Pulmonary Thromboendarterectomy

The Definitive Treatment for CTEPH

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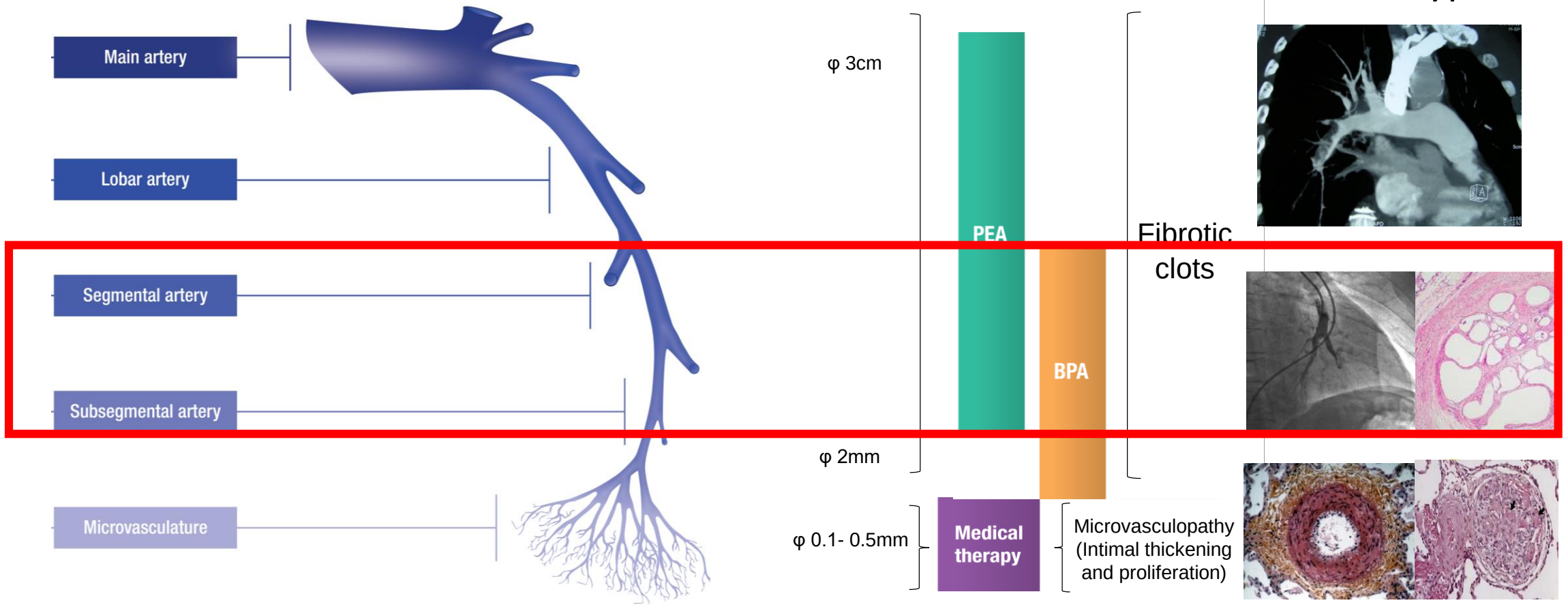
Disclosure

- I am a Cardiac Surgeon specialized in PTE/PEA

- Consultant
  - Bayer/MSD
  - Actelion / J&J
  - Wexler

- No conflict with this presentation

Site of action PTE/PEA, BPA and drugs



Madani et al, *Eur Respir Rev* 2017

Determination of Operability

- Extremely important as surgical therapy can be potentially curative
- Challenging
- Multifactorial
- Need to be careful about definitions
  - Technically Operability or “Resectability” vs Surgical Candidacy

- Requires an expert CTEPH team

My Bias….

- Recommended treatment of choice by every guideline
- Complete removal of all obstructive material
- Direct vision of the pulmonary vasculature
- Additional procedures if needed, ie PFO/ASD, Tricuspid valve, CABG, etc.
- Low rate of complications at expert centers
- Excellent long-term survival and outcomes
- One procedure and one hospital admission

….. there are PTE/PEA Challenges

- Operability and candidacy determination
- Complex operation
- Steep learning curve, specially for segmental and subsegmental disease
- Requires access to expert and experienced surgeons
- Requires buy-in from referring physicians and patients

- But there also has been some advances…

Recent Advances: Surgery

- More distal disease resection
  - Refinements in imaging, instruments and surgical techniques allow distal resection
- Higher risk patients
  - Severe PH
  - Severe RHF
  - Morbid Obesity
  - Elderly, PTE/PEA in octogenarians
- Better ability to address post-op compilations
  - Pulmonary Reperfusion Injury
  - Residual PH
  - Hemoptysis
- Minimally Invasive PTE/PEA – without sternotomy

Potential Red Flags:

- Limited distal disease and severe PH
- Parenchymal lung disease
- LV diastolic dysfunction
- Advanced Age
  - Acceptable outcomes in octogenarians
- Venous access catheters
- VA shunts
- Pacemaker leads
- Splenectomy
- Sickle Cell Anemia

