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Questions

- This presentation is provided with the understanding that the slide content must not be altered in any manner as the content is *subject to FDA regulations*.
- This presentation is to be used in conjunction with other resource material including the applicable Boston Scientific device *physician's manual* and any *implant accessories instructions* for use.
- This presentation is not intended to replace implant training.
- Proper surgical procedures and techniques are the responsibilities of the medical professional.
- If this presentation is not used in its entirety, the following information must be included:
 - Appropriate Indications
 - Contraindications
 - Warnings
 - Precautions and Adverse Events

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Questions

When we complete this program you will be able to:

- *Describe* basic room set up for pacemaker implant
- *Understand* the patient needs during implant
- *Describe* the basics of the implant procedure
- *Explain* the measurements taken during lead testing

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EP Lab/Surgical Suite Equipment Consists of:

- Fluoroscopic Imaging
- Patient Hemodynamic Monitors
 - EKG
 - Blood Pressure
 - Pulse Oximeter
- External Defibrillator – External Pacemaker
- Sterile Table and Instruments

Pacemaker Implant Set up

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EP Lab

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Objectives

Pacemaker
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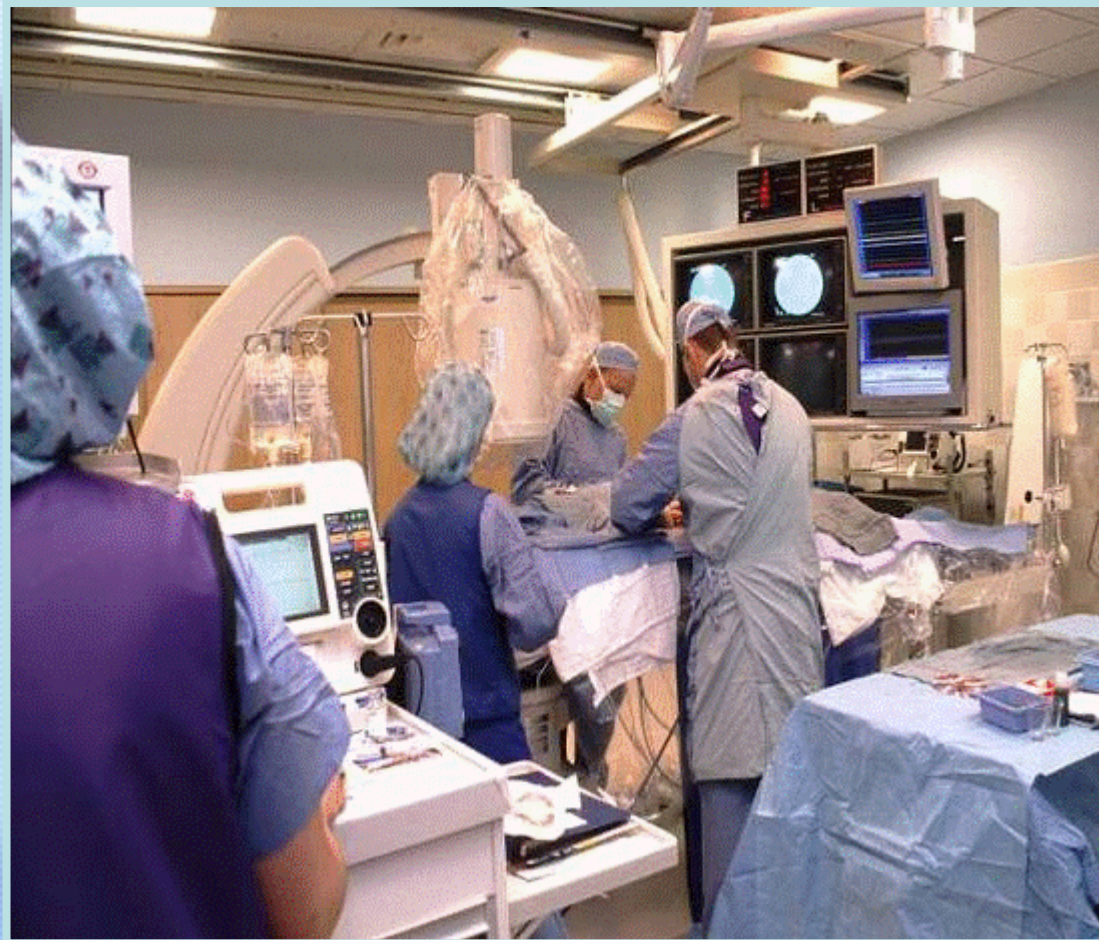
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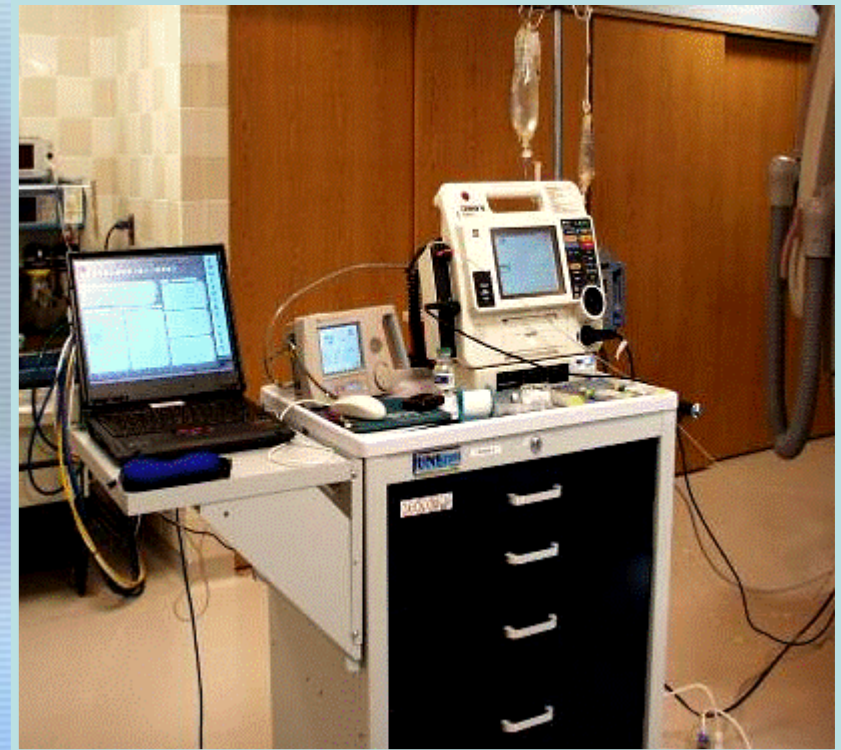
- Procedure
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Device Evaluation

