# Perioperative CIED Management

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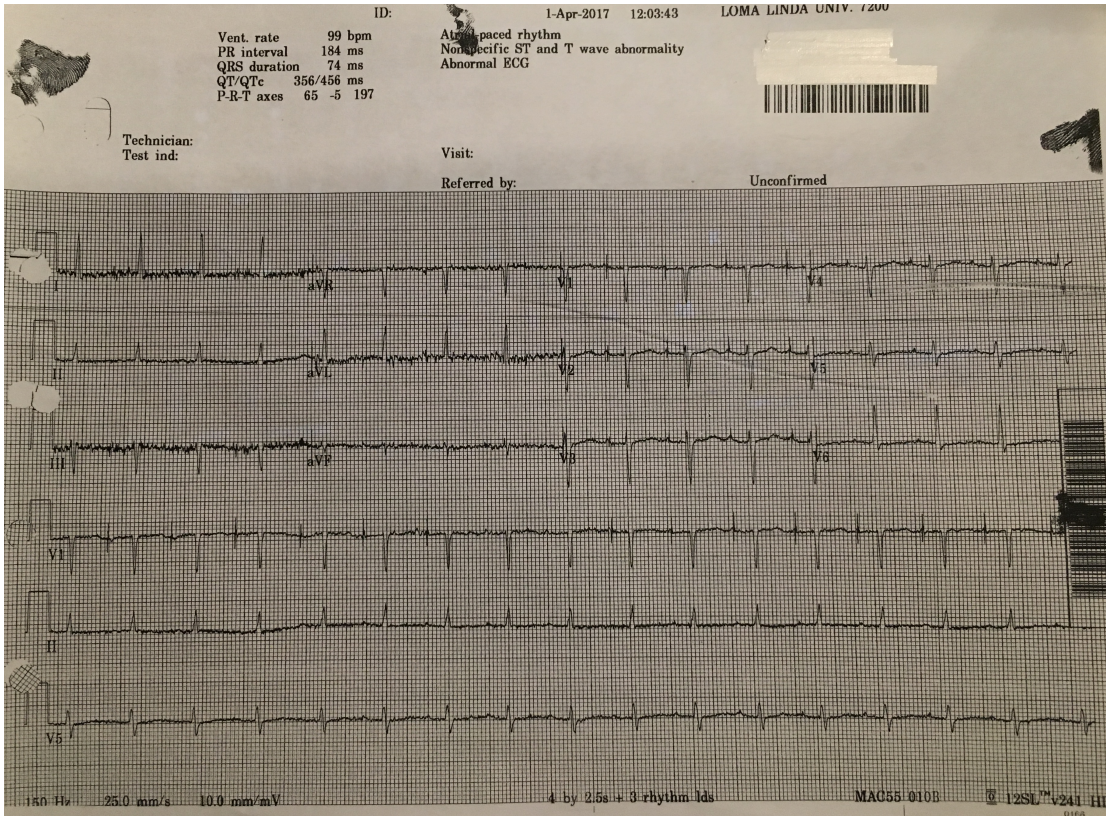
Cardiac Conference

# It’s 10:00PM on a Monday…

- A 76 YM with history of a-fib, left pneumonectomy, and esophageal stricture s/p stenting presents with a perforated esophagus and requires a L thoracotomy for washout and esophageal repair
- He has a permanent pacemaker implanted in the left chest wall, but he doesn’t know what brand
- His wife says that he had the pacemaker placed in 2009 because the “uppers weren’t talking to the lowers”
- Last interrogation was in November, “everything was fine and he’s not dependent”