None are contraindications

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Surgical Principles

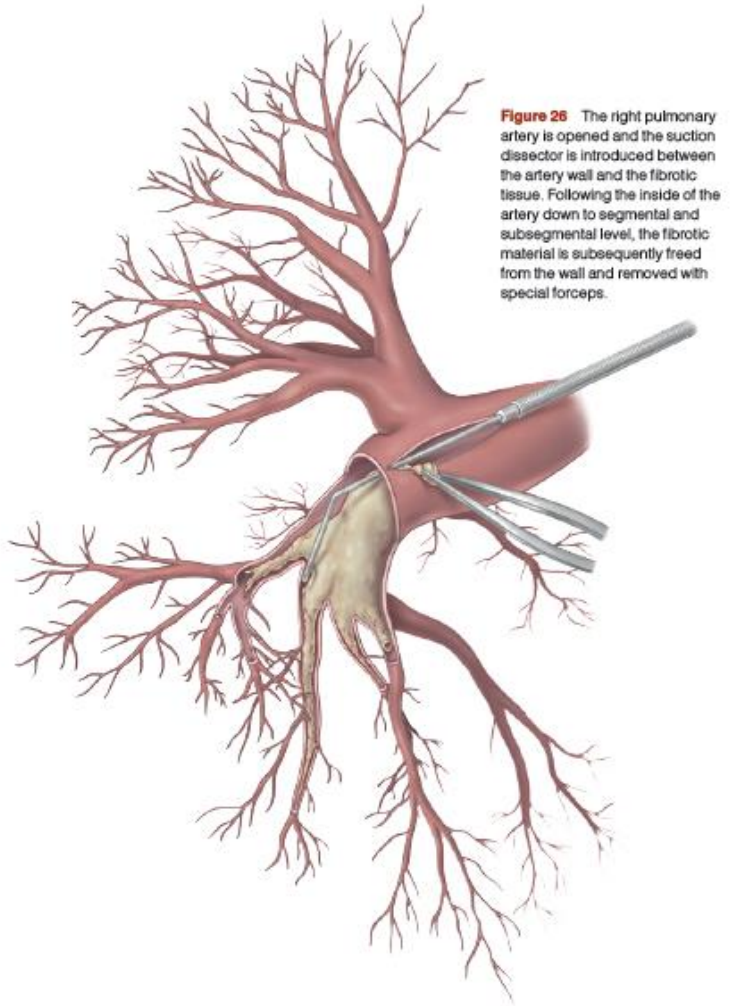
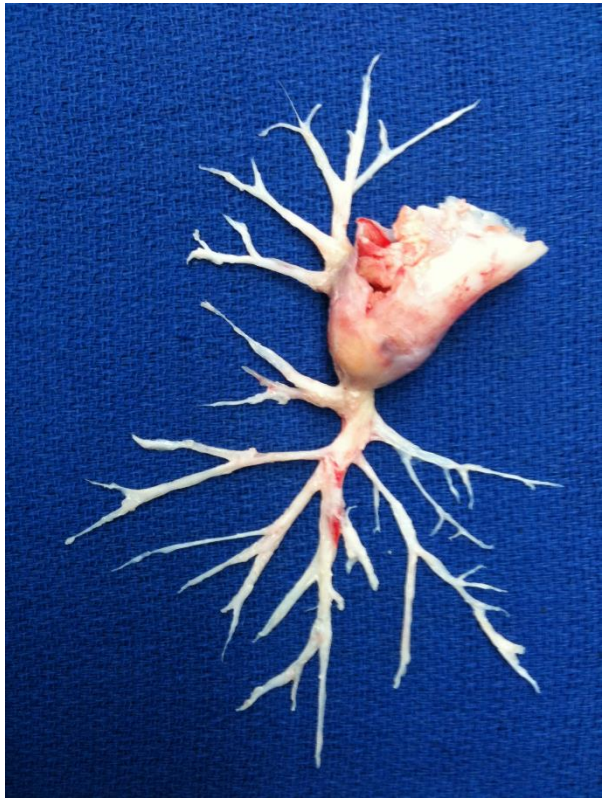


Illustration courtesy of Hotten, M. Thesis, Master Scientific Illustration, 2016.

- **Already well established[1,2]**
  - Median sternotomy
  - Cardiopulmonary bypass
  - Circulatory arrest
  - Bilateral endarterectomy
  - Identification of the plane
  - Complete endarterectomy



