A Case of Failure to Capture During Pacemaker Insertion for Complete Heart Block Following Myomectomy

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Introduction

A 58-year-old female, ASA 4 inpatient presented for a pacemaker implantation due to a complete heart block following a cardiac myomectomy the previous day. The initial surgery was successful; however, she went into a complete heart block overnight. She was transported from the Cardiovascular Intensive Care Unit with epicardial pacemaker leads to the EP lab for the procedure. She denied any previous medical history or drug allergies.

Learning Objectives

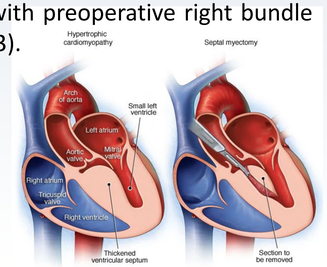
- ❖ **Describe anesthetic management of pacemaker implantation**
- ❖**Discuss common etiologies of failure to capture**
- ❖**Outline the treatment options for asystole**

Background

❖Cardiac myomectomy or ventricular septal myectomy is the primary therapeutic option for patients with obstructive hypertrophic cardiomyopathy.

❖ Patient denies any previous medical history but was experiencing fatigue and shortness of breath prior to initial diagnoses.

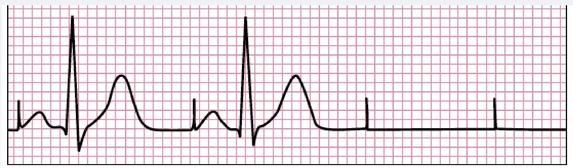
❖ Fewer than 1% of patients develop a complete heart block following septal myomectomy with a normal preoperative conduction. That rate rises to 35% with preoperative right bundle branch block (Ward and Dearani 2023).



The Mayo Clinic: Septal Myomectomy. [Digital Image]. Retrieved January 30, 2025

Case Description and Management

The patient arrived in the EP lab from CV-ICU alert and oriented with a right IJ and right radial arterial line. Patient was hemodynamically stable on norepinephrine 2 mcg/min with an initial BP of 102/63. ASA standard monitors were applied, timeout was performed, and induction of anesthesia was performed with a 40 mg bolus of propofol. A propofol infusion was then started at 70 mcg/kg/min. Procedure is moving along with the patient maintaining pacing through the epicardial leads placed overnight. The cardiologist requests alternation of pacing between anesthesia epicardial leads and the vendor-controlled transvenous leads. After three or four alternations of pacing, the epicardial leads fail to capture. Output is increased without success. The arterial line flatlines. The vendor then attempts to reclaim pacing through transvenous pacing, which is unsuccessful. The propofol infusion is turned off as troubleshooting the pacing box attached to the epicardial leads is performed. Sporadic capture is achieved through transvenous leads supported by sporadic arterial line waveforms indicating perfusion. Output is then maximized on both epicardial and transvenous pacing and full capture was retained after two minutes since initial failure to capture. Epinephrine was briefly considered until sporadic capture. Once the situation was stabilized, propofol infusion was restarted at a decreased dose of 50 mcg/kg/min. The rest of the procedure continued without incidence. Patient was woken up in the EP lab and returned to CV-ICU in stable condition.

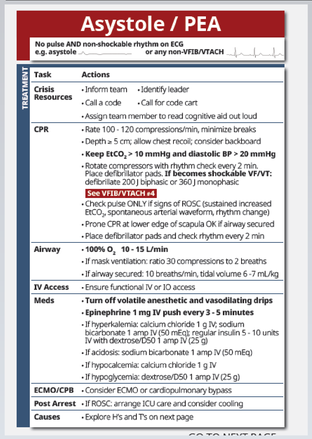


Failure to capture as evident by pacing spikes without p-wave, QRS, and/or T waves.

Jerrard, G., Barberlan, J., & Zeserson, E. (2019). *Pacemaker Basics for the Emergency Physician.* EM Resident: Cardiology. Retrieved January 30, 2025.

