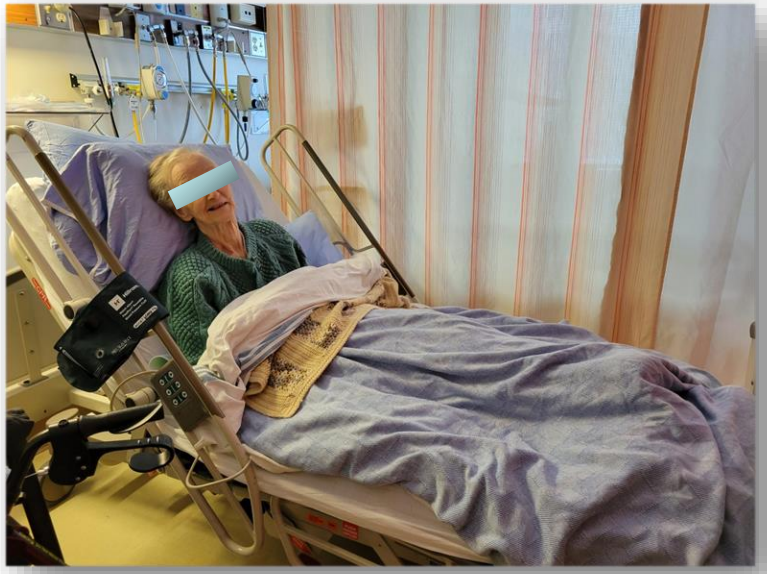
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Talc pleurodesis ?

	Pleurodesis
Symptom improvement	Yes
Pleurodesis success rate	60-90% (? 50% TPC)
Drainage duration	days
Complications	< 1%
Ambulatory	No/(Yes? TPC)
Need for outpatient care	No/(Yes? TPC)
Need for further interventions	Likely

MPE hospitalization: Avg LOS 5.5 - 16 days



Czarnecka-Kujawa et al. ACCP. 2023.
Alwakeel et al. JOBIP. 2023.
Taghizadeh et al. 2017. CHEST..
Ost et al 2018. CHEST.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Pleurodesis? Tunnelled catheter? Or?...

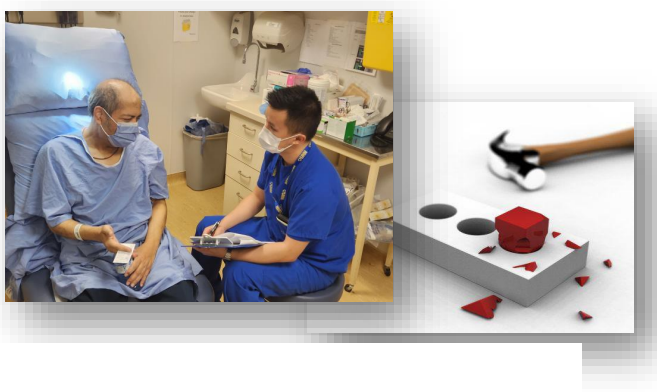
- Disease progression
  - Parenchymal
  - airway obstruction
  - Lymphangitic carcinomatosis
- Treatment complications
  - Pneumonitis
  - Fibrosis
- Other
  - Pneumonia
  - Venous thromboembolism
  - AECOPD/asthma/ILD
  - Tamponade
  - Ascites
  - Anemia
  - Arrhythmia

MPE hospitalization:
Avg LOS 5.5 - 16 days

Czarnecka-Kujawa et al. ACCP. 2023.
Alwakeel et al. JOBIP. 2023.
Taghizadeh et al. 2017. CHEST..
Ost et al 2018. CHEST.

Toronto General Hospital
University Health Network

Management of MPE **patient**



- Comprehensive assessment of the patient
  - Multidisciplinary pleural effusion management program

Alwakeel et al. JOBIP. 2023
Cloyes et al. BMJ Open Quality. 2023.

Management of MPE **patient**

- Comprehensive assessment of the patient
  - Multidisciplinary pleural effusion management program

Outcome	Pre-program, n = 69 (%)	Post-program, n = 75 (%)	p
Hospitalizations (n)	33 (48)	18 (24)	0.003

Alwakeel et al. JOBIP. 2023
Cloyes et al. BMJ Open Quality. 2023.

Management of MPE **patient**

- Comprehensive assessment of the patient
  - Multidisciplinary pleural effusion management program

Outcome	Pre-program, n = 69 (%)	Post-program, n = 75 (%)	p
Hospitalizations (n)	33 (48)	18 (24)	0.003
Patients with chest drain and no pleurodesis (n)	23 (46)	10 (13)	<0.001

Alwakeel et al. JOBIP. 2023
Cloyes et al. BMJ Open Quality. 2023.

Management of MPE **patient**

- Comprehensive assessment of the patient
  - Multidisciplinary pleural effusion management program

Outcome	Pre-program, n = 69 (%)	Post-program, n = 75 (%)	p
Hospitalizations (n)	33 (48)	18 (24)	0.003
Patients with chest drain and no pleurodesis (n)	23 (46)	10 (13)	<0.001
Days with chest tube n, $\overline{X} \pm SD$	1.6 ± 4.1	0.7± 2.5	0.007

Alwakeel et al. JOBIP. 2023
Cloyes et al. BMJ Open Quality. 2023.

Doctors of Thoracic Surgery

Management of MPE **patient**

- Comprehensive assessment of the patient
  - Multidisciplinary pleural effusion management program

Outcome	Pre-program, n = 69 (%)	Post-program, n = 75 (%)	p
Hospitalizations (n)	33 (48)	18 (24)	0.003
Patients with chest drain and no pleurodesis (n)	23 (46)	10 (13)	<0.001
Days with chest tube n, $\overline{X} \pm SD$	1.6 ± 4.1	0.7± 2.5	0.007
Initial presentation in ED	30 (44)	29 39)	0.56
ED visits n, $\overline{X} \pm SD$	0.7 ± 0.7	0.6 ± 0.7	0.41

Alwakeel et al. JOBIP. 2023
Cloyes et al. BMJ Open Quality. 2023.

Toronto General Hospital
University Health Network

Summary

- Incidence and prevalence of malignant pleural effusion are rising.
- Malignant pleural effusion is associated with high health care utilization and cost.
- MPE management with TPC and talc result in equivalent QOL.
- Compared to talc pleurodesis via a chest tube, pleurodesis via TPC has lower pleurodesis rate.
- Intrapleural chemotherapy may be useful in MPE/NSCLC management.
- Multidisciplinary care of MPE patients may reduce MPE health care utilization and cost.

Doctors of Thoracic Surgery®

Division of Thoracic Surgery, Toronto General Hospital

Thank you

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Kasia Czarnecka-Kujawa
Division of Thoracic Surgery
Division of Respirology
Toronto General Hospital
University Health Network

Thank you

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Advantages and disadvantages of most common MPE management options

	TPC
Symptom improvement	Yes
Pleurodesis success rate	Up to 45%
Drainage duration	4 weeks - > 4y
Complications	5-25%
Ambulatory	Yes
Need for outpatient care	Yes
Need for further interventions	Less likely

Factors to consider while offering definitive management of MPE

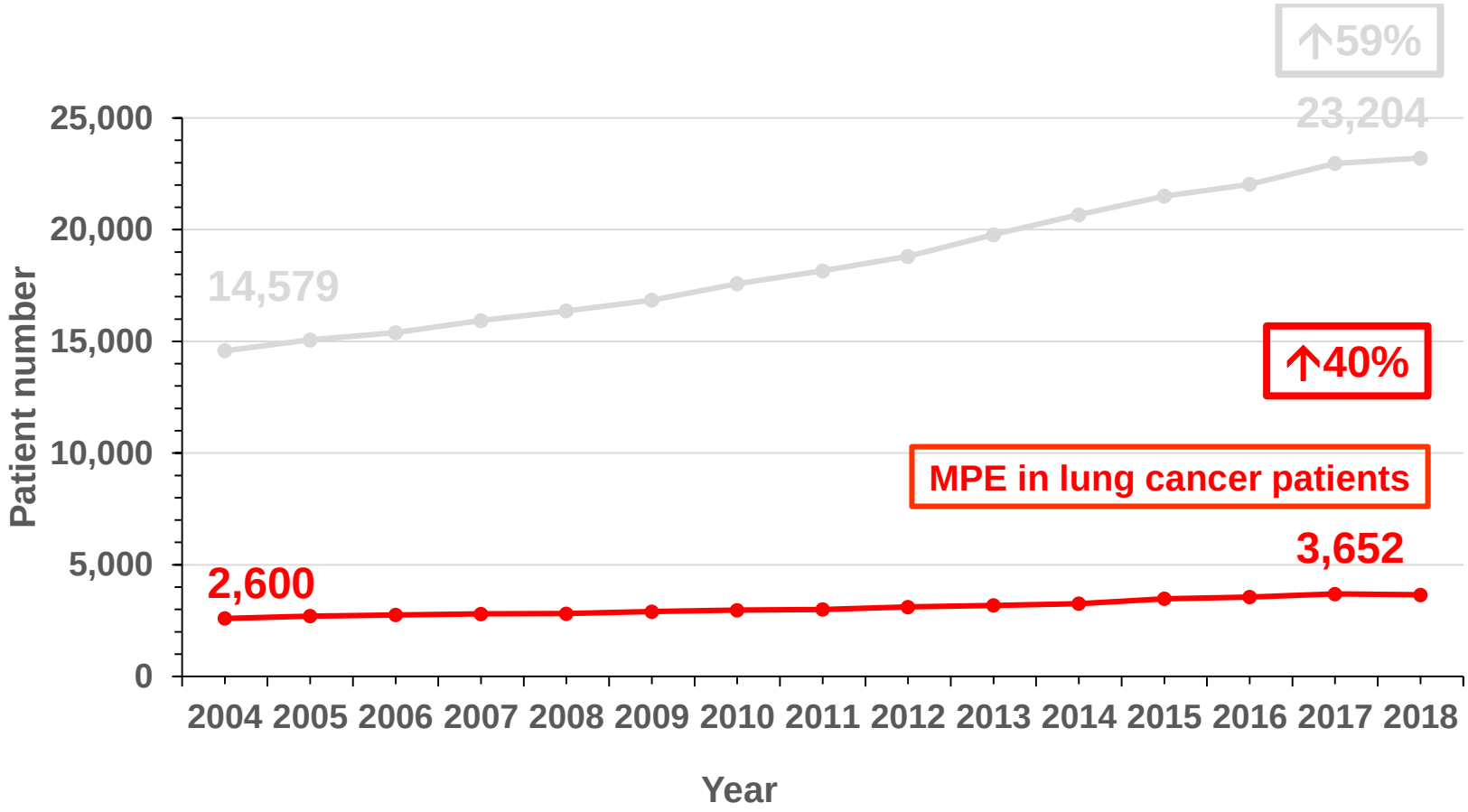
- Patient factors/wishes

- 86F with MPE and expandable lung, on chemo
  - Slow re-accumulation
  - Mild cognitive impairment
  - Wheelchair bound
  - Delirium with narcotics
  - **Option offered:** TPC