Madani et al. Op Tech in Tho & Card Surg 2006, 11:264-274

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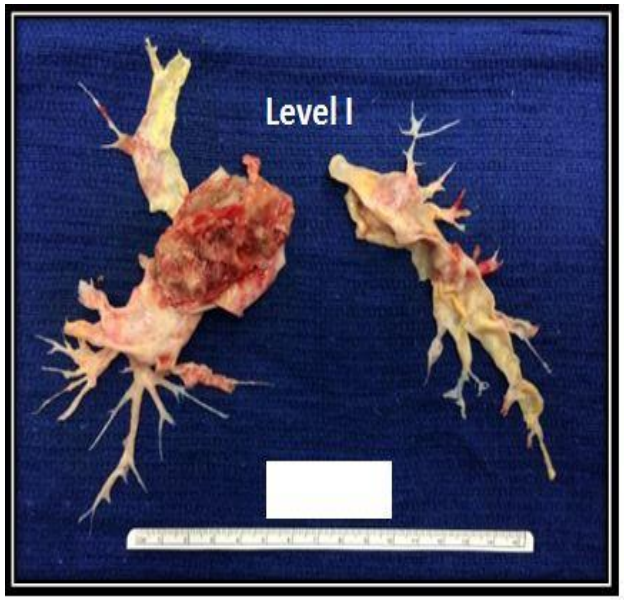
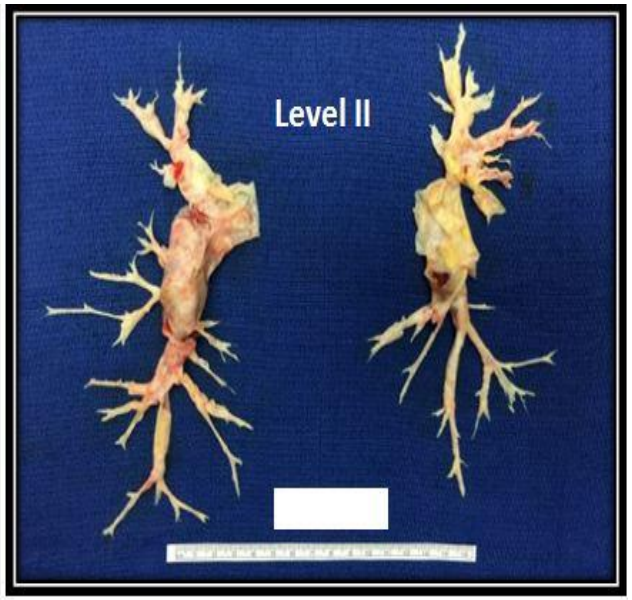
Who benefited from surgery?

PVR 1169 to 294





PVR 1290 to 204

PVR 858 to 365

PVR 527 to 188

UC San Diego Experience

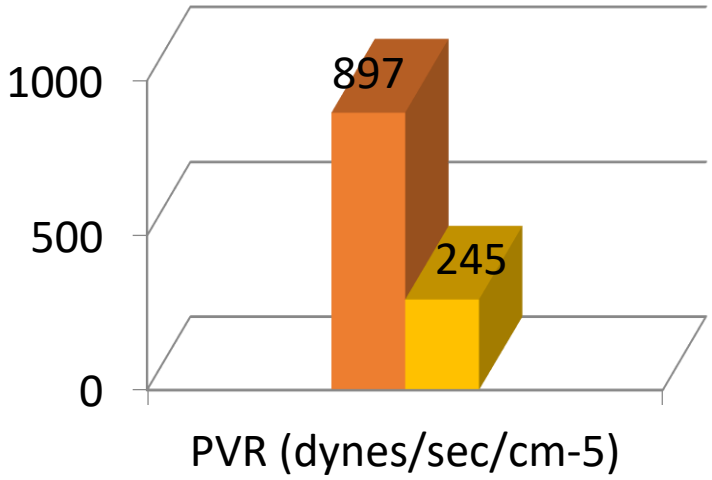
Total Number

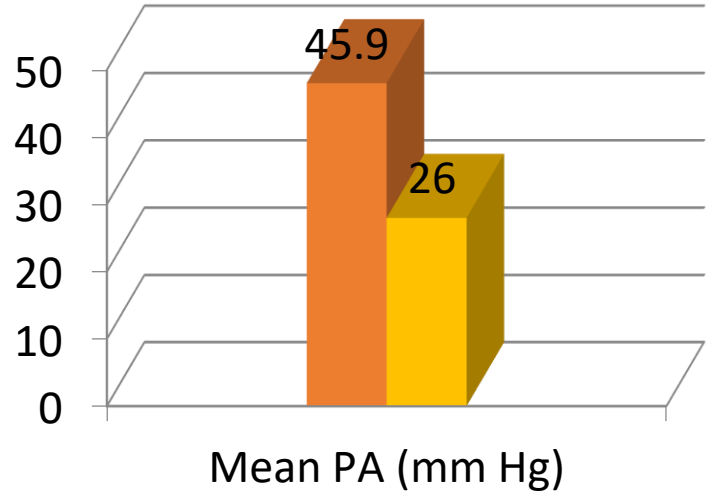
Close to 4000 (3938)

