

Pacemaker Facts

Anesthetic Pearls: Anesthetic Implications and Management of Cardiac Pacers

Initially, fixed rate ventricular pacing systems were used only for the control of complete heart block and Stokes Adams syncope. Innovation in the 70's led to the so-called "Universal" pacemaker. Presently, programmability and technological advances make the newest pacemakers able to be used in a variety of clinical conditions because of the variety of modes available. Approximately 150-200,000 pacers are implanted in the USA each year.

Anesthetically, management of the perioperative risk in pacer patients involves appropriately treating the underlying medical condition. Indications for permanent pacemaker placement include: symptomatic bradyarrhythmias, asymptomatic Mobitz-II or greater, sinus node dysfunction, some types of SVT or VT, orthotopic heart transplantation, HOCM/IHSS, and long QT syndrome. Most modern pacers can be programmed with an external device that emits either a coded radiofrequency message or a pulsed magnetic field to the pacemaker. There is **NO** universal programmer available. Electrocautery units (Bovie) have the potential to cause transient or permanent changes in the pacer function and programmability. If cautery is extensively used, the manufacture rep should disable the pacer and set it at a demand rate. Measures to decrease pacer susceptibility to cautery: 1) bipolar instead of unipolar cautery, 2) bovie grounding pad as far from pacer as possible, 3) bovie grounding pad not in line between operating site and pacing generator, 4) using lowest and shortest cautery current possible, 5) using nerve stimulators away from pacing generator. Placing a magnet over the pacing generator has varying results which may lead to generator reprogramming and is thus discouraged unless in dire circumstances (for many pacemaker devices, a magnet will cause a preset demand rate of between 60-90 bpm). However, once a magnet has been placed over a pacing generator, it should be left in place until a pacer reprogramming device is available.

The Inter-Society Commission for Heart Disease Resources (ICHD) developed symbol codes which are used to designate the pacemaker modes. A three-symbol code was developed in 1974 with the 4th and 5th symbols added in 1980. More commonly, the three-symbol code is used in clinical and medical practice (e.g. VVI, DOO, DDD).

ICHD code:

First symbol indicates chamber **Paced**

- A** = atrium
- V** = ventricle
- D** = dual (A&V)

Second symbol indicates chamber **Sensed**

- A** = atrium
- V** = ventricle
- D** = dual (A&V)
- O** = none

Third symbol indicates sensing function: **Activation** (pacing response to sensed stimuli)

- I** = inhibited
- T** = triggered
- D** = dual (A&V)
- O** = none

Fourth symbol indicates **Programmability**

- R** = rate modulated
- C** = communicating
- P** = simple rate and/or output programmability
- M** = multi-programmability of rate, output, sensitivity, mode, etc.
- O** = none

Fifth symbol indicates **Tachycardia function**

- P** = paced
- S** = single or double-timed shock
- D** = dual (pace & shock)
- O** = none

Pacing mode description:

- DOO** – dual chamber pacemaker that demand paces both the atria and ventricle at a preset rate; and does not sense or inhibit a conducted beat from the native cardiac tissue (common external pacer setting in the post-CPB period while still in the OR having electro-cautery used which could cause the pacer to activate or inhibit inappropriately).
- DDD** – dual chamber pacemaker that paces and senses both atria and ventricle; which is triggered by atrial activity and inhibited by ventricular activity (common external pacer setting for a post-CPB patient after the electro-cautery is completed).
- AAI** – atrial pacing with atrial sensing in which the response is inhibited (common in patients with Sick Sinus Syndrome).