Discussion

❖Guidelines for treatment of Asystole



Asystole / PEA

No pulse AND non-shockable rhythm on ECG
e.g. asystole ... or any non-VFIB/VTACH

TREATMENT

Task	Actions
Crisis Resources	• Inform team • Identify leader • Call a code • Call for code cart
CPR	• Assign team member to read cognitive aid out loud • Rate 100 - 120 compressions/min, minimize breaks • Depth ≥ 5 cm; allow chest recoil; consider backboard • **Keep $EtCO_2$ > 10 mmHg and diastolic BP > 20 mmHg** • Rotate compressors with rhythm check every 2 min. Place defib/diator pads. **If becomes shockable VF/VT:** defibrillate 200 J biphasic or 360 J monophasic See VFIB/VTACH #4 • Check pulse ONLY if signs of ROSC (sustained increased $EtCO_2$, spontaneous arterial waveform, rhythm change) • Prone CPR at lower edge of scapula OK if airway secured • Place defibrillator pads and check rhythm every 2 min
Airway	• **100% O_2 10 - 15 L/min** • If mask ventilation: ratio 30 compressions to 2 breaths • If airway secured: 10 breaths/min, tidal volume 6 -7 mL/kg
IV Access	• Ensure functional IV or IO access
Meds	• **Turn off volatile anesthetic and vasodilating drips** • **Epinephrine 1 mg IV push every 3 - 5 minutes** • If hyperkalemia: calcium chloride 1 g IV, sodium bicarbonate 1 amp IV (50 mEq); regular insulin 5 - 10 units IV with dextrose/D50 1 amp IV (25 g) • If acidosis: sodium bicarbonate 1 amp IV (50 mEq) • If hypocalcemia: calcium chloride 1 g IV • If hypoglycemia: dextrose/D50 1 amp IV (25 g)
ECMO/CPB	• Consider ECMO or cardiopulmonary bypass
Post Arrest	• If ROSC: arrange ICU care and consider cooling
Causes	• Explore H's and T's on next page

GO TO NEXT PAGE

Page 2 Asystole / PEA

DIFFERENTIAL DIAGNOSIS

TEE / TTE and labs will aid diagnosis; Invite input from team

Heart Rate - Vagal Stimulus
- Desulfiate abdomen
- Remove surgical retractors and sponges
- Remove pressure from eyes, neck, ears, and brain. Drain bladder

Hypovolemia
- Give rapid IV fluid bolus
- Check Hgb
- If anemia or hemorrhage: See Hemorrhage #12
- Consider relative hypovolemia:
  - If auto-PEEP: disconnect circuit
  - IVC compression
  - Obstructive or distributive shock
  - See Anaphylaxis #5
  - See High Spinal #14

Hypoxemia
- O_2 100% 10 - 15 L/min
- Check breathing circuit connections
- Confirm ETT placement with CO_2
- Check breath sounds
- Suction ET tube
- Consider chest x-ray; bronchoscopy
- See Hypoxemia #7

Hydrogen Ions - Acidosis
- Consider bicarbonate
- Balance increasing ventilation with potential decrease in CPR quality

Hyperkalemia
- Calcium chloride 1g IV
- Bicarbonate 1 amp IV (50 mEq)
- Insulin 5 - 10 units IV with D50 1 amp IV (25g) and monitor glucose
- Consider emergent dialysis

Hypokalemia
- Controlled potassium infusion
- Magnesium sulfate 1 - 2 g IV

Hypoglycemia
- Dextrose/D50 1 amp (25 g)
- Monitor glucose

Hypocalcemia
- Calcium chloride 1 g IV

Hyperthermia
See Malignant Hyperthermia #19

Hypothermia
- Actively warm: forced air, warm IV fluid, warm room
- Consider ECMO or bypass

Toxins
- Consider anesthetic overdose
- Consider medication error
- Turn off volatile anesthetic and vasodilating drips
- If local anesthetic has been given: See Local Anesthetic Toxicity #18

Tamponade - Cardiac
- Consider TEE / TTE
- Perform pericardiocentesis

Tension - Pneumothorax
- Check for asymmetric breath sounds, distended neck veins, deviated trachea
- Consider ultrasound for normal lung sliding, abnormal lung point
- Consider chest x-ray, but do NOT delay treatment
- Perform empiric needle decompression in 4th or 5th intercostal space anterior to the mid-axillary line, then chest tube See Pneumothorax #22

Thrombosis - Coronary
- Consider TEE / TTE to evaluate ventricular wall motion
- Consider emergent coronary revascularization See Myocardial Ischemia #20

Thrombosis - Pulmonary
- Consider TEE / TTE to evaluate right ventricular function and RVSP
- Consider fibrinolytic agents or pulmonary thrombectomy See Embolism #9

See Right Heart Failure #24

END

Stanford Anesthesia Cognitive Aid Group. (2021). [Emergency Manual, Asystole]. Retrieved January 30, 2025.

❖Long Term Etiologies of Pacemaker Failure to Capture

- Lead fracture
- Fibrosis/inflammation
- Cardiomyopathy
- Exit block
- Electrolyte imbalances

❖Short Term Etiologies of Pacemaker Failure to Capture

- Lead Dislodgement or malposition
- Premature lead failure
- Premature battery depletion
- Programming errors with suboptimal output

References

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