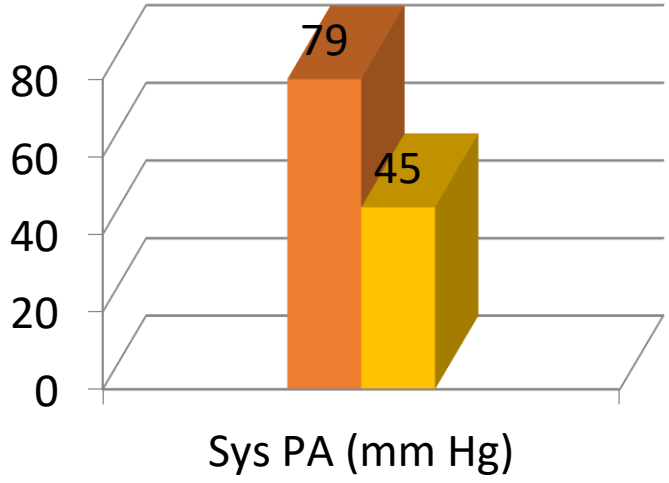
Mortality

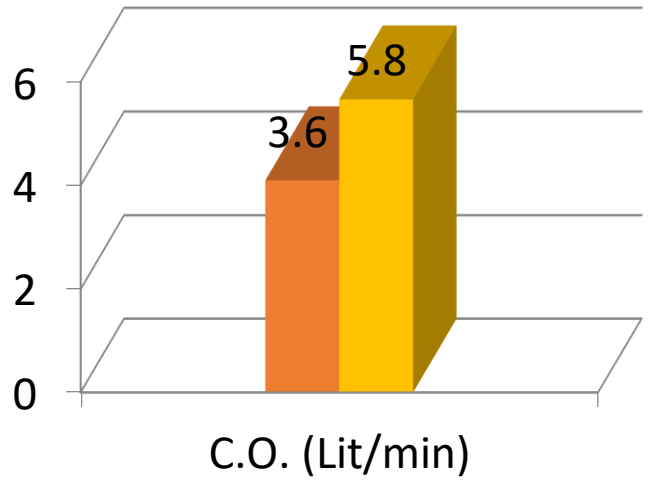
~ 2%

Pre & Post-op Hemodynamics





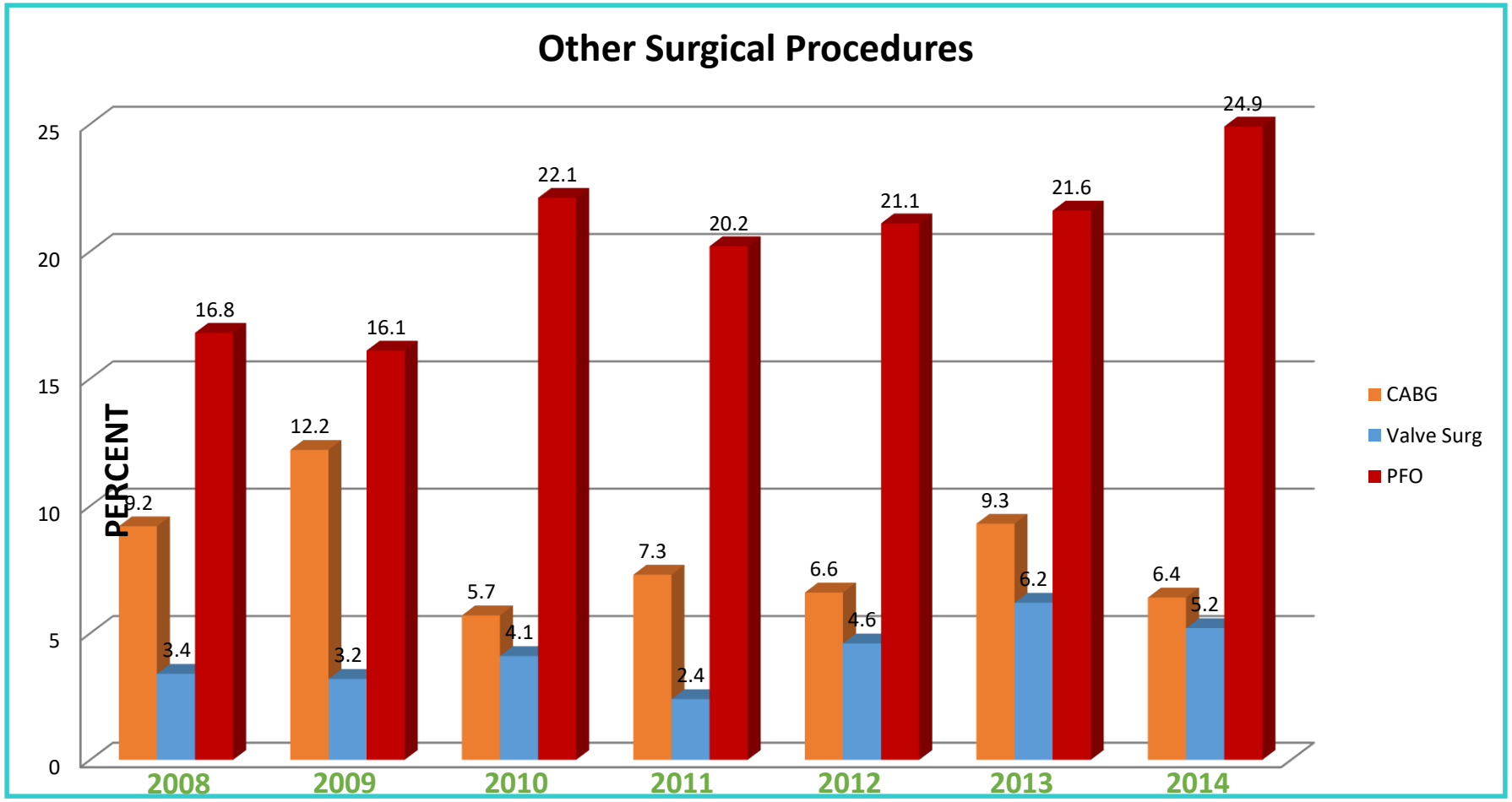




Pre-op

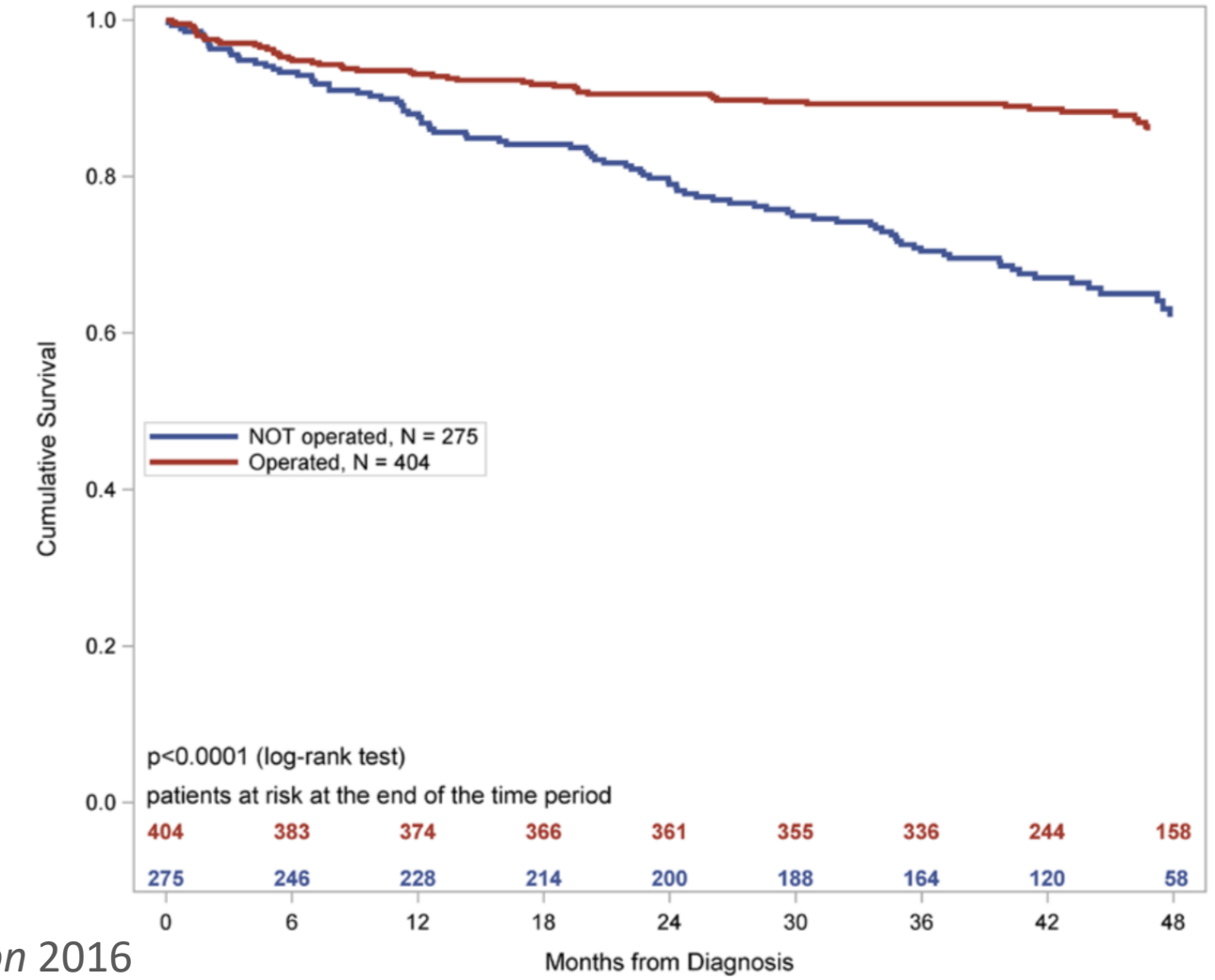
Post-op

Combined Procedures