- 55F MPE, trapped lung
  - Large MPE
  - Weekly thoracentesis
  - Improvement of dyspnea with drainage
  - Issue: not comfortable with TPC AND with CCAC visits at home
- **Option offered:** continue with thoracentesis until ready to commit

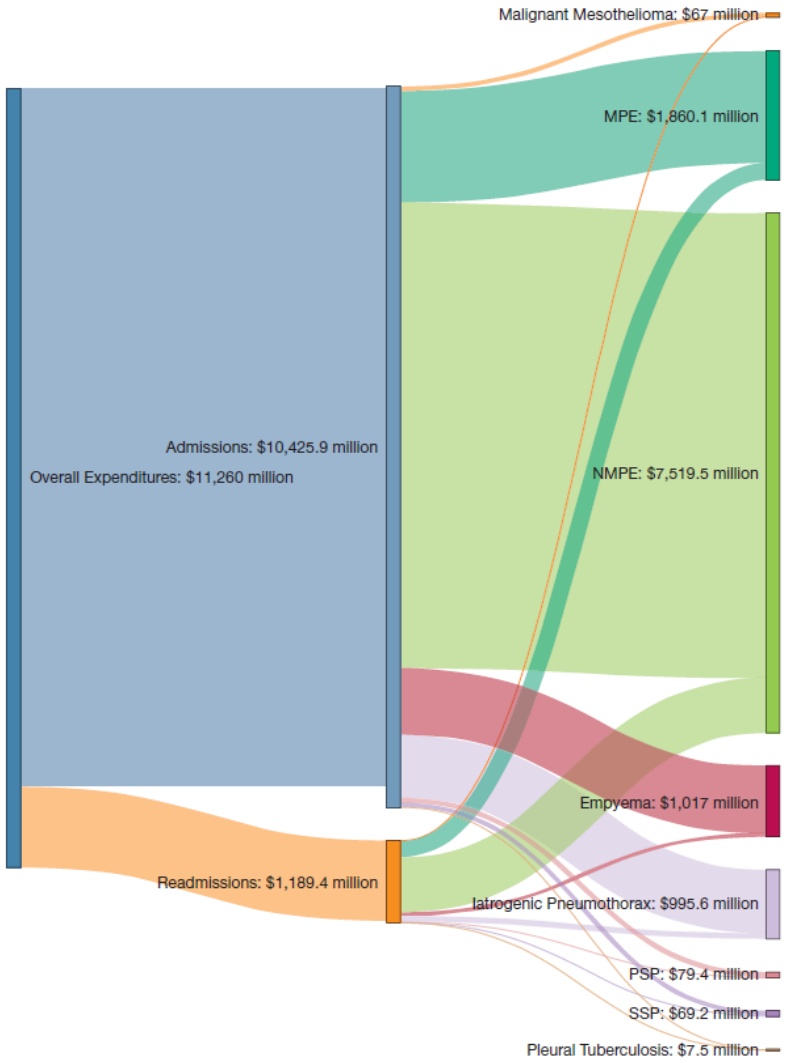
Doctors of Thoracic Surgery

Prevalence of Malignant Pleural Effusion in Ontario 2004-2018



Czarnecka-Kujawa et al. ACCP. 2023

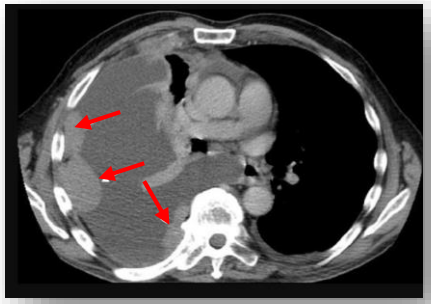
Toronto General Hospital
University Health Network


Malignant Mesothelioma: $67 million
MPE: $1,860.1 million
Admissions: $10,425.9 million
Overall Expenditures: $11,260 million
NMPE: $7,519.5 million
Empyema: $1,017 million
Readmissions: $1,189.4 million
Iatrogenic Pneumothorax: $995.6 million
PSP: $79.4 million
SSP: $69.2 million
Pleural Tuberculosis: $7.5 million

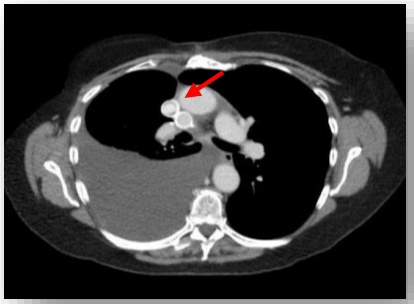
Doctors of Thoracic Surgery

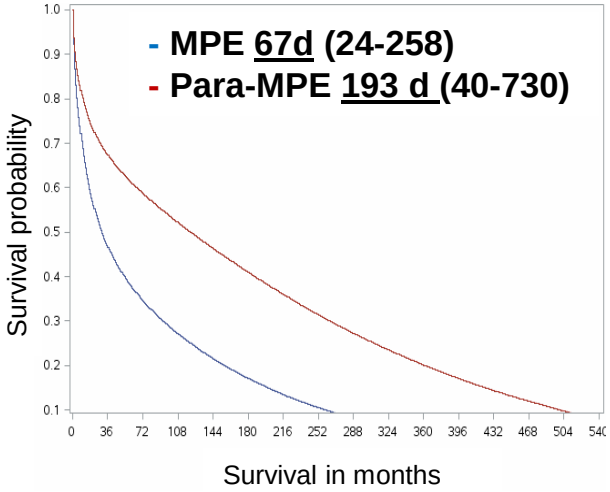
MPE vs. para-malignant effusion

- MPE
  - Effusion directly related to malignancy



- Para-malignant effusion
  - Tumor effect on pleural space
    - Bronchial obstruction
    - VTE
    - SCV syndrome
    - Post-radiation (trapped lung, lymphatic injury)





Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

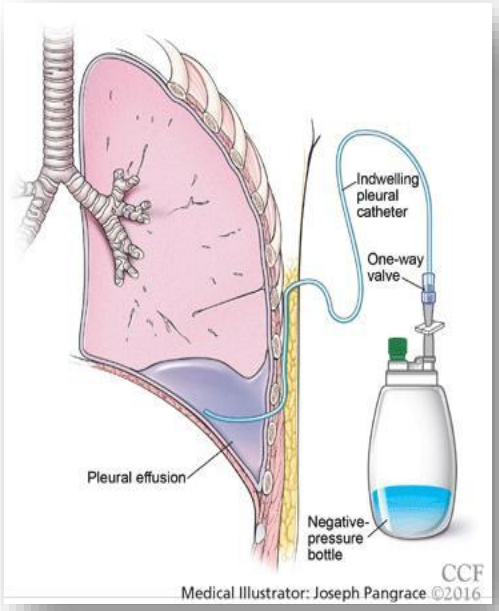
Doctors of Thoracic Surgery

Definitive MPE management

Tunneled pleural catheter

Pleurodesis

- Talc > other agents
- Slurry = poudrage
- VATS = chest tube



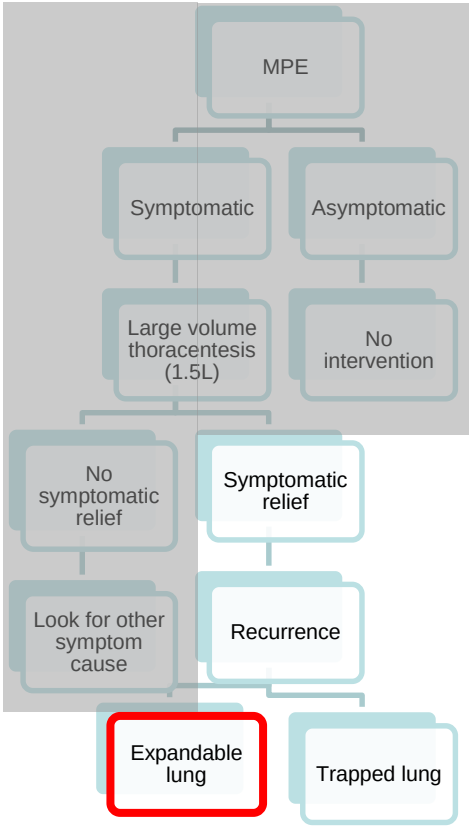
Pleurodesis via Tunneled pleural catheter

Bhatnagar et al. TAPSS JAMA. 2020.323;60-69.
Feller-Kopman et al. Am J Critic Resp Care Med. 2018;198:839-49.
Dresler at al. CHEST. 2005;127: 909-15.
Bhatnagar et al. NEJM. 2018.378;1313-22.
Yeung et al. Clin Exp Metastasis. 2020;4: 541-49.
Xia et al.PLoS ONE. 2014

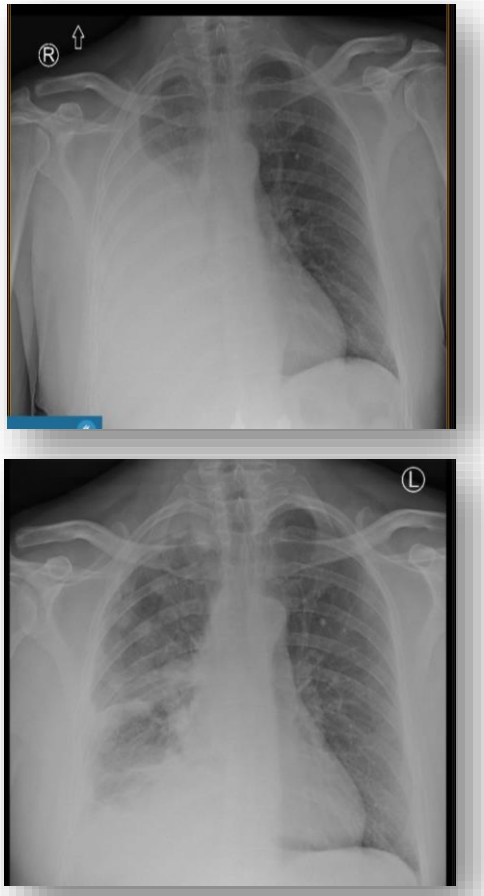
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE management



MPE management options	Expandable lung
Thoracentesis	✓
TPC	✓
Pleurodesis	✓
VATS	✓
Chest tube	✓
TPC	✓

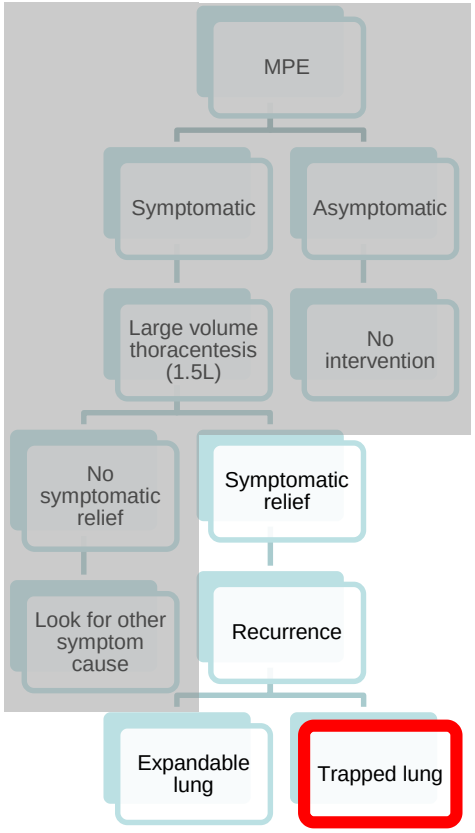


Am J Respir Crit Care Med. 2018;(198):839–849.
Roberts et al. Thorax. 2023;78:1143-56.

