**The Perfect Storm: Pacemakers, ICD's and Refractory VT**

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**Abstract:**

Test your clinical skills against this scenario: a syncope patient in electrical storm, with an ICD. What's your first move? Come refine your approach in this case-based session, and learn a few pearls for managing these tricky patients.

**Objectives:**

1. Review pacemakers and ICD functions and options
2. Develop an approach to refractory VT or electrical storm
3. Review the latest evidence for management of stable VT

**Notes:**

Pacemaker numbers

| | | |
|---|---|---|
| 1 | Chamber paced | A, V, D=dual, O=none |
| 2 | Chamber sensed | A, V, D, O |
| 3 | Sensing response | Triggered, Inhibited, D, O |
| 4 | Programmability | P=simple,<br>M=multiprogrammable<br>R=rate adaptive |
| 5 | Anti-tachycardia function | P=pacing<br>S=shock<br>D=dual (shock + pace) |

Magnets:

a. On a pacemaker: the pacer will switch to asynchronous pacing or fixed rate pacing. The magnet closes an internal switch, so the pacemaker is no longer inhibited by the patient's intrinsic activity.

b. On an ICD: the magnet stops the ICD from delivering shocks. NB. ICD's also work as ventricular pacers in case of bradyarrhythmias. The magnet has no impact on the underlying pacing function of an ICD.

Treatment options for ventricular storm:

1. Zap them
    a. synchronized cardioversion
    b. use their own ICD (if they have one)
    c. defibrillate in cardiac arrest
    d. consider dual-sequential defibrillation only for refractory VF (eg. Patient is not converting to sinus after 4-5 standard shocks)
    e. overdrive pacing. Either electrically or chemically (isoproterenol)

2. Reverse causes
    a. check the ECG for STEMI, long QT and Brugada (classic RBBB and saddleback ST elevation in V1-V3)
    b. send labs (electrolytes, TSH, tox, trop)
    c. get a CXR (consider CHF and pneumonia)

    Only 25% will have a reversible cause identified.

3. Anti-arrhythmics
    a. procainamide (10mg/kg over 20 minutes is the dose from PROCAMIO trial)
    b. amiodarone (150 mg boluses, or 300 mg in cardiac arrest)
    c. lidocaine
    d. sotalol

4. Chill them out (reduce catecholamine surge)
    a. analgesia
    b. sedation
    c. general anesthesia (with intubation please)
    d. esmolol

**References:**

1. Want a blog for an overview? Try this one from Life in the Fast Lane, or this one from EmDocs.

3. A podcast? Emcrit on the Syndromes of Cardiac Arrest.

4. Prefer your overview from a journal article? Try one of these:

Gao D, Sapp JL. Electrical storm: definitions, clinical importance, and treatment. Curr Opin Cardiol. 2013 Jan;28(1):72-9. doi: 10.1097/HCO.0b013e32835b59db. Review. PubMed PMID: 23160339.

Eifling M, Razavi M, and Massumi A. The evaluation and management of electrical storm. Tex Heart Inst J. 2011; 38(2): 111–121.

5. Need the primary data? Here's the PROCAMIO trial:

Ortiz M, Martin A, et al. Randomized comparison of intravenous procainamide versus intravenous amiodarone for the acute treatment of tolerated wide QRS tachycardia: the PROCAMIO study. Eur Heart J. 2017 38;1329-1335. doi:10.1093/eurheartj/ehw230

6. Details on esmolol?

Driver BE, Debaty G, Plummer DW, Smith SW. Use of esmolol after failure of standard cardiopulmonary resuscitation to treat patients with refractory ventricular fibrillation. Resuscitation. 2014 Jul 14. pii: S0300-9572(14)00642-X. doi: 10.1016/j.resuscitation.2014.06.032. [Epub ahead of print] PubMed PMID: 25033747.

Lee YH, Lee KJ, et al. Refractory ventricular fibrillation treated with esmolol. Resuscitation. 2016 Oct;107:150-5. doi: 10.1016/j.resuscitation.2016.07.243. Epub 2016 Aug 11.