Survival, 3-year, operated vs not operated

3-year Survival:
Operated = 89%
Not Operated = 70%



Delcroix M, et al. *Circulation* 2016

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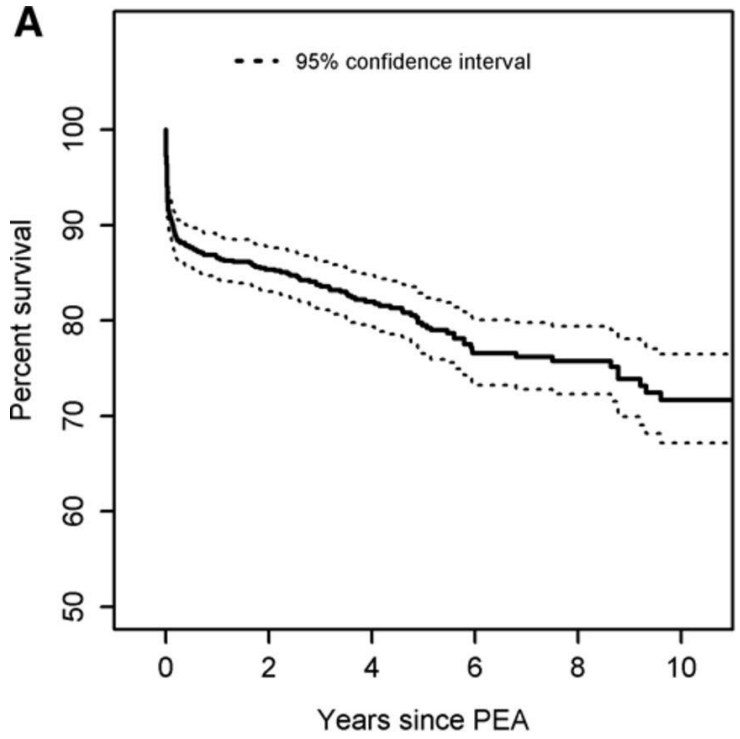
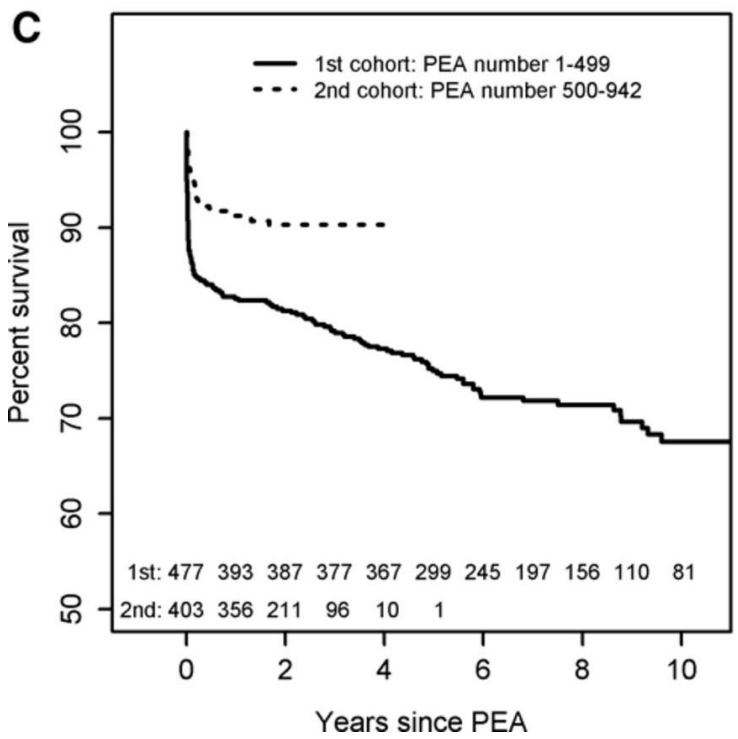