Questions

Circulating Nurse's Responsibilities:

- *Control* flow of case
- *Monitor* patient's vital signs
- *Anticipate* needs of personnel
- *Administer* medications as ordered
- *Chart* record of case
- *Reassure* patient



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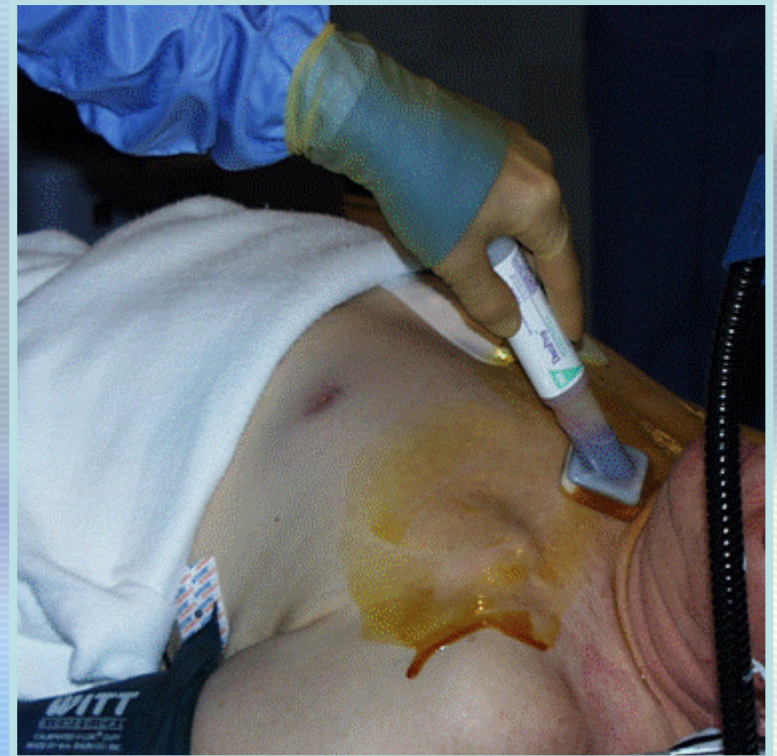
- Procedure
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Device Evaluation

Questions

Preparation

- Monitoring equipment is attached to the patient
- Gentle restraints are applied
- The skin is shaved and prepped