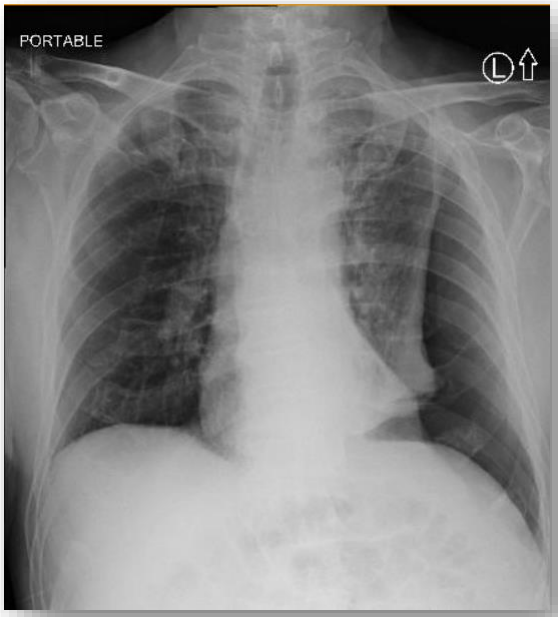
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE management



MPE management options	Trapped lung
Thoracentesis	✓
TPC	✓
Pleurodesis	
VATS	
Chest tube	
TPC	



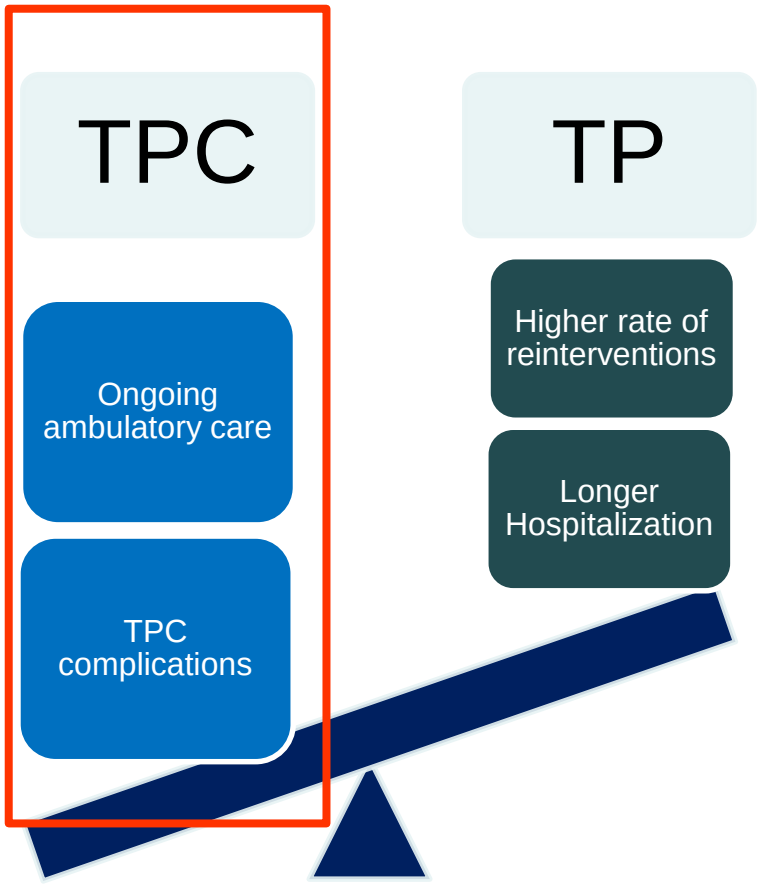
Am J Respir Crit Care Med. 2018;(198):839–849.
Roberts et al. Thorax. 2023;78:1143-56.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Choosing MPE management option

? Patients with survival < 6 mths



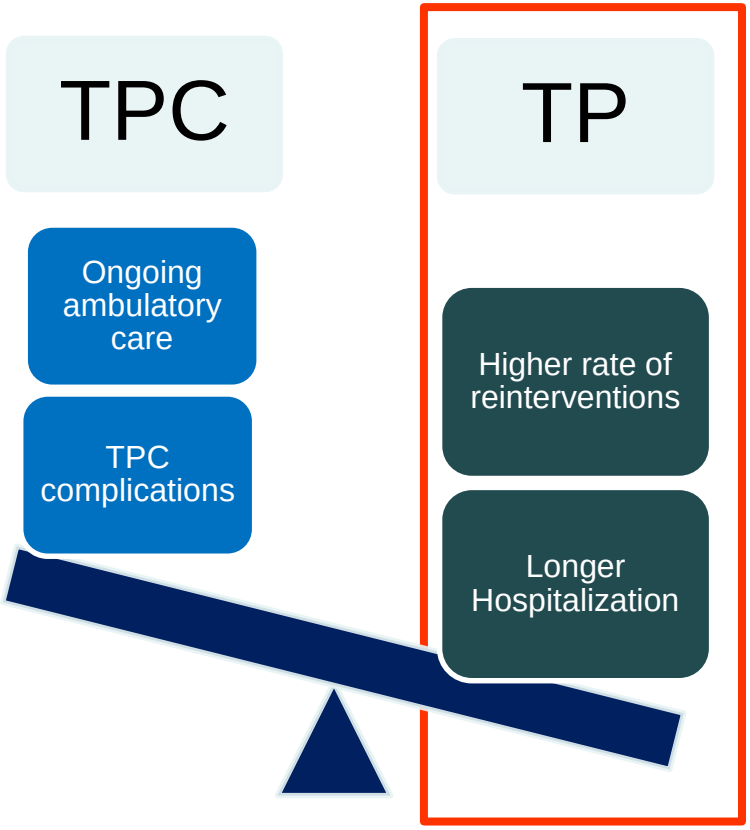
Shafiq et al.J Bronchol Inervent Pulmonol. 2015.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Choosing MPE management option

? Patients with survival > 6 mths



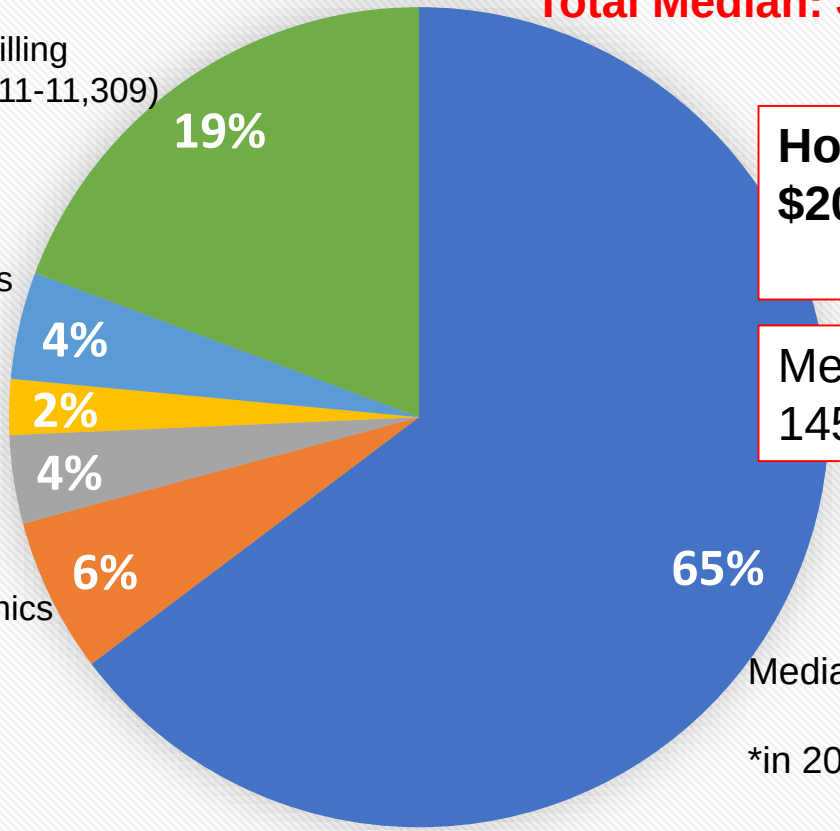
Shafiq et al.J Bronchol Inervent Pulmonol. 2015.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE patient health care costs

Total Median: $47,150 (24,005-89,566)*



Hospitalization
$20,406 (9,907 – 40,027)

Median survival
145 d (34-730)

Median 2-year costs

*in 2018 $CDN [$1CDN=$1.46US])

Czarnecka-Kujawa et al. ACCP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Inpatient days/procedures in MPE population

Pleural procedure used for MPE recurrence	No (%)	Total inpatient days Median (IQR)	Additional pleural procedures
Thoracentesis	10,019 (77)	31 (15-67)	17*
TPC	496 (4)	23 (12-52)	<1
Thoracoscopic pleurodesis	673 (5)	25 (15-42)	<1
Chest tube pleurodesis	1,779 (14)	34 (18-68)	1

Ost et al. CHEST. 2018;153(2):438-52.

