



## Offsite Anesthesia for Cardiac Procedures From EP to the Cath Lab

Dan Beck, M.D., M.S.  
Assistant Professor  
University of Colorado  
VA Eastern Colorado Health Care

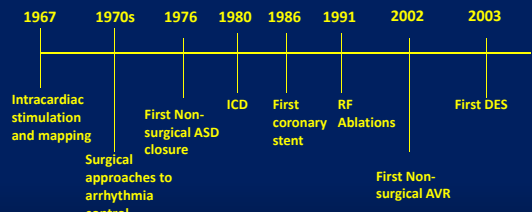
## Objectives

- Understand history and future role procedures
- Overview of procedures
- Understand challenges in cardiac lab
- Identify our role in cardiac interventions
- Discuss anesthetic risks related to EP/Cath
- Case Discussions and Complications

## What do they do up there?

<p><b>Cath Lab</b></p> <ul style="list-style-type: none"> <li>• Diagnostic Cath</li> <li>• STEMI</li> <li>• PCI</li> <li>• Peripheral angio – stents</li> <li>• IABP</li> <li>• Percutaneous Assist Device</li> <li>• PFO/ASD closure</li> <li>• Perc Valve – TAVI, Mitraclip</li> <li>• LAA occlusion</li> </ul>	<p><b>EP LAB</b></p> <ul style="list-style-type: none"> <li>• EP studies – mapping</li> <li>• Atrial and Ventricular ablation</li> <li>• Pacemakers, ICD, BiV</li> <li>• Generator Change</li> <li>• Cardioversion</li> <li>• Lead Extraction</li> </ul>
---	--

## History



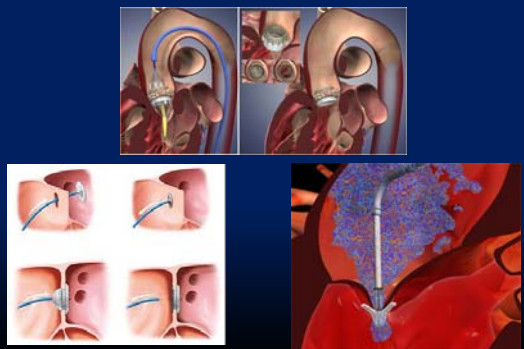
Timeline of cardiac procedures:

- 1967: Intracardiac stimulation and mapping
- 1970s: Surgical approaches to arrhythmia control
- 1976: First Non-surgical ASD closure
- 1980: ICD
- 1986: First coronary stent
- 1991: RF Ablations
- 2002: First Non-surgical AVR
- 2003: First DES

## Future Trends

- Over 5 million people have heart failure
- Expected to grow 5 fold in 20 years
- Increasing numbers using implanted devices
- CRT devices reduce hospitalization 50%
- Medical Care extending lifespan
- 25% increase in EP procedures last 10 yrs
- You will treat these patients somewhere

## Technological advances



Illustrations showing various cardiac procedures and anatomical views.

## New Technology

### Advanced Technology

- More Complex Procedures
- Often longer procedures
- New procedures = unknown complications

### Too Sick for Surgery?

- Lower Risk in Cath lab???
- High risk for sedation!!!

## Welcome to the Cath Lab



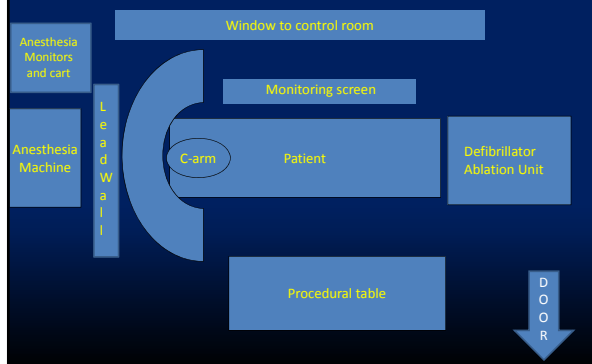
## Unique Environment

- Physical Limitations
- Cultural and political obstacles
- OR pressures and Cath lab pressures
- Communication between staff
- Fluoro - Mobile and unique imaging
  - ICE, IVUS, FFR

## Physical Environment

- Set up for convenience of the proceduralist
- Limited Space
- Moving Equipment
- Poor access to Patient
- Remote Location
  - Transport to OR can be time consuming
  - Help can be very far away
  - Typical resources not available

