

#### Anesthesia in the Electrophysiology Lab NICHOLAS WARREN, MSN CRNA

## Outline

- Patient Population Considerations
- Offsite Challenges of the Electrophysiology Lab
- Core Concepts in Electrophysiology Procedures
- Percutaneous Cardiac Ablations
  - AV Node Ablation
  - Atrial Fibrillation
  - Atrial Flutter
  - Ventricular Tachycardia
  - Supraventricular Tachycardia
- Watchmen Procedures
- Left Heart Catheterizations

#### **Cardiovascular Risks** EP and Cath Lab Patient Population

- CHF
- CAD and Acute Coronary
  Syndrome
- METs
- Arrhythmias
- Cardiomyopathy
- Valvular heart disease
- Pacemakers and AICDs

Class I	No limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation or dyspnoea.
Class II	Slight limitation of physical activity. Comfortable at rest but ordinary physical activity results in fatigue, palpitation or dyspnoea.
Class III	Marked limitation of physical activity. Comfortable at rest but less than ordinary activity results in fatigue, palpitation or dyspnoea.
Class IV	Unable to carry out any physical activity without discomfort. Symptoms at rest. If any physical activity is undertaken, discomfort is increased.

NYHA: New York Heart Association.

# Patient Population in Cardiac Cath and EP Lab Comorbidities

- Morbid Obesity
- OSA
- COPD
- Pulmonary HTN
- Older Adult Population
- Anti-coagulation Therapy

- Hepatic and Renal Insufficiency
- Anticipated Hemodynamic Instability
- Recovery from Anesthesia
  Planning



### General Concerns for Anesthesia

#### Offsite Challenges

- Remote from Main OR
- ► Limited Equipment → More Planning
- Location of Anesthesia Equipment
- Anesthesia Machine
- Access to patient
- Imaging Equipment Interference
- Familiar Anesthesia Team



# Radiation Safety and Radiocontrast Media

- Minimize Exposure
  - Distance, Time, Barriers
- Allergy to Contrast Dye
  - Corticosteroids
  - ▶ H1 and H2 Blocker
- Nephrotoxicity in IV Contrast Dye
  - Assess Renal Function
  - Limit Dose
  - Hydration

Position shield in Keep detector close Collimate. between to patient. and operator.

Movable lead skirt.

Disposable shielding.

patient

Radiation safety cap

Radiation safety glasses (with side panels).

skirt Lead and vest with thyroid collar.

# Medications Used within the Cath and EP Lab

#### Isoproterenol

- Tachycardia
- Hypotension
- Dobutamine
- ► Heparin
  - Left Heart Catheterization
  - ▶ Goal ACT > 250-300 seconds



# Additional Considerations Of Anesthetic Technique

- Patient Expectations
  - MAC vs General
- ► TEE
- Invasive vs Noninvasive Hemodynamic Monitoring
- Muscle Relaxants
- Peri-procedure e Hemodynamic Monitoring
- Apneic Pauses
  - Breath Holding
  - Apnea vs Jet Ventilation
- Emergence from GETA



## Components of Electrophysiology Ablation Procedures

- Vascular Access
  - Left Sided
- Arrhythmia Localization
- Structural Mapping
- Ablation
- Testing
- Pulling Lines



#### General Concerns for Electrophysiology Studies and Procedures

- Catheter Saline Infusion
- Thermal Injury Risk
  - Limit time (<30sec) and Intensity (25-35W)
- Remote Magnetic Catheter Navigation System
- Intra-catheter Echo
- Comorbid Patient Population



## Pharmacologic Implications Anesthetic Agents in EP

- Opioids
- Hypnotics: Propofol, Midazolam
- Ketamine Pro-Arrhythmogenic
  - Increase Reproducibility of Arrhythmia
- Volatile Anesthetics
  - QT Prolongation
  - Sevo <u>Reduces</u> SA conduction & Atrial HIS interval
- Dexmedetomidine induces bradycardia and delay SA and AV node conduction
- Local Anesthetics Lidocaine



#### Pharmacologic Implications for EP procedures

- Caution with Medications Acting on SNS
- Vasopressor and Inotropic
  Support
- Avoid high dose antimuscarinics
  - Glycopyrrolate:
    - M2 Receptor SA and AV Node Conduction
    - M3 Receptor Salivary Glands



# AV Nodal Ablation and Cardiac Resynchronization Therapy (CRT)

- Indications:
  - Refractory Atrial Fibrillation
- Pacemaker Placed prior to Ablation
- Structural Ablation
- Indication
- Ablation into Junctional Rhythm

- CRT
- Indications:
  - ▶ LVEF < 35%
  - ▶ QRS > 120ms
  - Left Bundle Branch Block
  - Sinus Rhythm
  - NYHA Class III or IV Symptoms
- Considerations
  - Sicker Patients
  - Longer Procedure duration – Coronary Sinus
  - Larger Device



