

Pulmonary Hypertension Perioperative Management

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Introduction

Definition of Pulmonary Hypertension

- Increased Mean Pulmonary Arterial Pressure
 - mPAP > 25mmHg at Rest
 - Normal: 14 (11-17) mmHg
 - mPAP > 30 mmHg
 - Dropped from Definition
 - Found in Many Normal Patients

McLaughlin et al., Circulation 2009; 119:2250
Kovace et al., Eur Respir J 2009; 34:888

Introduction (cont.)

Types of Pulmonary Hypertension

- Pulmonary Arterial Hypertension
- With Left-Sided Heart Disease
- With Lung Disease/Hypoxemia
- Due to Chronic Thrombosis/Emboli
- Miscellaneous
 - Sarcoidosis, Histiocytosis X, Lymphangiomatosis, Compression of Pulmonary Vessels (Adenopathy, Tumor, Fibrosing Mediastinitis)

Pulmonary Arterial Hypertension

Etiology

- Idiopathic
- Familial
- Associated with Diseases/Conditions
 - Collagen Vascular Disease, Congenital Shunts, Portal Hypertension, HIV, Drugs/Toxins, Miscellany
- Venous or Capillary Disease
- Persistent PAH of the Newborn

Pulmonary Arterial Hypertension (cont.)

Lung Diseases

- COPD
- Interstitial Lung Disease
- Sleep-Disordered Breathing/Obstructive Sleep Apnea
- Alveolar Hypoventilation
- Long-Term Exposure to High Altitude
- Developmental Abnormalities

Natural History

- Median Life Expectancy
 - 2.8 years
- Prevention
- Screening of High Risk Patients
 - Family History
 - Congenital Heart Disease
 - Connective Tissue Disease
 - Symptoms of PAH

Pulmonary Hypertension

Therapeutic Options

- Reversal of Hypoxemia
- Management of Left Heart Failure
- Vasodilators
 - Calcium Channel Blockers
 - Prostacyclin Analogues
 - Endothelin Receptor Antagonists
 - PDE-V Inhibitors

Pulmonary Hypertension (cont.)

Therapeutic Options

- Calcium Channel Blockers
 - Nifedipine, Diltiazem, Amlodipine
 - Minimally Effective in Treating PAH
- Prostacyclin Analogues
 - Epoprostenol (Intravenous)
 - Treprostinil (Oral and Intravenous)
 - Iloprost (Inhaled)
- Endothelin Receptor Antagonists
 - Bosentan (Oral)
- PDE-V Inhibitors
 - Sildenafil

Perioperative Risk

- Marked Increase in Risk
 - 29% Complication Rate
 - 4/28 Mortality
 - Mild to Moderate Pulmonary Hypertension
- Emergency Procedures, Major Surgery, Long Operative Times Increase Risk

PAH Perioperative Management

Assessing Risk

- Contraindication to Liver Transplantation
- Thoracic Surgery
 - Changes in Lung Volume, Intrathoracic Pressure, Oxygenation
 - Acute Changes in PVR and RV Function
- Laparoscopy
 - Decrease Preload, Increased Afterload
- Rapid Intraoperative Blood Loss
- Peripartum
 - Therapy Decreases Mortality (38% to 25%)

Ross Curr Opin Anesthesiol 2010; 23:25
Pedoto Curr Opin Anesthesiol 2010; 22:44
Bedard Eur Heart J 2009; 30:256

Pulmonary Hypertension (cont.)

Effect on Outcomes

- 145 Patients
 - Retrospective Analysis
 - Non-Cardiac Surgery
 - General Anesthetic
- 42% Short-Term Morbid Events
 - Respiratory Failure (28%)
 - Cardiac Dysrhythmia (12%)
 - Congestive Heart Failure (11%)
- 7% (n=10) Death Within 30 d
 - Respiratory Failure (60%), RV Failure (50%)

Pulmonary Hypertension (cont.)

Effect on Outcomes

- Thoracic Surgical Patients
 - 61.5% Morbidity
- Orthopedic Surgical Patients
 - 48% Morbidity
- Gynecologic/Urologic/Plastic/Breast Surgical Patients
 - 16.7% Morbidity

Pulmonary Hypertension (cont.)

Effect on Outcomes

- 173 Patients; 96 PAH, 77 Control
- Non-Cardiac Surgery
- PAH Significant Risk for
 - Congestive Heart Failure
 - Sepsis
 - Respiratory Failure

Pulmonary Hypertension (cont.)

Effect on Outcomes

- RVSP/SBP Ratio
 - >0.66 Associated with Short-Term Morbidity
- CHF Most Frequent Post-Operative Event
- Patients More Likely to Require Post-Operative ICU Care
- Patients More Likely Readmitted to Hospital Within 30 d

Pulmonary Hypertension (cont.)

Preoperative Assessment

- Evaluation of Symptoms
 - Functional Capacity
- ECG, Chest Radiograph, Echocardiogram
- Arterial Blood Gas

Pulmonary Hypertension (cont.)

Preoperative Assessment

- Evaluation for RV Dysfunction
 - Right Heart Catheterization
 - Re-Evaluation of Surgery
- Aggressive Intervention
 - COPD Patients
 - Supplemental Oxygen
 - Bronchodilators
 - Antibiotics
 - Steroids
 - Cardiac (LV Dysfunction) Patients
 - Inotropes
 - Vasodilators

Perioperative Management

Anesthetic Technique

- Maintain Preload and SVR
 - Maximize Cardiac Function
 - Maximize Right Heart Perfusion
 - Systolic to RV Systolic Gradient
- Prevent Increases in PVR
 - Hypoxia, Hypercarbia, Acidosis, Agitation, Pain, Hypothermia
- Aggressive Treatment of Hypotension
 - Vasoconstrictors
 - Inotropic Support
- Modulation of PVR in RV Failure
 - Inhaled Prostaglandins (Iloprost)

Perioperative Management (cont.)

Anesthetic Monitoring

- Intermediate to High Risk Procedures
 - Thoracotomy/Thoracoscopy
 - Prolonged Laparoscopy
 - Open Intra-Abdominal Procedures
- Invasive Monitoring
 - Pulmonary Artery Catheter
 - Transesophageal Echocardiography
- Intensive Therapy
 - Inhaled Iloprost
 - Inhaled Nitric Oxide
 - Intravenous Prostacyclin
 - Inotropic Therapy to Maintain RV Perfusion/Cardiac Function