Pacemaker Implant Set up

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Draping



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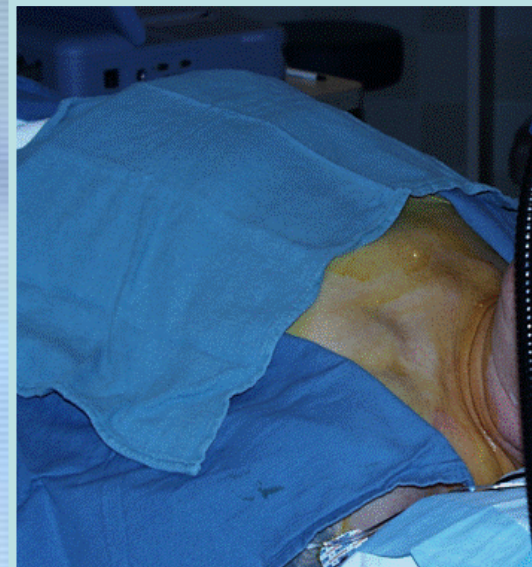
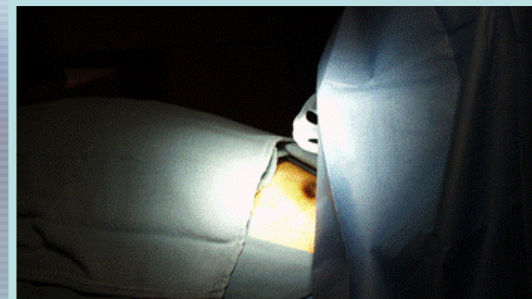
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Device Evaluation

Questions

Draping the Patient

- The surgical area is cordoned off with sterile towels
- The patient's entire body is draped



Pacemaker Implant Set up

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Questions

Sterile Table Consists of:

- Pacemaker Tray
- Surgical Instruments
- Drapes
- Cautery Equipment
- Sterile Basins



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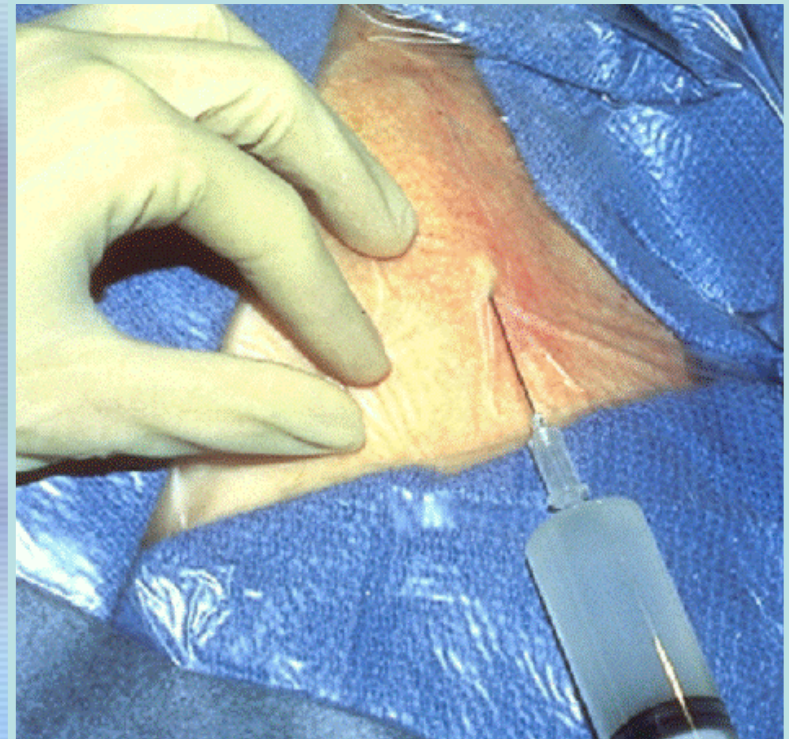
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Questions

Administration of Local Anesthetic

- The skin is numbed with Xylocaine
- A sedative is usually given prior to the procedure to help relieve anxiety



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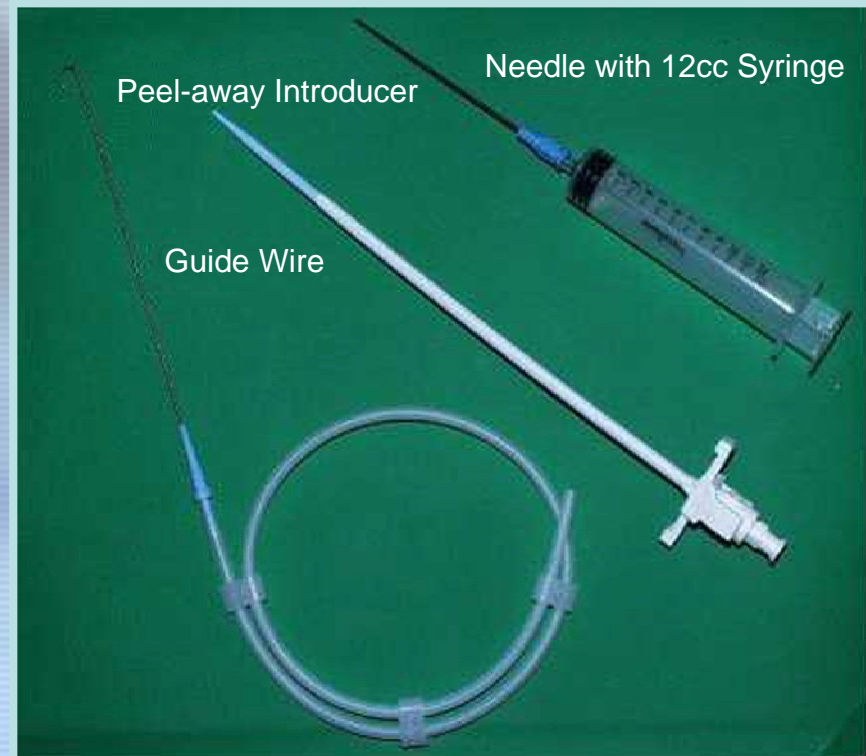
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Questions

