Chronic Thromboembolic Pulmonary Hypertension

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Clinical Case

- 47 yo woman with history of DVT, pulmonary emboli and IVC filter.
- Subsequent to the pulmonary embolism the patient was anticoagulated.
- Initial work up revealed a heterozygote prothrombin mutation
- Initial echocardiogram revealed significant pulmonary arterial hypertension; RVSP=70 mm Hg.
- She underwent an attempt to treat with local tPA. L PA was occluded
- At three months of chronic anticoagulation the patient reported marked exertional shortness of breath and signs and sx of R sided heart failure
PAH Definition

- m PAP at rest >25
- PCW<15 mm Hd
- PVR>/=240 dn/cm5 (3 WU)
Definition of CTEP

CTEP is defined as a mean pulmonary arterial pressure greater than 25 mm of Hg that persists 6 months after pulmonary embolism is diagnosed.

Characterize for organized thrombotic occlusions of the PA with or without small-vessel vasculopathy.

PATHOGENESIS
Associated Conditions

- 10-20% have anticardiolipin antibody
- Elevated factor VIII
- Chronic inflammatory disorders
- Myeloproliferative disorders
- Splenectomy

Risk Factor for development of CTEP

- Large initial pulmonary emboli
- Idiopathic etiology
- Recurrent pulmonary emboli
- Intravenous catheter
- History of splenectomy
- Cancer
- Non blood O group, lupus anticoagulant, APLA, Factor VIII

Diagnosis

- Evaluate presence/absence of venous thromboembolism
  - Venous doppler
- Quantify pulmonary arterial pressures/right ventricular function
  - Echocardiography
  - Right heart catheterization
- Quantify vascular obstruction
  - VQ scan
  - Pulmonary angiogram/CT angiography
Differential Diagnosis of segmental abnormalities - V/Q scan

- Pulmonary capillary hemangiomatosis
- Fibrosing mediastinitis
- Pulmonary vasculitis
- Sarcomas of pulmonary arteries
Pulmonary Angiography Findings

- Pouch Defects
- Pulmonary arteries webs pr bands
- Intimal irregularities
- Abrupt narrowing of major pulmonary arteries
- Obstruction of lobar or segmental vessels at their origin

Right Heart Catheterization

- Right atrium = 15 mm Hg
- Right Ventricle = 110/20 mm Hg
- Pulmonary artery = 110/40 65 mm Hg
- PCW = 5 mm Hg
- CO = 2.38 l.p.m
- CI = 1.61
- PVR = 2016
CTEPH After a First Episode of PE

PROGNOSIS

CTEPH 5 year survival
- m PAP>50 mm Hg 10%
- Post TEA 89%

PULMONARY THROMBOENDARCTERECTOMY

- Surgery is the treatment of choice
- Early surgery preferred
- Need for life-long anticoagulation
Pulmonary Thromboembolectomy
Risk factor for increased mortality

- DLCO<60 TL,co% pred
- 6 min walk test less than 250 feet
- PVR greater than 100 dsc-5

Condliffe R. ERJ 2009

Pulmonary Vascular Resistance

- Preoperative

- Post operative
  - >500 dsc-5 = 10.3% mortality
  - <500 dsc-5 = 0.9% mortality

Madani MM. Ann Thorac Surg 2012
Thromboendarcterectomy Surgical Types

- Type 1: fresh thrombus in the main-lobar pulmonary arteries
- Type 2: intimal thickening and fibrosis prox to segmental arteries
- Type 3: disease within distal segmental arteries only
- Type 4: distal arteriolar vasculopathy w/out visible TE disease


Non-surgical Candidates: Treatment Options

- Medicine
  - Epoprostenol – prostacyclin infusion
  - Sildenafil – phosphodiesterase-5 inhibitor
  - Bosentan/Ambrisentan/Mazitentan – endothelin antagonist
  - Riociguat

- Balloon angioplasty
  - Has been done successfully
  - Still considered experimental

- Lung transplant
  - For people with advanced small vessel disease without comorbidities that preclude surgery
Riociguat

- Stimulate soluble guanylate cyclase (sGC) which serves as a receptor for nitric oxide (NO). NO-sGC catalyses synthesis of cGMP
- Indicated for CTEP after surgical treatment or inoperable to improve FC and exercise capacity
- Indicated for patient with FC II-III
- Requires dose titration
- Possible teratogenic

Unresolved Issues

- Residual pulmonary hypertension after surgery (11-35%)
  - Early (<3 months)
  - Late (>3 months)
- Medical treatment prior to surgery
Summary

- CTEP is a rare condition
- Diagnosis requires a good index of suspicion
- Evaluation and management requires a specialized center
- Surgery is the treatment of choice
- Medical treatment may be indicated post surgery and in inoperable patients