Survival, long term, by experience

10-year survival:
Operated = 72%





Canon et al. *Circulation* 2016

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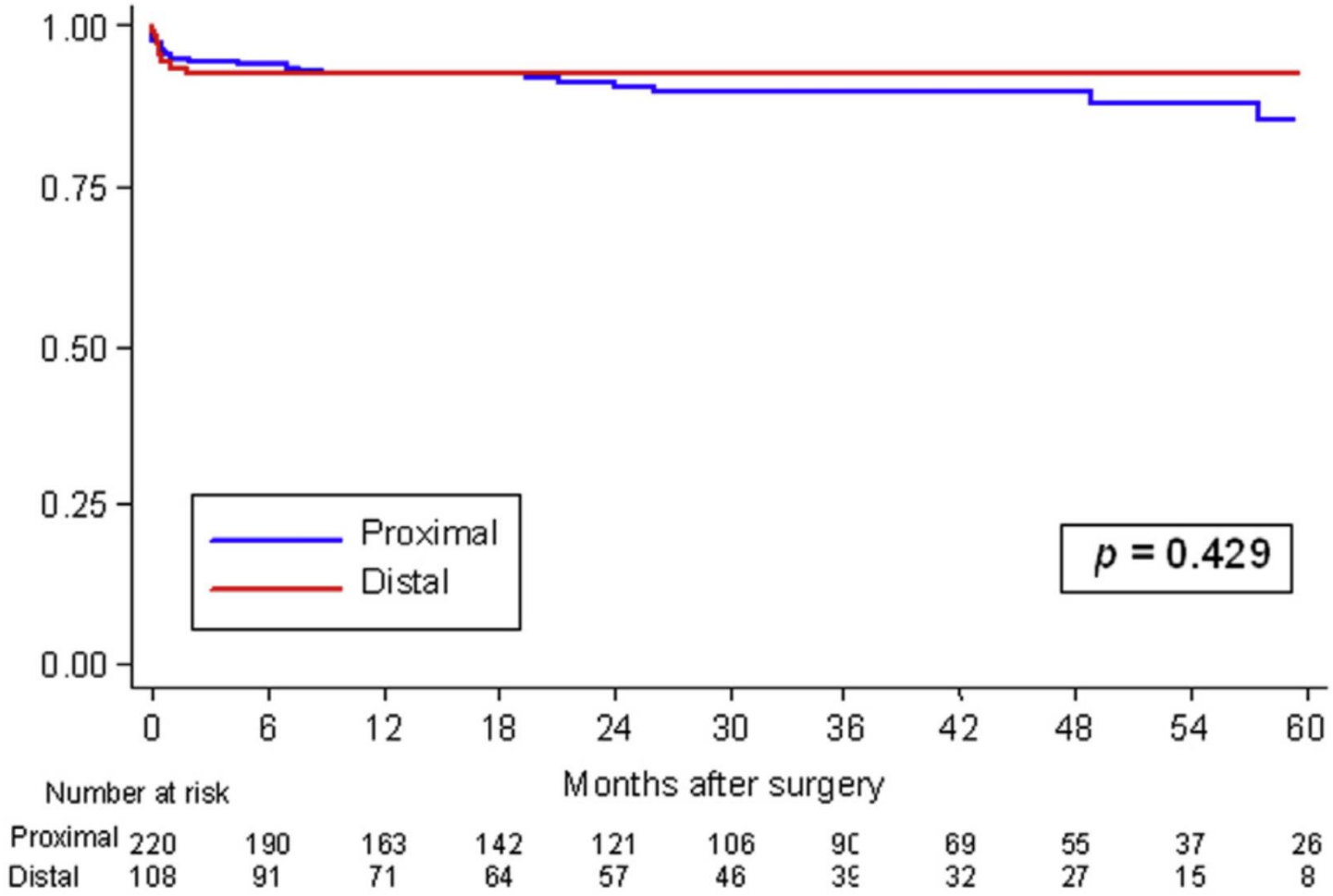
Survival, by technical difficulty ‘proximal’ vs ‘distal’ disease