# What do you think??

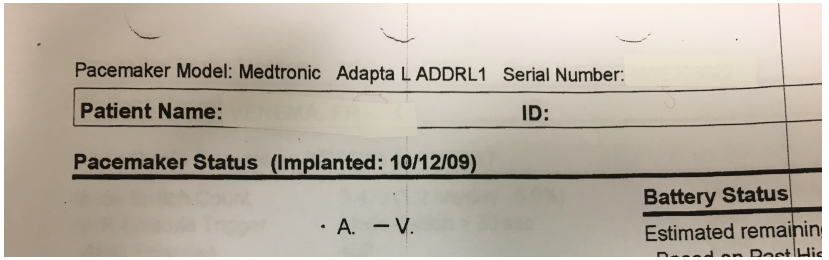


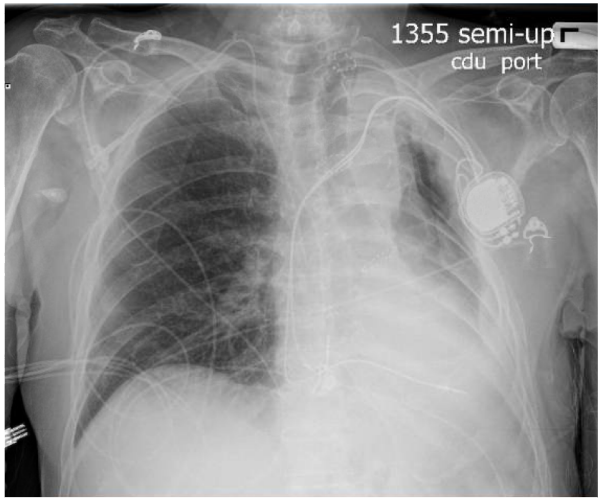
# What do you want to know about the pacemaker?

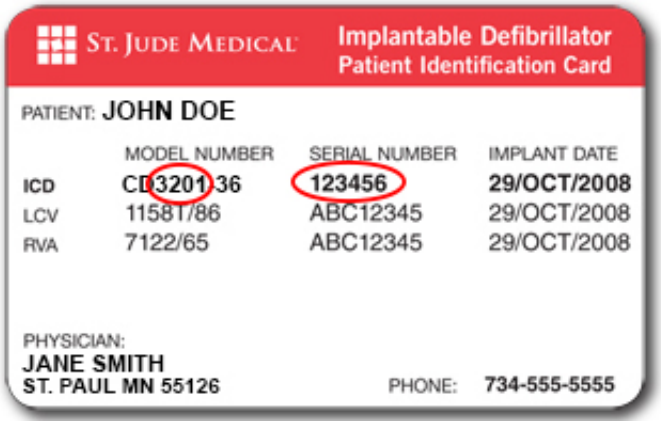
- Last interrogation should be within
  - 12 months for PM
  - 6 months for AICD and CRT devices
- Device manufacturer and programmed functionality
- Indications for placement
- Battery life
- Degree of PM dependence and underlying rhythm
- Response to magnet application
- Type of procedure and potential for use of electrocautery