## Room Layout



## Practice models 2010s

- ~2/3 of centers use a mix of anesthesia providers (team MD or CRNA model) and RN sedation
- 1/3 exclusively anesthesia or RN sedation
- ¼ responded anesthesia was warranted >50% of time regardless of availability
- Frequent reasons for RN sedation alone
  - Unavailability of anesthesia services
  - Difficulty in scheduling
  - Prolonged OR turnover times

## Cultural differences vs the OR

- Cardiologist is a medical director
  - Used to working with RN, techs who take orders
  - Not used to working with another MD
- May not know full skill set of anesthesiologist
  - May think sedation is our only role in their procedure
- Roles and responsibilities of care unclear
  - Hemodynamics, oxygenation, patient position
- Lack of communication leads to conflict and poor overall patient care

## Cultural Obstacles

- Rationale for requesting anesthesia presence
  - High risk patient
  - High risk procedure
- May assume our presence allows them to do everything exactly as they normally would
  - Location - OR vs lab vs hybrid OR
  - Appropriate Anesthetic - sedation vs controlled airway
  - Drug of choice (“Just give some propofol”)
- Not experts in high risk patient anesthesia
  - You are, that’s why they consulted you!

## Recognize the Home Team’s Skill

- Cardiovascular knowledge
- Internal medicine background
- Procedural ability
  - Vascular access, echo, temp pacing wires, IABP
- Lab ancillary staff
  - ABGs, mixing gtts, getting supplies
  - Navigating the foreign environment
  - Calling for help

## OR pressure vs Cath/EP lab needs

- Surgeons have block time, elective needs are fixed on a week to week basis
- Offsite locations create staffing challenges
  - Running 1 room all day remote offsite
  - 1-4 rooms in OR
  - Varies based on hospital layout
- Cath/EP lab are high volume, fast turnover
  - More daytime unscheduled cases
  - Unpredictable needs for anesthesia

## Who are these patients?

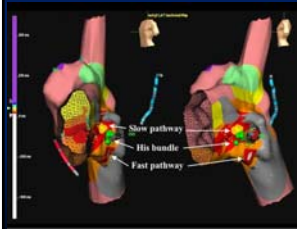
- CAD and arrhythmia
- Dementia
- PTSD
- CVA
- Obesity; OSA; difficult airway
- Obstructive and restrictive lung disease
- Low EF with accompanying sequelae
- Renal Insufficiency
- Hepatic Insufficiency
- Diabetes and other metabolic syndromes

## What the patients and proceduralists bring to the table?

- Histories and comorbidities
- Uncommon medications
  - Unique to EP patients
- Interventionalists are “surgeons of medicine”
  - Narrow focus, may not be aware of all history
  - Urgent or emergent procedures may prevent thorough H&P

## Unique Procedures

### Electrophysiology Studies



- Mapping studies using stimulation and response
- Multiple catheters in heart
- Induced and spontaneous arrhythmias
- Isolate arrhythmia circuit
- Endocardial - venous access
- Epicardial - pericardial sheath

## Electrophysiology studies

- Pre-procedural workups
  - H&P, TTE, Right/left heart cath
  - Anti-coagulation status
- Monitors –Standard ASA monitors
  - Defibrillator pads
  - Radiolucent 12 lead ECG
- Supine position on fluoro table with C-arm
- Intra-procedural anesthetic needs
  - MAC vs GETA

## Intra-procedural approach

- Pre-procedural TTE or TEE
- Access via groin
  - Venous only for right sided procedures
  - Trans-septal puncture for Left sided procedures
    - Anticoagulation, ACT, protamine reversal
  - Intraprocedural imaging
    - Fluro, ICE, TEE guided
- Mapping may take hours
  - Isolating arrhythmia focus or pathways

## EP mapping studies

- Catheter placement
  - High right atrium
  - RV apex
  - Adjacent to His bundle – tricuspid annulus
  - Coronary sinus catheters
- Allows pacing-recording ability to map and detect abnormal conduction pathways
- Catecholamine infusions to help incite arrhythmia
- Confirms diagnosis prior to intervention

## Anesthetic Drugs

- Commonly assumed anesthetic drugs influence cardiac conduction and myocardial refractoriness
  - Inhalational, IV agents, NMB, opioids, and anticholinergics may all have effects
- Volatile anesthetics
  - Isoflurane/Sevoflurane
    - AV nodal conduction unchanged, His-purkinje slowed
- Rocuronium most free of CV side effects
- Opioids can have vagolytic effects
- Propofol may alter HR in either direction
- All agents may lower SVR and cause reflex tachycardia

