Dysrhythmias, Defibrillators, Pacemakers & Anesthesia

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Dysrhythmias, Defibrillators, Pacemakers and Anesthesia

- Background
- Surgical Procedures
- Anesthetic Considerations
- Anesthetic Care of Patients with Defibrillators and Pacemakers
Dysrhythmias, Defibrillators, Pacemakers and Anesthesia

Background

- Cardiology vs Cardiac Surgery
  - You find them - we treat them
- Cardiology or Cardiac Surgery
  - You treat them or we treat them
- Cardiology and Cardiac Surgery
  - You find them — we both treat them
Procedures

- Atrial fibrillation ablation and left atrial appendage excision during cardiac surgery
- Surgical ablation with left atrial appendage excision
- Epicardial lead placement for defibrillator or biventricular pacing
- Watchman device for left atrial appendage occlusion
Surgical treatment of atrial fibrillation
- Maze Procedure
- Modified Maze or Cox-Maze Procedure
  - Radio-frequency/Cryo Ablation
- Selective mapping and ablation of autonomic ganglia
- Left atrial appendage excision
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- Exmaze Procedure

From: www.exmaze.com
Anesthetic Considerations

- Patients are at risk for dysrhythmias and ischemia and often have pre-existing heart failure
- Inhalational agents confer a level of ischemic protection
- One lung ventilation is necessary for primary ablation and lead placement
- Atrial/Ventricular injury with catastrophic hemorrhage is possible
- Arterial catheter is useful for rhythm, rate and pressure
Cryo-ablation Unit
Cryoablation
Radio-Frequency Generator
Radio Frequency Ablation
Stapler for Left Atrial Appendage Excision
Watchman Device

- Requires a CHADS score of 1
  - CHF, HTN, Age>75 yrs, Diabetes, Stroke
Electrical Perspective

- 1 mA = perceptible current
- 5 mA = harmless current
- 20 mA = “Let go” current
- 100-300 mA = Ventricular fibrillation
- 6000 mA = sustained ventricular contraction, respiratory paralysis
Electrical Perspective

- Microshock
  - 100 micro amps  Ventricular fibrillation
  - 10 micro Amps is the maximum for 60 cycle interference

- 60 cycle frequency ie household current is within frequency range most likely to cause fibrillation but most suitable for electrical transmission
Pacemakers
What to do???

- For pacemakers, determine if pacer dependent if so use magnet to convert to asynchronous mode
- Limit bovie to short bursts (3-5 sec)
- Avoid excessive arm/shoulder extension on the side of the device
- Surgery of the head and neck on that side have special considerations
- Selectively place current return pad
Pacemakers

- Avoid hyperventilation and hypokalemia as potassium shifts theoretically may alter thresholds

- For bradycardia
  - Stop using electrocautery
  - Use pharmacology ie ephedrine followed by epinephrine
  - Use transcutaneous pacing
Intra-operative Management of Pacemakers

- Magnets may change pacemakers into an asynchronous mode.
- All defibrillators have pacemakers but magnets only disable the defibrillator.
- Pacemaker function can only be modified by interrogation when accompanying by a defibrillator.
Defibrillators & Electricity 101

- Physics
  - $1 \text{ amp} = 1 \text{ coulomb/sec}$
  - $1 \text{ coulomb} = 1 \text{ Joule/volt}$
  - $1 \text{ Joule} = 1 \text{ watt sec}$
  - $1 \text{ ws/v} = 1 \text{C} = 1\text{amp sec}$
  - $1 \text{ volt} = 1 \text{ amp} \times 1 \text{ ohm}$  \text{ Ohms law}
Defibrillators Background

- 1899- small shocks caused fibrillation and large shocks reversed fibrillation
- 1947 Beck: transformed 120 volts to 300-1000 volts ac but myocardial damage occurred
Defibrillator Background

- 1950’s paddles delivered 300 volts of ac current
- Eskin and Klimov use 1000 volts externally
- 1959 - Lown used ac current to charge capacitors to 1000 volts to deliver a damped sinusoidal wave of 100-200 joules of 5 ms duration via paddles
1980’s – A biphasic truncated wave (BTE) was shown to be equally or more efficacious.

Biphasic waves alternate the direction of impulses every 10 ms (get you coming or going).

Shock success 90% compared to 60% for monophasic defibrillation; use 200 vs 300 j energy, 20-30 j for internal paddles.

Units are smaller and more compact, leading to AED and implantable defibrillators.
Defibrillator silhouettes
Caring for Patients with Defibrillators

- Identify, if possible, the model of defibrillator from patient card, call company or view chest x-ray
- Consider relative risk for unwanted discharge based on type of surgery
- Use magnet if indicated
- Reprogramming requires an order from a cardiologist
Caring for Patients with Defibrillators

- Insure external defibrillator/pacer available
- Remove magnet for intra-operative tachy-dysrhythmias or fibrillation
- Write note “Magnet used and removed per manufacturers instructions”
- Interrogate device only if intra-operative issue occurs
Defibrillator Function

- Defibrillators detect 60 cycle interference and bovie interference,
- They charge, re-assess the “dysrhythmia” then discharge (which takes 6 or more seconds)
- The algorithm increases sensitivity following detection of abnormal electrical activity
- Consequently bovie activity of less than 6 seconds will not allow for a discharge of the unit
Defibrillators

- A defibrillator is like a dog
  - Beware until you know it lest it bite you
  - Once you know it, it is your best friend

- MIMO – **M**AGNET **I**T AND **M**OVE **O**N