# Device Identification

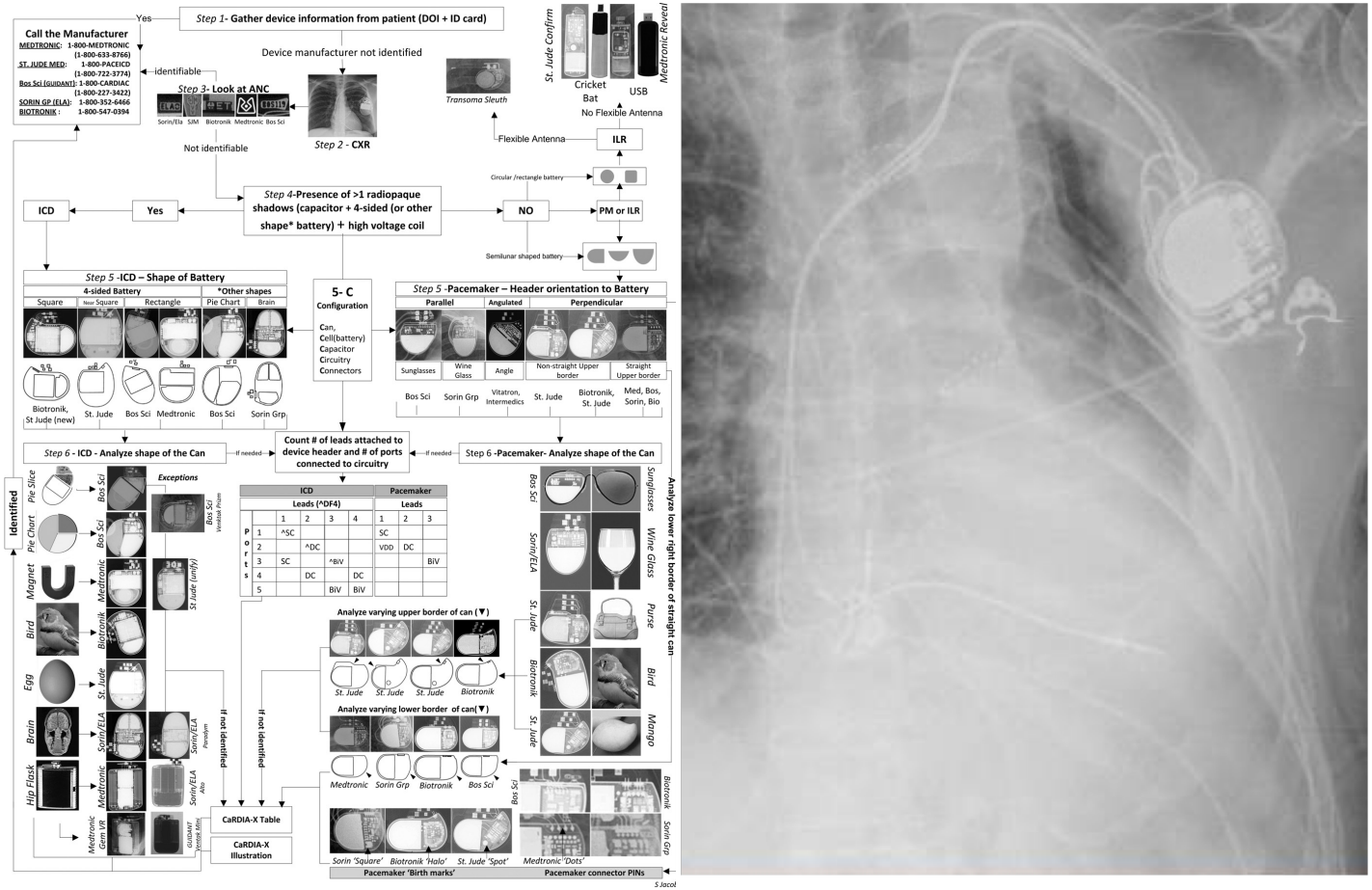
- CIED team records and interrogation reports
- Patient device implantation card
- Chest x-ray



# CaRDIA-X Device Identification



# Interrogation Report

**Parameter Summary**

| | | | | | |
|---|---|---|---|---|---|
| Mode | AAIR<=>DDDR | Lower Rate | 60 ppm | Paced AV | 180 ms |
| Mode Switch | On | Upper Tracking Rate | 130 ppm | Sensed AV | 140 ms |
| Detection Rate | 185 bpm | Upper Sensor Rate | 140 ppm | | |

**Battery Status**

| | |
|---|---|
| Estimated remaining longevity: Based on Past History | 5.5 years, 3 - 7.5 years |
| Voltage/Impedance | 2.79 V / 1,056 ohms |

| Lead Summary | Atrial | Ventricular |
|---|---|---|
| Measured Threshold | 0.625 V at 0.40 ms | 1.125 V at 0.40 ms |
| Date Measured | 03/27/17 | 03/26/17 |
| Programmed Output | 1.500 V / 0.40 ms | 2.250 V / 0.40 ms |
| Capture | Adaptive | Adaptive |
| Measured P / R Wave | | 11.2 to 16.0 mV |
| Programmed Sensitivity | 1.00 mV | 4.00 mV |
| Measured Impedance | 406 ohms | 478 ohms |
| Lead Status | OK | OK |
| Lead Model | 507652 | 507658 |
| Implanted | 10/12/09 | 10/12/09 |