Toronto General Hospital
University Health Network

Factors to consider while offering definitive management of MPE

- Comprehensive assessment of patient symptoms
- Patient factors/wishes/expected survival
- Local resources

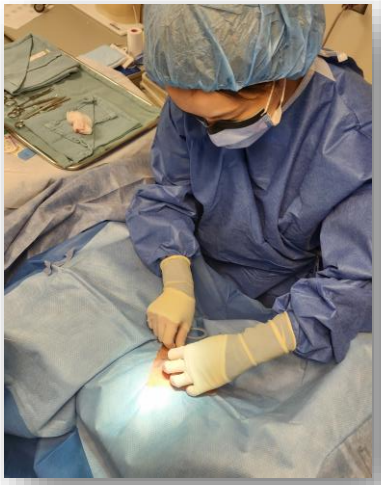
- 86F with MPE and expandable lung, on chemo
  - Slow re-accumulation
  - Mild cognitive impairment
  - Wheelchair bound
  - Delirium with narcotics

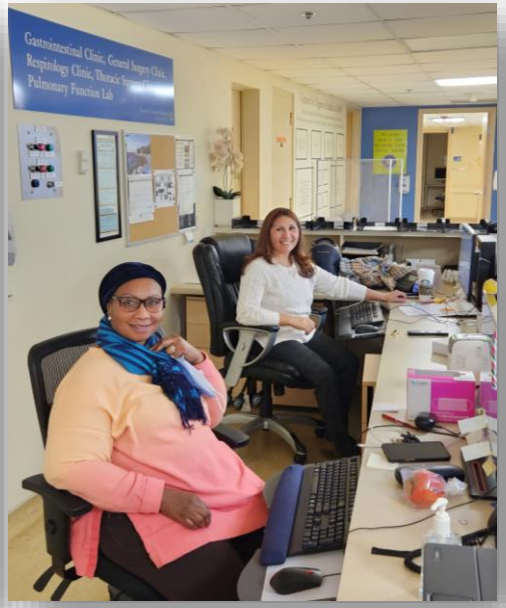
  - **Option offered:** TPC

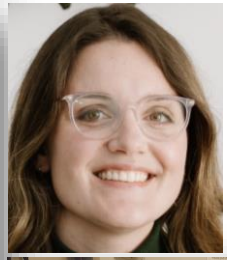
Doctors of Thoracic Surgery®

- MPE management by a dedicated program:
- ↓ hospitalization
- ↓ chest tube insertion

RACE (Rapid Assessment of Complex Pleural Effusions) Program Toronto General Hospital







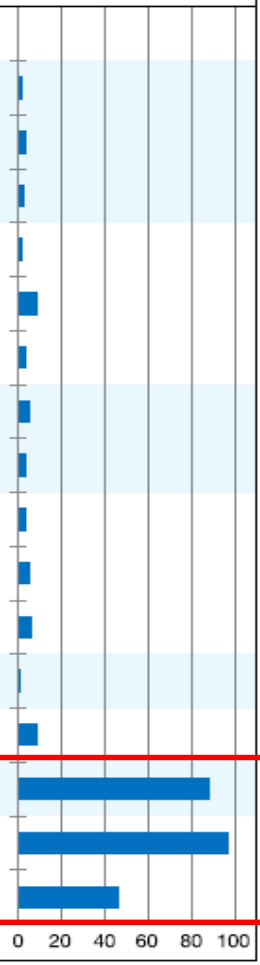
Alwakeel er al. JOBIP. 2023

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Ambulatory MPE management outcomes

Outcome	Number of Studies	Percent with Outcome: *Combined Results*	*Single Study Minimum*	*Single Study Maximum*
Bleeding	6	**0.4** (4/903)	0 (0/295)	0,9 (1/109)
Infection, unspecified	3	**2.0** (7/346)	1.7 (5/295)	5.9 (1/17)
Cellulitis	10	**3.4** (32/935)	1.3 (1/77)	25 (3/12)
Empyema	13	**2.8** (33/1168)	0 (0/12)	16,7 (2/12)
Dislocated catheter	7	**2.2** (14/648)	1.3 (3/240)	17.7 (3/17)
Malfunction of catheter	2	**9.1** (11/121)	0.0 (0/12)	10.1 (11/109)
Obstructed / clogged catheter	10	**3.7** (33/895)	0,9 (1/107)	17,6 (6/34)
Pain, unspecified	2	**5.6** (8/142)	2.0 (1/51)	7.7 (7/91)
Pain, beyond immediate post-procedure	5	**3.2** (18/558)	0.4 (1/240)	14.3 (4/28)
Pneumothorax, unspecified	5	**3.9** (17/439)	0 (0/27)	38,9 (7/18)
Pneumothorax, asymptomatic	3	**5.4** (9/168)	2,4 (3/125)	25 (3/12)
Pneumothorax requiring chest tube	1	**5.9** (3/51)	5.9 (3/51)	5.9 (3/51)
Tract metastasis	10	**0.8** (9/1093)	0 (0/107)	3.7 (1/27)
Catheter removed due to complication	8	**8.5** (54/633)	1.6 (1/63)	20,6 (7/34)
Without complication	10	**87.5** (517/591)	54,5 (6/11)	100 (55/55)
Symptomatic improvement	12	**95.6** (628/657)	86.2 (50/58)	100 (100/100)
Spontaneous pleurodesis	12	**45.6** (430/943)	11.8 (4/34)	76.4 (42/55)



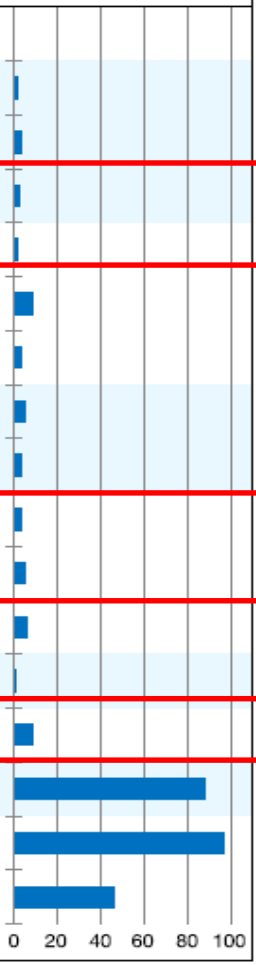
Meter et al. J Gen Int Med. 2011; 1: 70-6.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

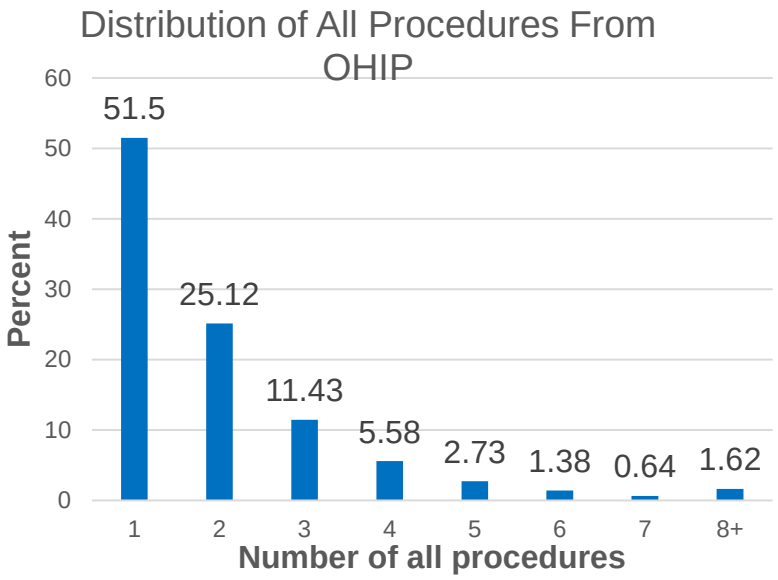
Ambulatory MPE management outcomes

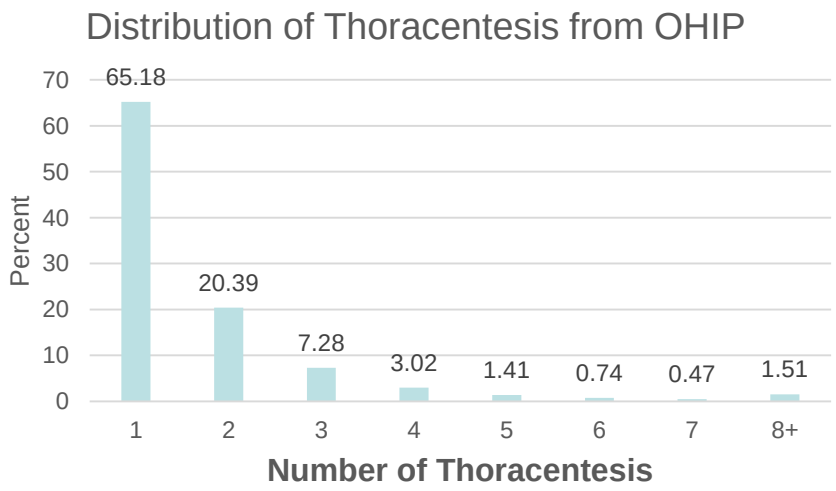
Outcome	Number of Studies	Percent with Outcome: *Combined Results*	*Single Study Minimum*	*Single Study Maximum*
Bleeding	6	**0.4** (4/903)	0 (0/295)	0,9 (1/109)
Infection, unspecified	3	**2.0** (7/346)	1.7 (5/295)	5.9 (1/17)
Cellulitis	10	**3.4** (32/935)	1,3 (1/77)	25 (3/12)
Empyema	13	**2.8** (33/1168)	0 (0/12)	16,7 (2/12)
Dislocated catheter	7	**2.2** (14/648)	1.3 (3/240)	17.7 (3/17)
Malfunction of catheter	2	**9.1** (11/121)	0.0 (0/12)	10.1 (11/109)
Obstructed / clogged catheter	10	**3.7** (33/895)	0,9 (1/107)	17,6 (6/34)
Pain, unspecified	2	**5.6** (8/142)	2.0 (1/51)	7.7 (7/91)
Pain, beyond immediate post-procedure	5	**3.2** (18/558)	0.4 (1/240)	14.3 (4/28)
Pneumothorax, unspecified	5	**3.9** (17/439)	0 (0/27)	38,9 (7/18)
Pneumothorax, asymptomatic	3	**5.4** (9/168)	2,4 (3/125)	25 (3/12)
Pneumothorax requiring chest tube	1	**5.9** (3/51)	5.9 (3/51)	5.9 (3/51)
Tract metastasis	10	**0.8** (9/1093)	0 (0/107)	3.7 (1/27)
Catheter removed due to complication	8	**8.5** (54/633)	1,6 (1/63)	20,6 (7/34)
Without complication	10	**87.5** (517/591)	54,5 (6/11)	100 (55/55)
Symptomatic improvement	12	**95.6** (628/657)	86.2 (50/58)	100 (100/100)
Spontaneous pleurodesis	12	**45.6** (430/943)	11.8 (4/34)	76.4 (42/55)



Meter et al. J Gen Int Med. 2011; 1: 70-6.