D’Armini A, et al. *J Thorac Cardiovasc Surg* 2014

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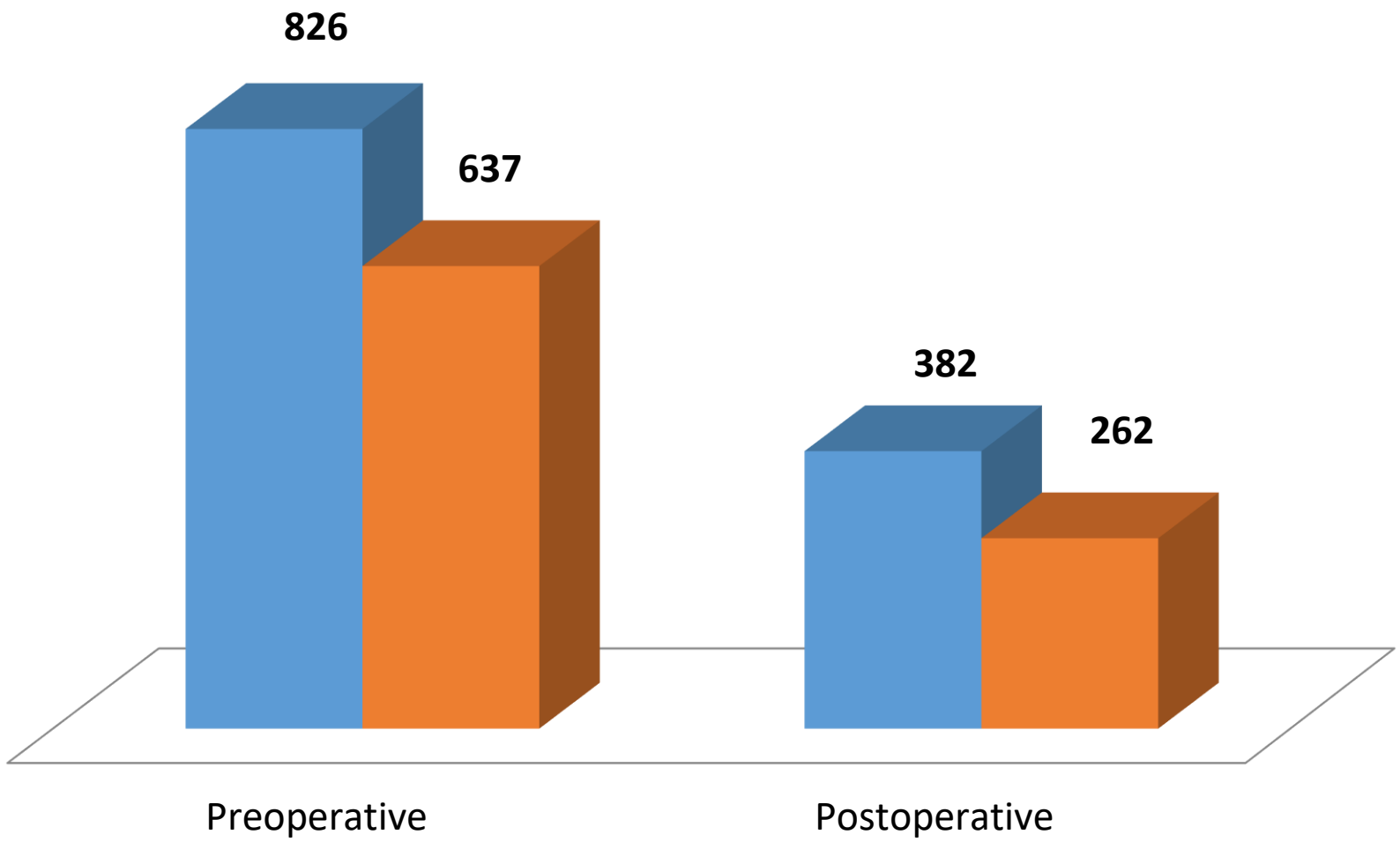
Distal PTE/PEA – UCSD Outcomes

- Data Analyzed for patients between Jan 2013 and Jan 2016
- 521 patients
  - 381 with Level I or Level II disease at least on one side (Proximal)
  - 105 with Level III at least on one side
  - 35 with bilateral Level IV disease only