#### Venous and Transseptal Puncture (TSP) Procedures

- Venous Access Femoral
- Echocardiograph Guidance
  - ► TEE vs ICE
- Continuous Hemodynamic Monitoring
- Major Complications: 1-2%
  - Cardiac Perforation & Tamponade
  - Thrombus Formation
  - ► Air Embolism
  - Septal Defect Creation
- Contra-indicated
  - Absolute IAS Thrombus
  - Relative



### Atrial Fibrillation Ablation

- Transesophageal Echocardiogram
- Left Sided Procedure Transeptal
- Continuous Hemodynamic BP Monitoring
- Cautery vs Cryo Ablation Technique
- Emergence and Post Operative Management
- High Frequency Jet Ventilation\*



Chowdhury P, Lewis WR, Schweikert RA, Cummings JE. Ablation of atrial fibrillation: what can we tell our patients? Cleve Clin J Med 2009; 76(9)543-550. doi:10.3949/ccjm.76a.08091



### Atrial Fibrillation Ablation

#### Radiofrequency Ablation (RFA)

- Heats Myocardial Tissue
  - Thermal Injury (esophagus)
- Pulmonary Artery Near Esophagus
  - ► Esophageal Temp. Probe  $\rightarrow$  GETA
- Saline flush @2ml/min
  - Cools Myocardium

#### Cryoablation

- Freezing myocardial tissue
- Risks
  - Hypothermia
  - Pulmonary Vein Stenosis
  - Phrenic Nerve Stimulation
    Avoid NDMR



## Atrial Flutter Ablation

- Shorter\* Length Ablation
- Dexmedetomidine Controversial
  - Reduced Reproducibility of Arrhythmia
  - Reduced incidence of Airway Obstruction and improve outcomes
- Ketamine pro-arrhythmic

- Pain/Discomfort
- Can be Right or Left Sided
  - Right Sided Typical AFL
  - Left Sided Atypical AFL



## Ventricular Tachycardia Ablation

#### Causes:

- Fibrotic Tissue and scare related ischemia
- Structural Heart Disease
- Hypertrophic Cardiomyopathy
- Valvular Heart Disease
- Sarcoidosis
- Idiopathic Conduction Anomalies
- Long QT Syndrome
- Brugada Syndrome
- Advanced Comorbid Population

MAC vs GETA

- Arrhythmia Inducibility
- Consider duration and complexity of the procedure
- Monomorphic vs Polymorphic
- Stable vs Unstable
- Continuous Hemodynamic Monitoring
- Phrenic Nerve Mapping
- Pain and Discomfort

#### SVT ABLATIONS Common SVT Variants

A: Typical AV-Nodal Reentrant Tachycardia

B: Typical AV Reciprocating Tachycardia

C: Atrial Tachycardia

D: Normal Sinus Rhythm

Wolf Parkinson White (Not Shown)



## Reentrant Tachyarrhythmia Ablations

#### MAC Sedation

- Ketamine may be preferable hypnotic agent
- Avoid Dexmedetomidine
- Shorter Procedure
- AVNRT Ablating into:
  - Junctional
  - Idioventricular
  - Paced\*

#### Wolf Parkinson White

- Verapamil & Adenosine ineffective
- Avoid Digoxin and Calcium Channel Blockers in this Patient Population
  - Enhance Accessory Pathway Conduction
  - Ventricular Fibrillation
- Beta Blockade for rate control
- Comorbid with AVNRT

## Left Atrial Appendage Closure: Watchmen's Device

- 90% of AF-related CVA result from embolisms of the Left Atrial Appendage
- Indications:
  - ► AF unresponsive to Rhythm Control Medication
  - Not Tolerating Anticoagulation
- Continuous Arterial Monitoring
- ► TEE Guidance → Sedation vs GETA
- Complications as any TSP
  - Plus Risk of Device Thrombus







**Images of Boston Scientific** 



#### Left Sided Heart Catheterization & Percutaneous Left Ventricular Assist Devices

- Sedation Often provided by Cardiologist & RN
- Critical Illness, Left Main Disease, Impending CV Collapse
- Minimal Sedation
- Hemodynamic Support
- Percutaneous Coronary Artherectomy
- Ventricular Support
  - Intra-Aortic Balloon Pump
  - Impella
  - TandemHeart
  - Reitan

### Arterial Cannulation

#### **Femoral Artery**

- Easily accessed Larger Artery
- Allows for larger sheath
- Easier access if pt. has extensive PAD
- Complications:
  - Bleeding,
  - Hematoma
  - Retroperitoneal Bleed
  - Pseudoaneurysm
  - No Collateral Circulation

#### **Radial Artery**

- Cannulation Cocktail
  - ▶ Heparin 3,000units
  - NGT 200mg
  - Verapamil 2.5mg
- Faster Recovery
- TR Band
- Lower Risk of Morbidity & Mortality
- Collateral Circulation