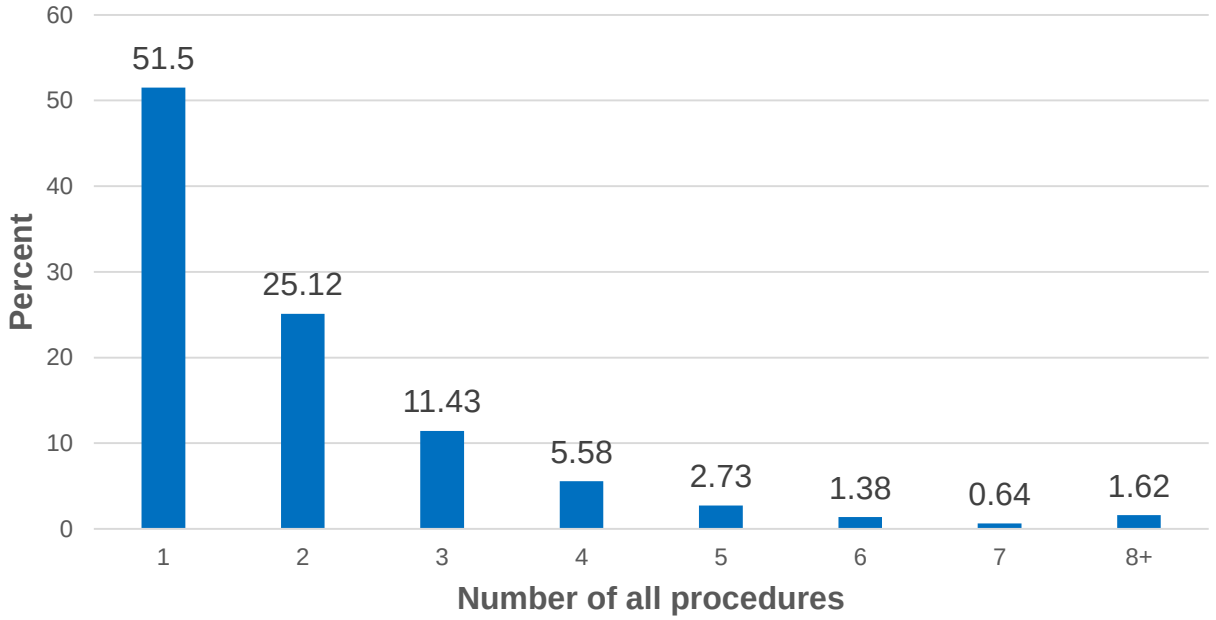
Toronto General Hospital
University Health Network


Distribution of All Procedures From OHIP
Percent
60
50
40
30
20
10
0
51.5
25.12
11.43
5.58
2.73
1.38
0.64
1.62
1
2
3
4
5
6
7
8+
Number of all procedures


Distribution of Thoracentesis from OHIP
Percent
70
60
50
40
30
20
10
0
65.18
20.39
7.28
3.02
1.41
0.74
0.47
1.51
1
2
3
4
5
6
7
8+
Number of Thoracentesis

Doctors of Thoracic Surgery

Procedures in Ontario MPE patients 2004-2018



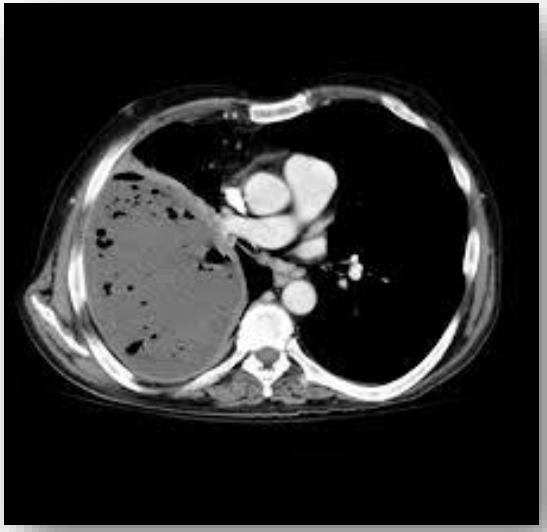
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Patients managed with TPC need ongoing outpatient support

Tract metastasis

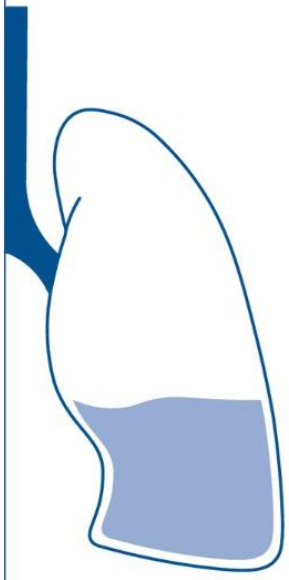
Empyema: time to empyema 158 days*



Toronto General Hospital
University Health Network

The OPTIMUM trial

Outpatient IPC management for malignant pleural effusion was not superior to inpatient chest drain and talc pleurodesis in improving quality of life after 30 days

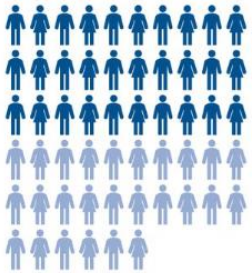


Participants: 142 patients with malignant pleural effusion

Intervention: Outpatient IPC ± talc pleurodesis

Control: Inpatient chest drain + talc pleurodesis

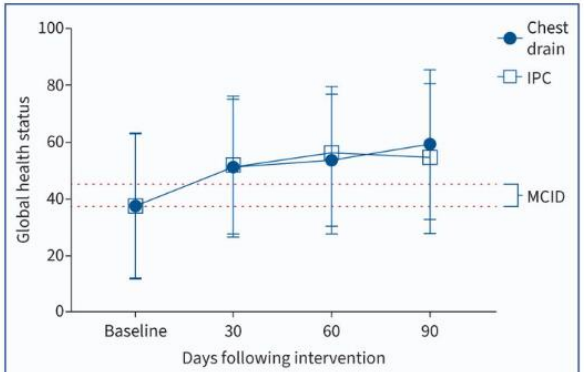
Primary outcome: Global health status at 30 days post-intervention (EORTC QLQ-C30)



Chest drain: 30/56 patients had a significant (>8 points) improvement in global health status at 30 days

IPC: 33/58 patients had a significant (>8 points) improvement in global health status at 30 days

Results: Primary outcome data were available in 58 IPC and 56 chest drain participants



Global health status scores measured using the EORTC QLQ-C30 over 90-day follow-up

Day 30 mean intergroup difference in baseline-adjusted global health status of 2.06 (95% CI −5.86–9.99); p=0.61

Take home: Management choice should be based on patient preferences, acceptability of risk, social circumstances and treatment accessibility

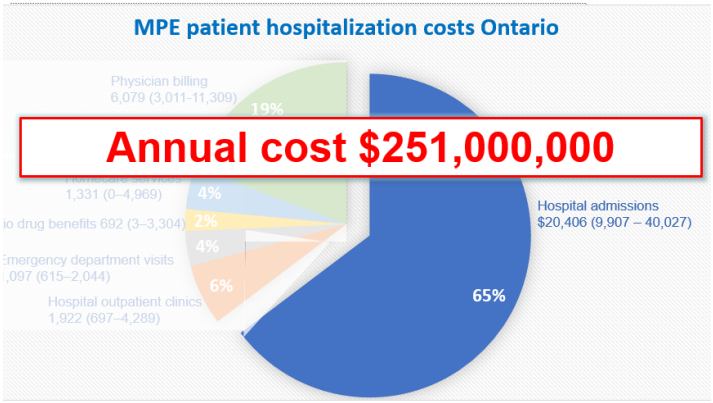
Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE1 Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Malignant pleural effusion

- 10-12% of Ontario Cancer patients
- Median length of stay 10 (5-18)
- Hospital readmission rate:
  - 25.6% (95% CI 25.0%- 26.3)
- Readmission mortality rate:
  - 17.3% (95% CI 16.6% - 18.1%)



Ost et al. CHEST. 2018
Czarnecka-Kujawa et al. ACCP 2023

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

MPE at UHN

- ~ 250 admissions with MPE as primary admission diagnosis
- Annually ~400-570 admissions
    - Effusion as secondary admission diagnosis
- 16.8% mortality
- LOS: 16.5 days
- Cost/admission: $30,743

>$ 7,685,750 /year

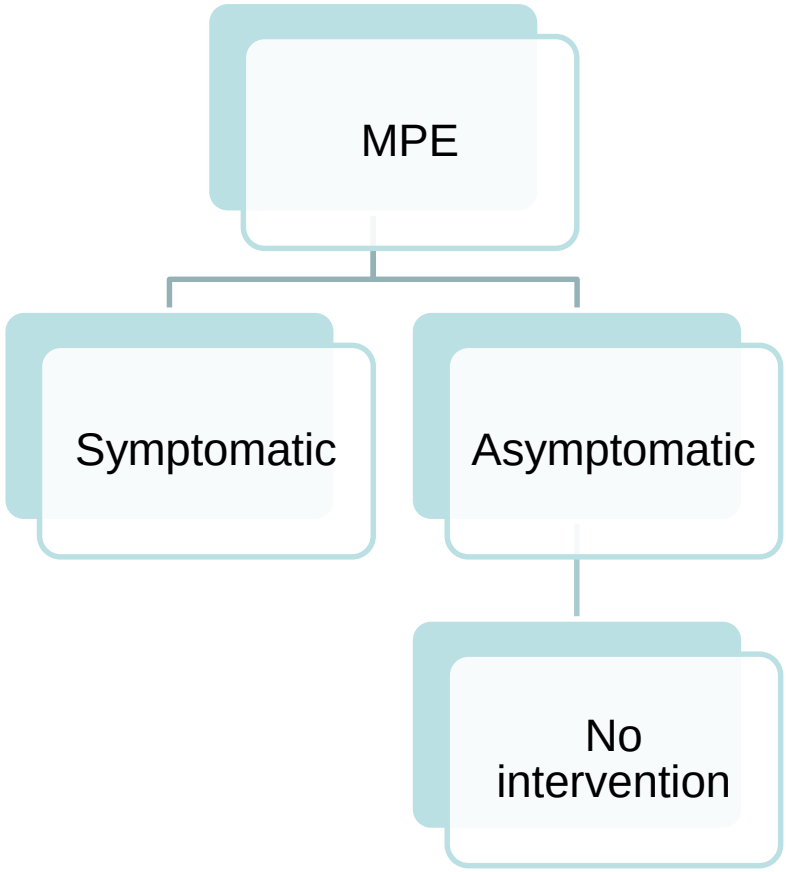
UHN decision support 2008-2018
Cost expressed in CAN Dollars, adjusted for inflation to 2024, using CPI, Bank of Canada

MPE - management goals

- Improve patient's quality of life
    - Improve pleural effusion-related symptoms
    - Reduce number of pleural based procedures
    - Reduce number of days spent in hospital
- Reduce health care costs

Doctors of Thoracic Surgery

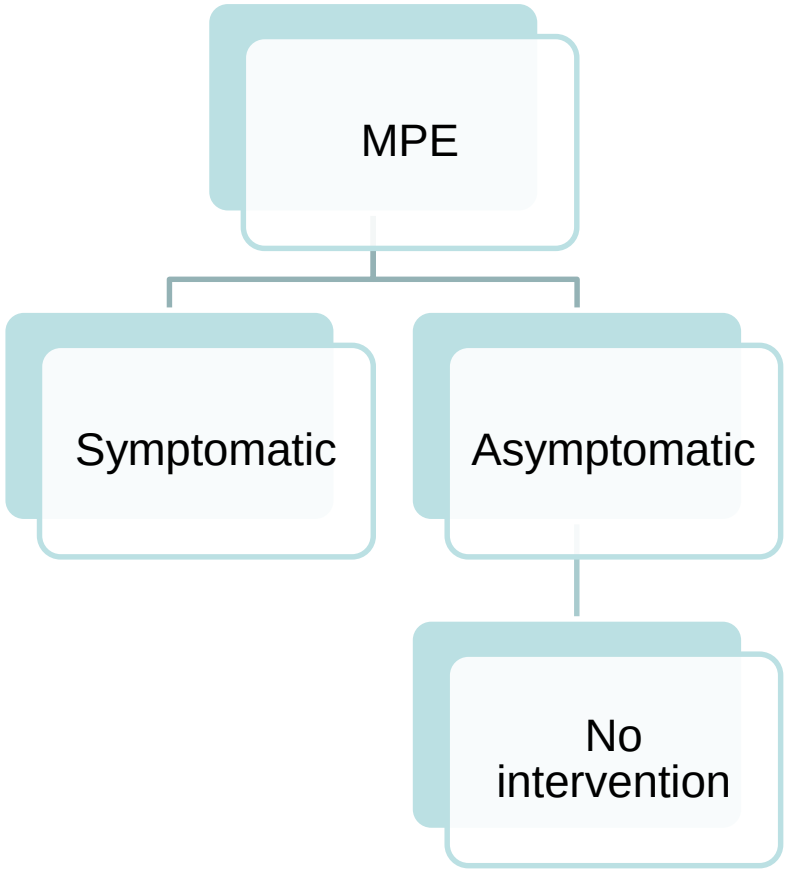
MPE – management guidelines



Am J Respir Crit Care Med. 2018;(198):839–849.