**Pacing (% of total):**

| | |
|---|---|
| AS - VS | 27.1% |
| AS - VP | 1.9% |
| AP - VS | 50.0% |
| AP - VP | 21.1% |
| MVP | On |

# Standard Nomenclature

- Chamber paced (atrial - A, ventricular - V, dual - D)
- Chamber sensed (atrial - A, ventricular -V, dual - D)
- Response to sensing (triggered –T , inhibited - I, dual - D)
- Programmability or rate modulation (none – O, rate modulation – R)
- Multisite pacing (atrial - A, ventricular - V, dual - D, none – O)

# Electromagnetic Interference (EMI)

- Phantom reprogramming is no longer a concern as programming is done with complex digital signals
- CIED device technology has rapidly evolved and the routine application of a magnet may not be sufficient or appropriate to ameliorate the effects of electrocautery in the preoperative setting
- Magnet response may be programmable
- For example, if a patient with an AICD is pacer dependent, application of a magnet will deactivate the AICD, but does not put the pacer in an asynchronous mode
- Cardiac resynchronization therapy (CRT) patients need special consideration

# Failure Due to EMI

- Pacing inhibition due to inappropriate tracking of electrocautery noise
- Interference with rate responsive algorithms -> may trigger upper rate limit pacing
- Inappropriate delivery of anti-tachycardic therapy
- Damage at the tissue lead interface
- Pulse generator damage
- Induction of electric reset mode

# Determinants of the Extent of Interference

- Strength
- Duration
- Type of EMI

# Sources of EMI

- Monopolar electrocautery
- Radiofrequency ablation
- Cardioversion
- Therapeutic radiation
- ECT
- GI procedures using electrocautery
- TENS units
- Spinal cord stimulators

# Limiting the Effects of Monopolar Electrocautery

- Electrocautery should be used at lowest level possible, higher cautery settings increase the risk of inappropriate device function
- Direct the path of the electrocautery at least 6 inches away from the CIED
- Minimize the cautery applications to bursts < 5 seconds
- Monopolar electrocautery is rarely an issue for CIEDs when applied below the umbilicus

# Perioperative Considerations for CIED Management

- Perioperative management of CIEDs should be individualized for each patient based on CIED type and the planned procedure
- The “CIED team” should provide recommendations for perioperative management
  - Cardiologists/electrophysiologists, anesthesiologists, surgeons
- Industry employed device representatives should NOT provide recommendations for perioperative CIED management

**The Heart Rhythm Society (HRS)/American Society of Anesthesiologists (ASA) Expert Consensus Statement on the Perioperative Management of Patients with Implantable Defibrillators, Pacemakers and Arrhythmia Monitors: Facilities and Patient Management**

- Monopolar electrocautery below the umbilicus
  - Convert pacemakers to asynchronous mode only when interference is observed
  - Prophylactic magnet application is reasonable to deactivate AICDs, but probably unnecessary
- Monopolar electrocautery above the umbilicus and GI procedures using electrocautery
  - Reprogramming or magnet application is recommended for all AICDs
  - It is preferable for pacemakers to be set to an asynchronous mode

# WAIT.
# I CAN just put a magnet on it?!

- Magnet response may be programmable and application of a magnet may have no effect on device function
- Magnets do not render pacing asynchronous in patients with AICD
- The magnet rate may compete with the patient's native rhythm
- The magnet AV delay may be different than the patient's programmed AV delay and may interfere with normal conduction
- Magnet application may alter the pacing amplitude

# Recommendations

- Identify the device
- Review the interrogation report
- Battery life and lead function
- Indication for placement
- Dependence
- Magnet response
- Consider needs for reprogramming versus magnet application
- Always have a magnet immediately available
- Consider the need for transcutaneous pacing