## RF Ablation

- Localized burn similar to electrocautery
- Power and length of burn determines depth
- Catheter size, irrigated and cooled catheters
  - Irrigated catheters add volume to circulation
- Risks: steam pops, clotting, deep burns
  - Monitor patient for 20-30 minutes during waiting period
- Post RF study – try to stimulate arrhythmia or test timing of pathway

## ICD or PPM

- Vascular access
  - Usually Left subclavian
- Pocket formation under LA
- Wire placement
  - Can be lengthy – searching for ideal place
  - Wire burrowed/screwed into myocardium
- ICD Device Testing - Cardioversion
  - R on T induced VF
  - Device defibrillates ..... hopefully

## EP Challenges

- Prolonged procedure
  - 4+ hours of MAC with little stimulation
  - Initial studies may request no sedation
- PPM or ICD placement may request no NMB
  - Detect phrenic nerve stimulation from pacing

## Common Complications

- Vascular access issues
- Unstable arrhythmias
- Complete heart block requiring PPM
- Cardiac perforation and tamponade
- Left side procedures
  - Pulmonary vein stenosis
  - Atrio-esophageal fistulas
  - stroke

## Lead Extractions

- ICD or PPM lead removal
  - Endocarditis
  - Lead failure/multiple lead replacements
- Traction removal vs laser or mechanical extraction
  - Adhesions to great veins
  - Intramyocardial adhesions
  - Myocardial injury-perforation

## Lead Extraction Preparedness

- Pre-procedural
  - IV access
  - Arterial line
  - Blood bank
- Systems based planning
  - Surgical backup
  - Perfusionist backup
  - OR availability

## Procedure and Disposition

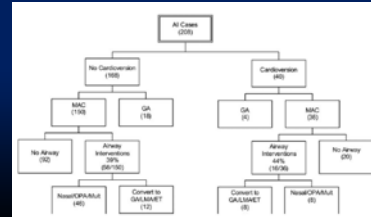
- GETA
- TEE guidance
  - Anesthesia or cardiology
  - Lead position pre-extraction
  - Presence of effusions
- ICU Monitoring
- Post-op TTE if concerns
  - Pericardial effusions

## Clear Communication is Key

- Discuss with the proceduralist
  - What exactly is he going to be doing?
  - Length of procedure
  - Points of potential instability
    - Plan for those events
  - Patient specific risk factors
  - Do we need/have surgical backup?
- Ongoing communication
  - Listen via headset and communicate often

## Airway Emergencies

- ~40% of cases require airway adjuncts or interventions
- Physical access to airway limited



Trentman, TL, JCAVA 2009.

## Case Discussion

- 68 yo M with SVT resulting in syncope, fall with facial fractures repaired in OR, jaw wired shut presents for EP mapping and ablation
  - MAC with remifentanyl and propofol
- IV kink results in drug delivery backup
- Kink discovered and adjusted- patient received bolus of both agents
- Apnea ensued

## Case continued

- Anesthesia team (CRNA/MD) unable to mask ventilate
- Wire cutters not immediately available
- Call for help
- Emergency cricothyrotomy to establish definitive airway

## Too Sick for Surgery?

- New or unfamiliar procedures
- Need for unusual approaches and equipment
- Unanticipated course of procedure
- Excellent communication is obligatory

## Anesthetic Plan

- Proceduralist doesn't dictate your anesthetic
  - Understand physiologic needs of the procedure
- Assess your patient's medical needs and ability to tolerate the procedures
- Tailor your plan to your environment
  - Access to airway mid procedure
  - Availability of surgical and OR backup
  - Communicate, communicate, communicate

## Equipment

- If you even think about needing it, bring it
- Consider airway adjuvants
  - Multiple blades, video laryngoscope, FOB
- Special drugs, gtts, pumps, tubing
- Ultrasounds, TEE, central lines
- Plan for space limitations
- Understand what equipment your offsite location has – it is a cardiology suite

## Anesthesia Personnel safety

- Moving equipment
  - Pay attention, keep your eyes open
- Radiation safety
  - Lead aprons, lead shield, eye protection
  - Radiation dosimeter
  - Radiation scatter and inverse square law
  - Time, barriers, and distance

## Summary

- Understand the procedures, risks, pitfalls
- Communication and planning are key
- Clearly delineate patient care roles
- Understand your environment and plan for it
- Use your anesthetic knowledge to create the proper plan for your patient
- Be ready for everything