Toronto General Hospital
University Health Network

MPE – management guidelines

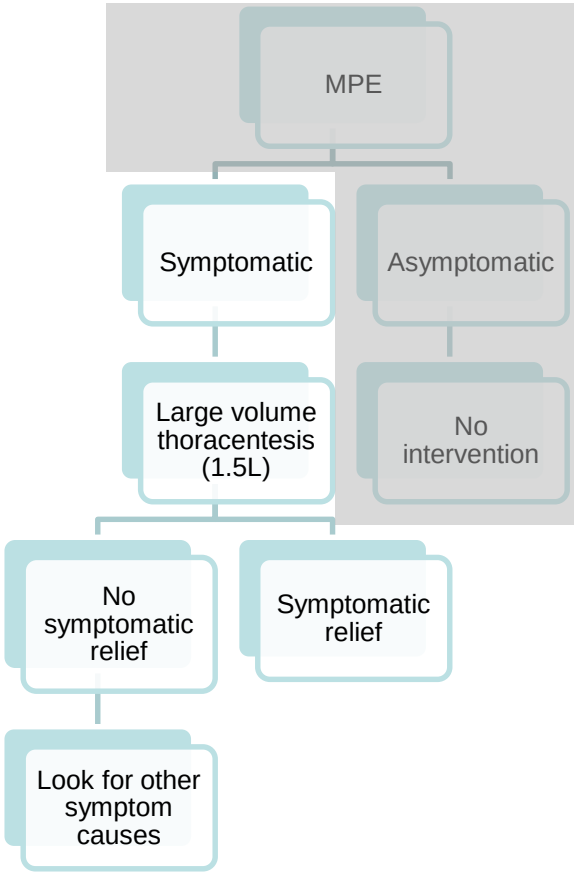


- no drainage unless:
  - confirmation of diagnosis needed
  - suspicion of infection
  - ? chylothorax
  - Organ dysfunction

Am J Respir Crit Care Med. 2018;(198):839–849.

Doctors of Thoracic Surgery

MPE – management guidelines



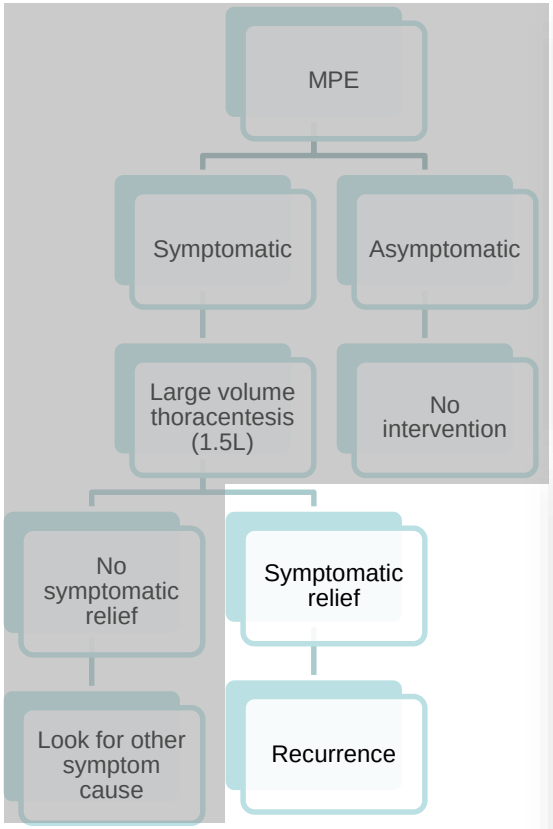
- Disease progression
  - Parenchymal
  - airway obstruction
  - Lymphangitic carcinomatosis
- Treatment complications
  - Pneumonitis
  - Fibrosis
- Other
  - Pneumonia
  - Venous thromboembolism
  - AECOPD/asthma/ILD
  - Pericardial effusion
  - Ascites
  - Anemia

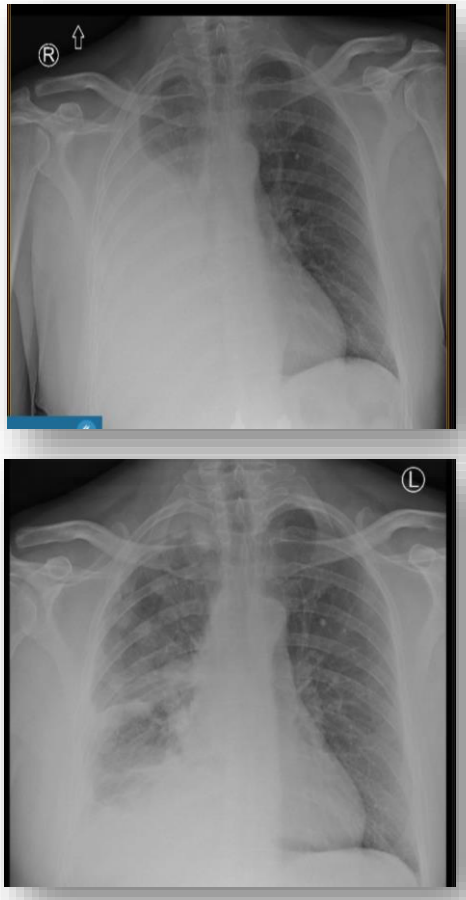
Am J Respir Crit Care Med. 2018;(198):839–849.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines





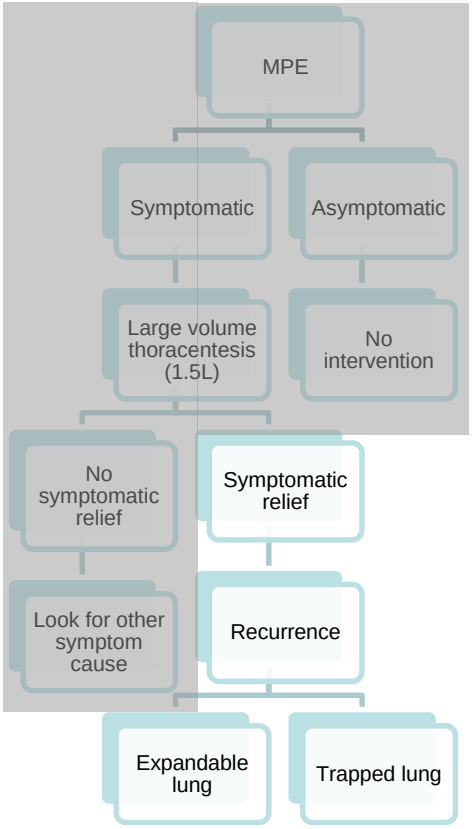
- > 50% effusions recur
- 58% recur rapidly (within 1 month)
- ? Plans for management at time of first drainage

Am J Respir Crit Care Med. 2018;(198):839–849.
Ost et al. CHEST. 2018;153(2):438-52.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines

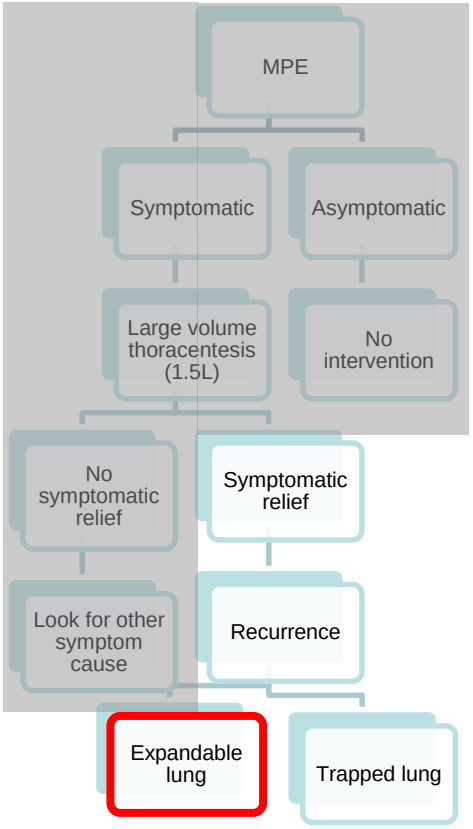


Am J Respir Crit Care Med. 2018;(198):839–849.

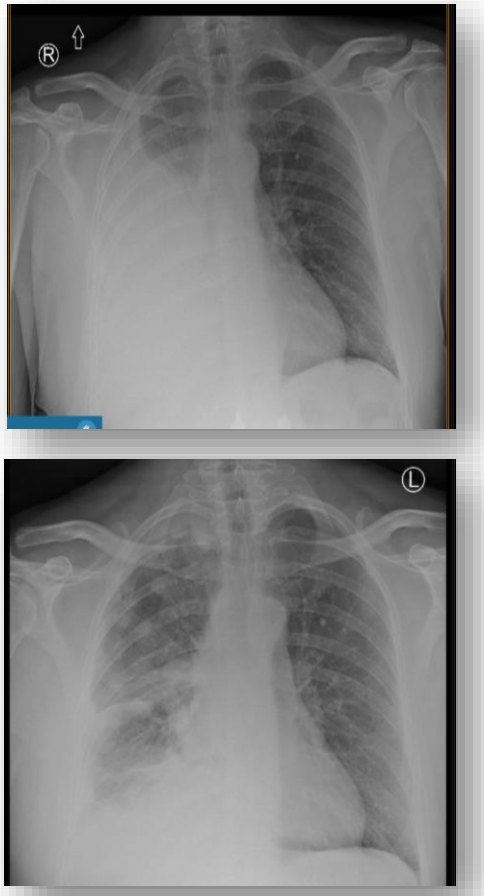
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines



MPE management options	Expandable lung
Thoracentesis	✓
TPC	✓
Pleurodesis	✓
VATS	✓
Chest tube	✓
TPC	✓
Pleuroperitoneal shunt	✓
Decortication/pleurectomy	✓

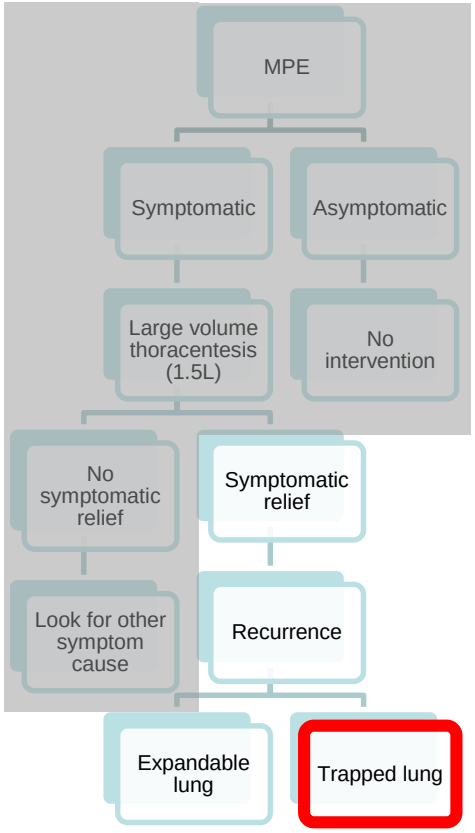


Am J Respir Crit Care Med. 2018;(198):839–849.

