Pulmonary Angioplasty for Chronic Thromboembolic Pulmonary Hypertension

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DISCLOSURE

None
Chronic Thromboembolic Pulmonary HTN

- Pulmonary HTN that persists 6 months after PE
  - Occurs after 1-5% of PE

- Lifelong anticoagulation
  - Risk of recurrent PE and pulmonary thrombosis
Surgical endarterectomy – Class I AHA/ESC

- 20 - 50% are not surgical candidates
- 1.3 - 4.7% perioperative mortality
- 1/3 normalize hemodynamics

Photo: courtesy Dr. D Joyce, Mayo Clinic

Medical therapy

• Modest benefit
  • Inoperable patient - distal disease/comorbidities
  • Persistent PH after surgery

• Off label idiopathic PH drugs
  • Prostanoids
  • Endothelin receptor antagonists
  • Phosphodiesterase 5 inhibitors
Riociguat: FDA approved for CTEPH

- Stimulates soluble guanylate cyclase (sGC)-cyclic GMP pathway and sensitizes sGC binding to nitric oxide
  - *Increased 6-min walk by 39 m*
  - *Reduced PVR by 2.8 WU*
  - *Estimated annual cost $100,000*

2. Simonneau G. Eur Respir J. 2015 May;45(5):1293-302
Case 1: 27 Year Old Male Farmer

• Late 2013:
  • Dyspnea and cough
  • CT: PE - warfarin
  • Anticardiolipin antibody positive

• July 2014:
  • Class III
  • Echo – moderate RV dysfunction
  • RHC – mean PA 45 mmHg
VQ scan

Ventilation

Perfusion

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CTA – distal disease

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Pulmonary Artery Angioplasty

Baseline

After multiple procedures
Balloon Angioplasty for CTEPH (N=29 pts, 51 procedures)

NYHA

Mean PAP (mm Hg)

Baseline Follow-up

Baseline Follow-up

NYHA

Mean PAP (mm Hg)

Baseline Follow-up

P<0.01


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27 year old farmer
Outcome – December 2015

- 4 PTPAs over 7 months
- PA pressure - mean 30
  - 2.5 Wood units, CO 7.1
- Resolution of symptoms
  - Farming full time
Case 2: 42 year old female

- Dyspnea after initiating hormonal contraception
- No significant PMH
CT Chest done 3 mo after symptom onset
Initial Therapy

- Enoxaparin and Warfarin
- Negative thrombophilia evaluation

12 Months later

- Ongoing NYHA class III dyspnea
- Exercise RHC - mean PA pressure 45 mmHg
Follow-up CT
Right Lower Lobe Pulmonary Angiogram
Right Lower Lobe PTPA
Right Lower Lobe post-PTPA
2-month follow-up

**Baseline**
- Functional Class III
- Workload 6 mets
- Peak VO2
  - 15.4 mL/kg/ min

**After PTPA**
- Functional Class II
- Workload 8 mets
- Peak VO2
  - 20.1 mL/kg/ min
  - 65% of predicted
V/Q Scan

Perfusion Imaging

Ventilation Imaging
Left Lower Lobe Pulmonary Angiography
PTPA to Left Lower Lobe

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Case Outcome

- Functional class 1
- PVR - 0.97 WU after 2 procedures
- Mean PA pressure at rest – 18 mmHg
  - Peak exercise – 40 mmHg
Unresolved challenges: Total occlusions
Unresolved challenges: Extensive thrombus
Unresolved challenges: Small vessel occlusions
PTPA for inoperable CTEPH

• Decreased mPA by 12-21mmHg
  • Improved functional class

• Patient Selection
  • Symtomatic distal disease
  • Residual pHTN after surgical endarterectomy

• Vessel Selection
  • filling defects, intravascular webs, No CTOs
  • Treat only 2-3 vessels per procedure


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Potential PTPA Complications

• Reperfusion pulmonary edema (35-60%)
• Hemoptysis
• Vascular injuries
• Access site complications
• Death (1.5-10%)
Mayo experience (~25 patients, ~60 PTPA)

• Hemoptysis
  • 1 minor (blood tinged sputum)
  • 1 moderate (2 cups, on DAPT after PCI)

• Pulmonary edema
  • 1 minor SOB and dry cough
  • 1 minor - made severe by IV fluids in ER
    • Intubated for “ARDS”
  • Major ilio-psoas bleed 4 days later upon starting IV heparin
  • Unexplained sudden death 10 days after going home

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Mayo experience

- Majority get symptom relief
  - Improvement in mean PA pressure

- When does PTPA not work?
  - Dilated large vessels with very distal small vessel occlusions
  - Coexisting interstitial lung disease

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Perfusion SPECT/CTA Fusion

Yanagisawa R, Frantz R, Sandhu G  JACC Intervention 2017
Follow-up Imaging 6 Months after BPA

Pre PTPA

Post PTPA

Yanagisawa R, Frantz R, Sandhu G  JACC Intervention 2017
Summary

- PTPA is beneficial
  - distal emboli and inoperable patients
- Marked improvement in QOL in most patients
- Patient and lesion selection needs further study
Thank you!