Level III PTE/PEA – No main or lobar disease



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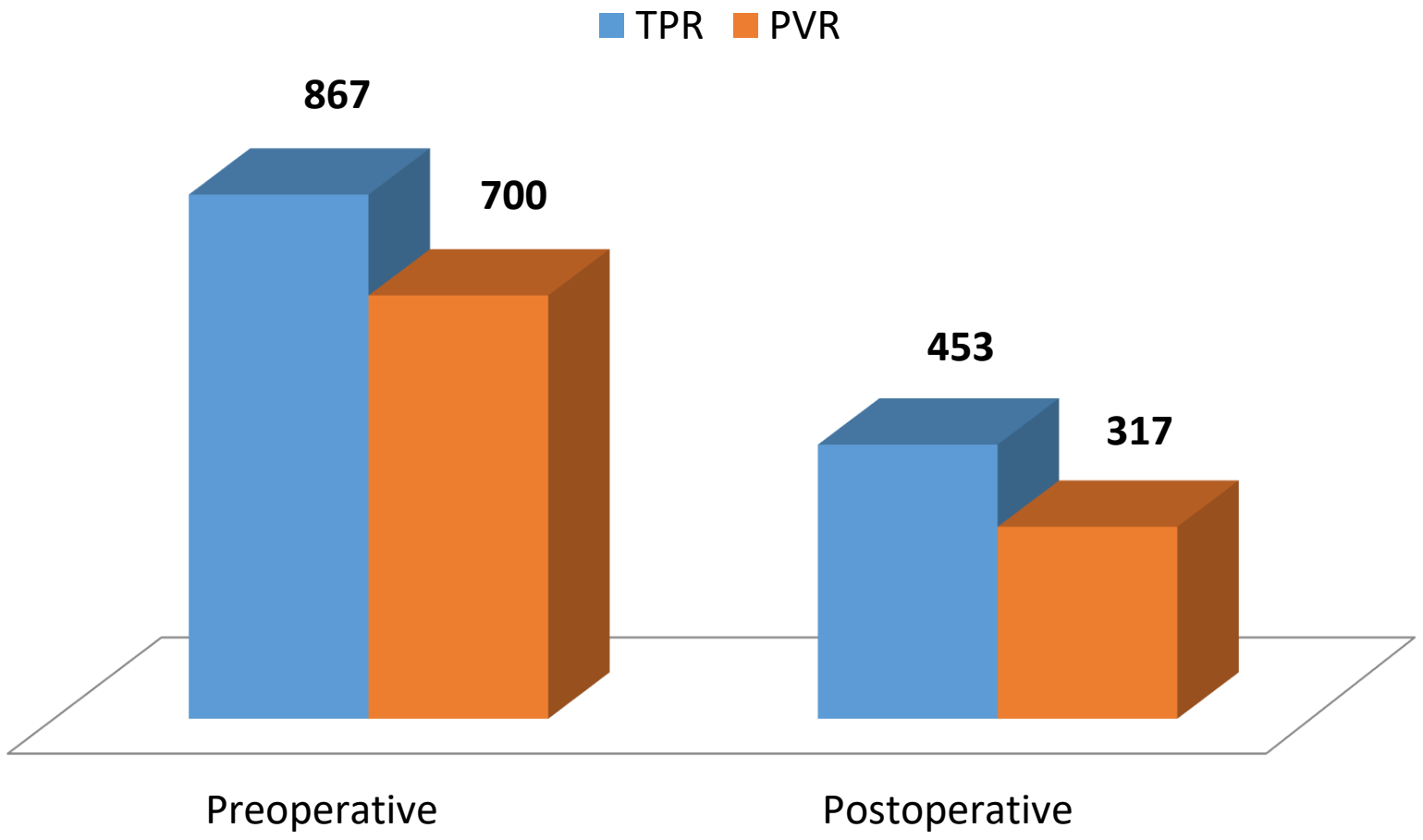
Level IV PTE/PEA – Only subsegmental disease



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Level III/Level IV Endarterectomy Results

- Each group exhibited improvements in pulmonary hemodynamics postoperatively with comparable mortality rates.
- A higher percentage of patients with Level IV disease showed residual pulmonary hypertension
- Patients with Level III or IV disease
  - were more often female
  - more frequently had a history of an indwelling intravenous device,
  - less often had a history of deep vein thrombosis or a hypercoagulable state.

Recent Case Presentation

- 80 yo frail, debilitated, and cardiac cachexia
- Multiple medical problems, but no history of DVT or PE
- Severe CTEPH with Class III/IV symptoms
- PAP 78/31 (52), PVR about 1300

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BIPLANE A LAO 20
Notes
Comments


BIPLANE A RAO
4 fps
Notes

MIS PTE Incisions and Specimen

Post-op Course

- Uncomplicated post-op course
- Extubated on POD2
- PAP 36/15 (23), PVR 359
- Initial anticipated weakness
- Aggressive PT/OT
- Ready for DC home on POD10
- D/C'd on POD14

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Conclusion

- PTE/PEA is the definitive and preferred choice for treatment of CTEPH
- In certain patients, PTE/PEA can be potentially curative
- As a general rule, subsegmental disease can be considered as the limit of surgical accessibility, and PTE/PEA should always be considered as the first option
- Disease accessibility can vary between surgeons and patients, and many factors contribute to the decision making, including a concordance of disease and severity of PH

Conclusion

- Determination of the best treatment approach needs a multidisciplinary evaluation by an expert CTEPH team
- Surgery, BPA, and/or Medical therapy should be thought of as complimentary, as opposed to independent and unrelated
- Ultimately, patients will have the most benefit from an unbiased multidisciplinary team of experts
- Key ingredient to success is an excellent and dedicated team