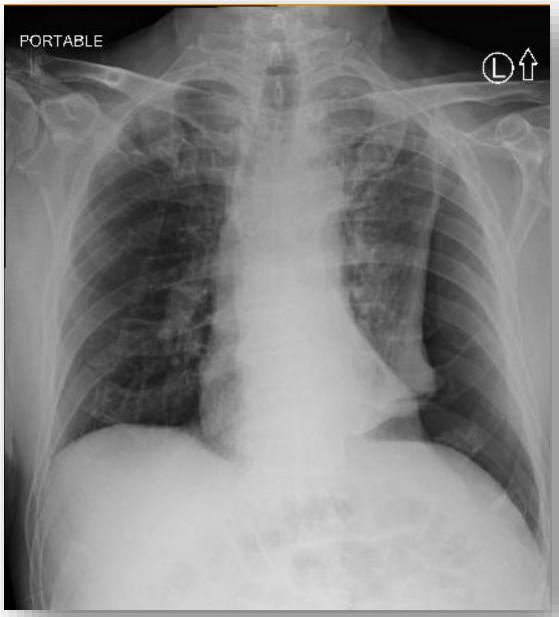
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

MPE – management guidelines



MPE management options	Trapped lung
Thoracentesis	✓
TPC	✓
Pleurodesis	
VATS	
Chest tube	
TPC	
Pleuroperitoneal shunt	✓
Decortication/pleurectomy	✓



Am J Respir Crit Care Med. 2018;(198):839–849.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE1 Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Doctors of Thoracic Surgery

TPC vs Talc in MPE management

Study	LOS		Hospital admissions (effusion related)		Additional procedures		Adverse events	
	TPC	TP	TPC	TP	TPC	TP	TPC	TP
TIME2 Davies 2012	0 IQR 0-1	4 IQR 2-6			6%	22%	40%	13%
Fysh et al CHEST 2012	3 IQR 2-8	10 IQR 8-26	2 IQR 1-3	2 IQR 1-4	14%	32%	19%	45%
AMPLE Thomas. 2017	10 IQR 3-17	12 IQR 7-21	1 IQR 1-4	4 IQR 3-6	4%	22%	30%	18%
Boshuizen 2017	0	5	1	1.5	15%	35%	19%	16%

Doctors of Thoracic Surgery

Advantages and disadvantages of most common MPE management options

	TPC	Pleurodesis
Symptom improvement	Yes	Yes
Pleurodesis success rate	Up to 40%	60-90%
Drainage duration	4 weeks - > 4 y	days
Infection risk	5-10%	< 1%
Ambulatory	Yes	No
Need for outpatient care	YES	NO

Factors to consider while offering definitive management of MPE

- Patient factors/wishes

- 86F with MPE and expandable lung, on chemo
  - Slow re-accumulation
  - Mild cognitive impairment
  - Wheelchair bound
  - Delirium with narcotics
  - **Option offered:** TPC

- 55F MPE, trapped lung
  - Large MPE
  - Weekly thoracentesis
  - Improvement of dyspnea with drainage
  - Issue: not comfortable with TPC AND with CCAC visits at home
- **Option offered:** continue with thoracentesis until ready to commit

Doctors of Thoracic Surgery®

Is ongoing support needed for patients managed with TPC?

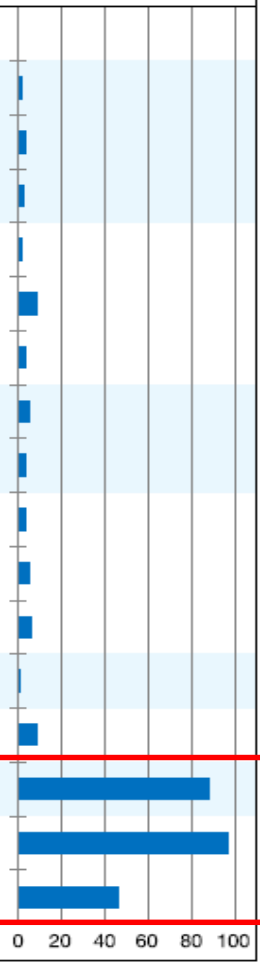
- Ongoing patient/family/oncology support
  - Catheter-related questions
  - Catheter-related complications
  - Is it time to remove the catheter?

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Ambulatory MPE management outcomes

Outcome	Number of Studies	Percent with Outcome: *Combined Results*	*Single Study Minimum*	*Single Study Maximum*
Bleeding	6	**0.4** (4/903)	0 (0/295)	0,9 (1/109)
Infection, unspecified	3	**2.0** (7/346)	1.7 (5/295)	5.9 (1/17)
Cellulitis	10	**3.4** (32/935)	1.3 (1/77)	25 (3/12)
Empyema	13	**2.8** (33/1168)	0 (0/12)	16,7 (2/12)
Dislocated catheter	7	**2.2** (14/648)	1.3 (3/240)	17.7 (3/17)
Malfunction of catheter	2	**9.1** (11/121)	0.0 (0/12)	10.1 (11/109)
Obstructed / clogged catheter	10	**3.7** (33/895)	0,9 (1/107)	17,6 (6/34)
Pain, unspecified	2	**5.6** (8/142)	2.0 (1/51)	7.7 (7/91)
Pain, beyond immediate post-procedure	5	**3.2** (18/558)	0.4 (1/240)	14.3 (4/28)
Pneumothorax, unspecified	5	**3.9** (17/439)	0 (0/27)	38,9 (7/18)
Pneumothorax, asymptomatic	3	**5.4** (9/168)	2,4 (3/125)	25 (3/12)
Pneumothorax requiring chest tube	1	**5.9** (3/51)	5.9 (3/51)	5.9 (3/51)
Tract metastasis	10	**0.8** (9/1093)	0 (0/107)	3.7 (1/27)
Catheter removed due to complication	8	**8.5** (54/633)	1.6 (1/63)	20,6 (7/34)
Without complication	10	**87.5** (517/591)	54,5 (6/11)	100 (55/55)
Symptomatic improvement	12	**95.6** (628/657)	86.2 (50/58)	100 (100/100)
Spontaneous pleurodesis	12	**45.6** (430/943)	11.8 (4/34)	76.4 (42/55)



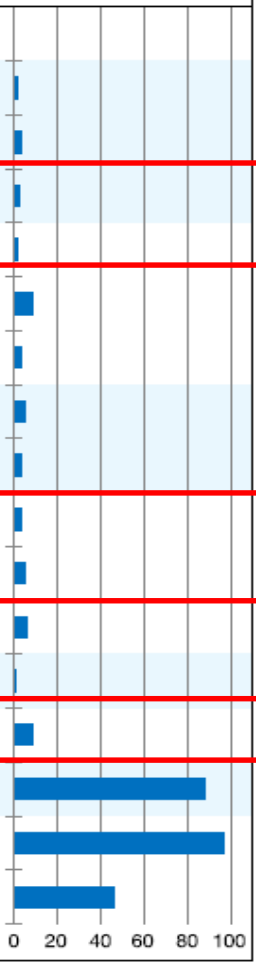
Meter et al. J Gen Int Med. 2011; 1: 70-6.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Ambulatory MPE management outcomes

Outcome	Number of Studies	Percent with Outcome: *Combined Results*	*Single Study Minimum*	*Single Study Maximum*
Bleeding	6	**0.4** (4/903)	0 (0/295)	0,9 (1/109)
Infection, unspecified	3	**2.0** (7/346)	1.7 (5/295)	5.9 (1/17)
Cellulitis	10	**3.4** (32/935)	1,3 (1/77)	25 (3/12)
Empyema	13	**2.8** (33/1168)	0 (0/12)	16,7 (2/12)
Dislocated catheter	7	**2.2** (14/648)	1.3 (3/240)	17.7 (3/17)
Malfunction of catheter	2	**9.1** (11/121)	0.0 (0/12)	10.1 (11/109)
Obstructed / clogged catheter	10	**3.7** (33/895)	0,9 (1/107)	17,6 (6/34)
Pain, unspecified	2	**5.6** (8/142)	2.0 (1/51)	7.7 (7/91)
Pain, beyond immediate post-procedure	5	**3.2** (18/558)	0.4 (1/240)	14.3 (4/28)
Pneumothorax, unspecified	5	**3.9** (17/439)	0 (0/27)	38,9 (7/18)
Pneumothorax, asymptomatic	3	**5.4** (9/168)	2,4 (3/125)	25 (3/12)
Pneumothorax requiring chest tube	1	**5.9** (3/51)	5.9 (3/51)	5.9 (3/51)
Tract metastasis	10	**0.8** (9/1093)	0 (0/107)	3.7 (1/27)
Catheter removed due to complication	8	**8.5** (54/633)	1,6 (1/63)	20,6 (7/34)
Without complication	10	**87.5** (517/591)	54,5 (6/11)	100 (55/55)
Symptomatic improvement	12	**95.6** (628/657)	86.2 (50/58)	100 (100/100)
Spontaneous pleurodesis	12	**45.6** (430/943)	11.8 (4/34)	76.4 (42/55)



Meter et al. J Gen Int Med. 2011; 1: 70-6.

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

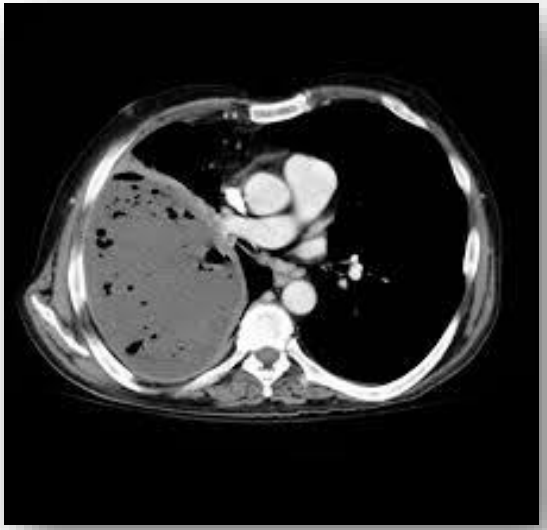
Patients managed with TPC need ongoing outpatient support

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

Patients managed with TPC need ongoing outpatient support

Tract metastasis



Empyema

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

Is ongoing support needed for patients managed with TPC?

- Ongoing patient/family/oncology support
  - Catheter-related questions
  - Catheter-related complications
  - Is it time to remove the catheter?

- Ongoing community nursing support
  - Diminishing comfort level of the nursing staff in managing indwelling devices

- Longer survival of patients with MPE (?more time at risk for complications/catheter-related issues)

Doctors of Thoracic Surgery®

Rapid Assessment of Complex Pleural Effusion (RACE) program

- **RACE Program introduced in 2012**
- **Goal:**
  - Prompt access to definitive management of MPE for the UHN patients
  - Improving QOL for patients with MPE
  - Reducing ER/ hospital/ambulatory visits related to MPE
  - Reducing health care costs related to MPE care
  - Clinical research for continued quality improvement in MPE care

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

RACE (Rapid Assessment of Complex Pleural Effusions) Program

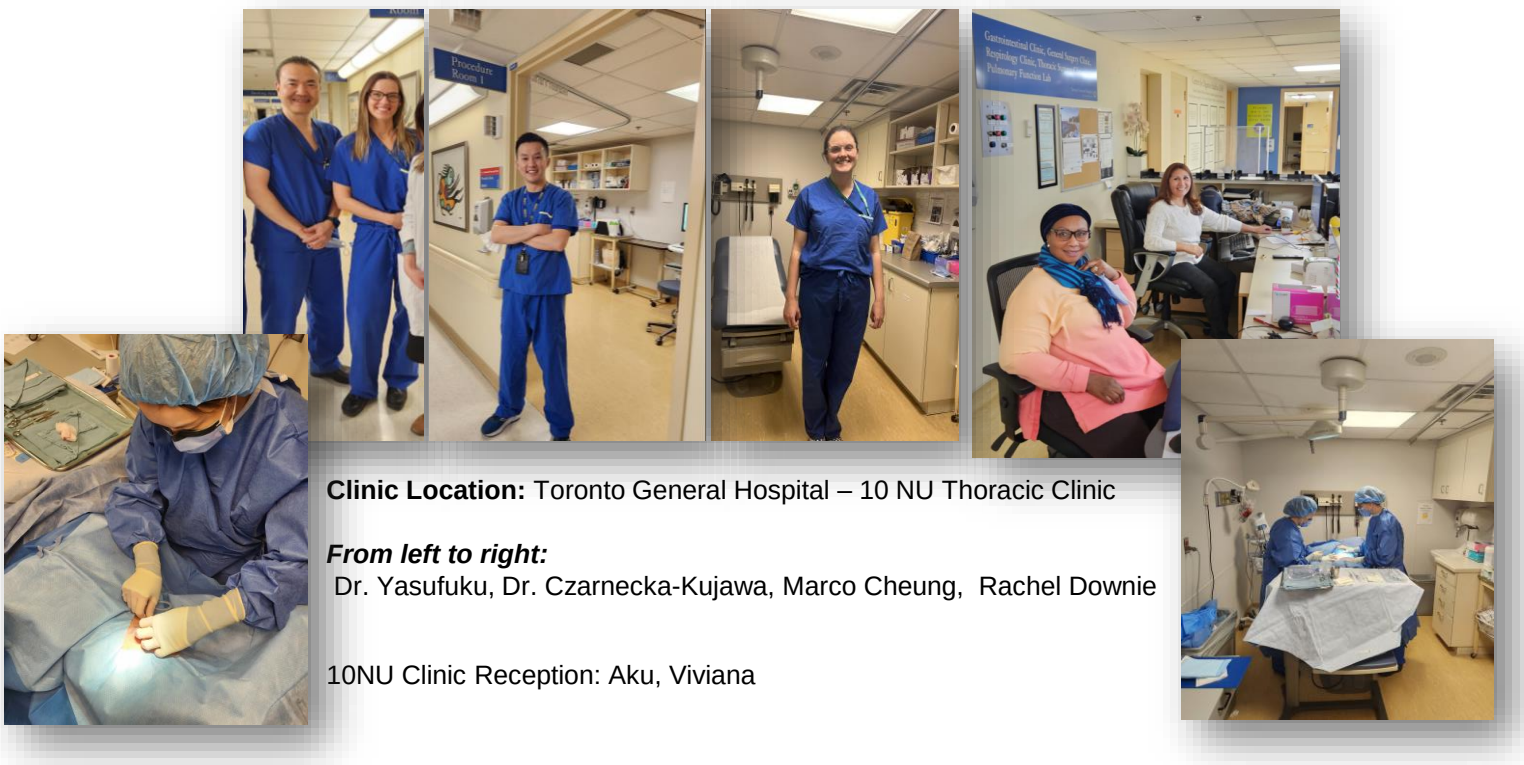
- The RACE program is a part of the Department of Thoracic Surgery
- We offer:
    - Prompt assessment of UHN MPE patients interested in definitive MPE management
    - Patent centered definitive MPE management
    - Long-term follow-up of MPE patients managed with TPC
    - Shift inpatient management of MPEs to an ambulatory setting

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

RACE (Rapid Assessment of Complex Pleural Effusions) Program

MEET OUR TEAM



Clinic Location: Toronto General Hospital – 10 NU Thoracic Clinic

From left to right:
Dr. Yasufuku, Dr. Czarnecka-Kujawa, Marco Cheung, Rachel Downie

10NU Clinic Reception: Aku, Viviana

Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery®

RACE (Rapid Assessment of Complex Pleural Effusions) Program

Services RACE at present does not provide:

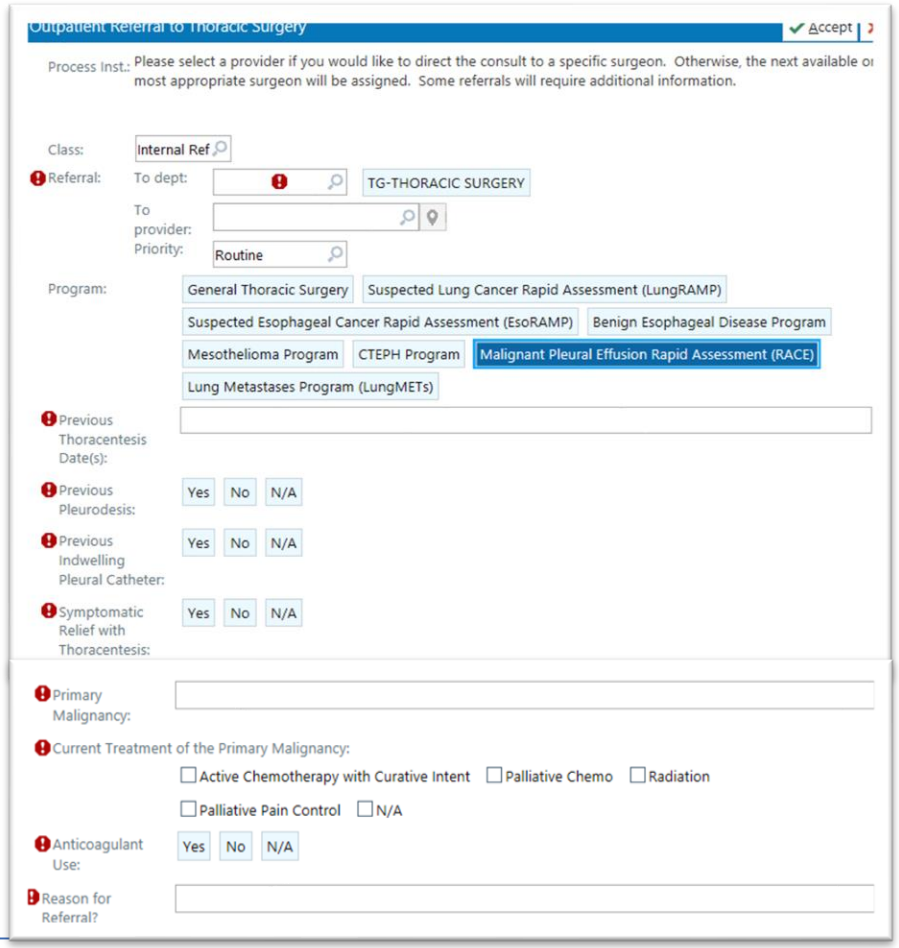
- Ongoing management of Non-Malignant Pleural Effusions
- Ongoing therapeutic thoracentesis for MPE patients not pursuing definitive management
- Support for indwelling devices inserted outside of the RACE program
- Replace services of ER/Urgent care for patients in acute distress

Doctors of Thoracic Surgery

RACE (Rapid Assessment of Complex Pleural Effusions) Program

Out-Patient RACE Referrals
via EPIC

- Go to *"Add Orders"*
- Type *"Outpatient Referral to Thoracic Surgery"* or "*REF13*"
- Select "*RACE program*" as subcategory
- Fill out requested patient information



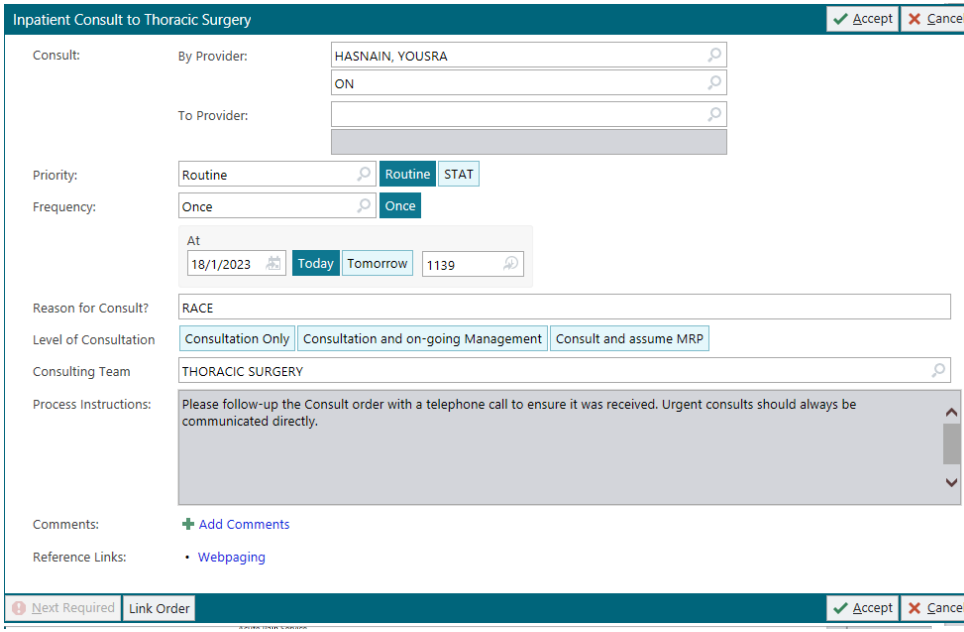
Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

RACE (Rapid Assessment of Complex Pleural Effusions) Program

In-Patient RACE Referrals
via EPIC

- Go to "*Inpatient Orders*"
- Type "*Inpatient Consult to Thoracic Surgery*" or type "*CON73*"
- In the free text for reason for referral, type in "*RACE consultation*"



Toronto General Hospital
University Health Network

Doctors of Thoracic Surgery

RACE Team
Division of Thoracic Surgery
Division of Respirology
Toronto General Hospital
University Health Network

Thank you

Toronto General Hospital
University Health Network