Introducer Kit Consists of:

- Introducer
- J-guide wire
- Needle with syringe



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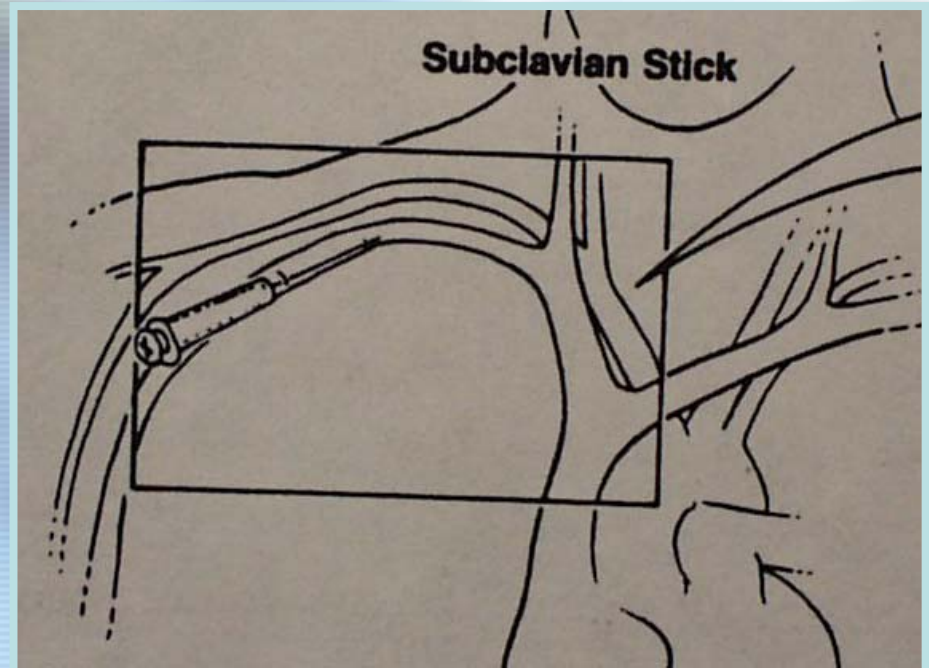
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Device Evaluation

Questions

Lead Insertion

- The needle is inserted into the subclavian vein
- The J-wire is inserted through the needle
- The needle is removed and the introducer is advanced over the wire



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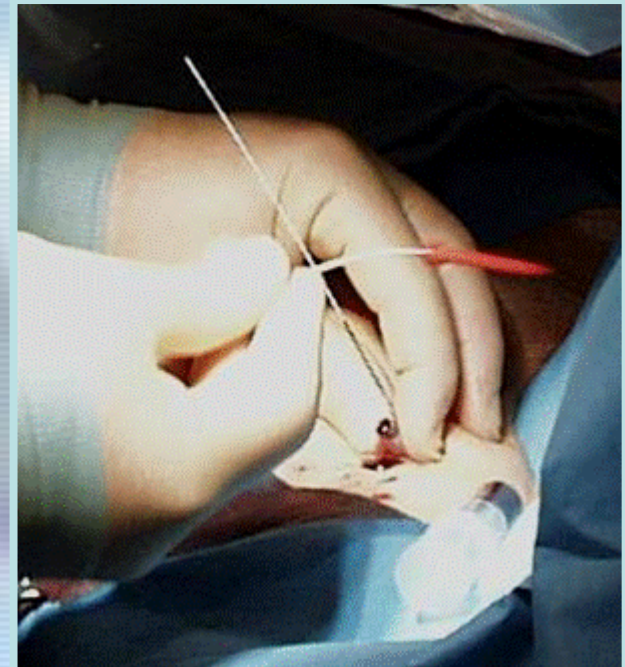
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Questions

Guide Wire Introduction

- Access for both the atrial and ventricular lead is obtained
- The lead is inserted through the introducer and then the introducer is peeled away



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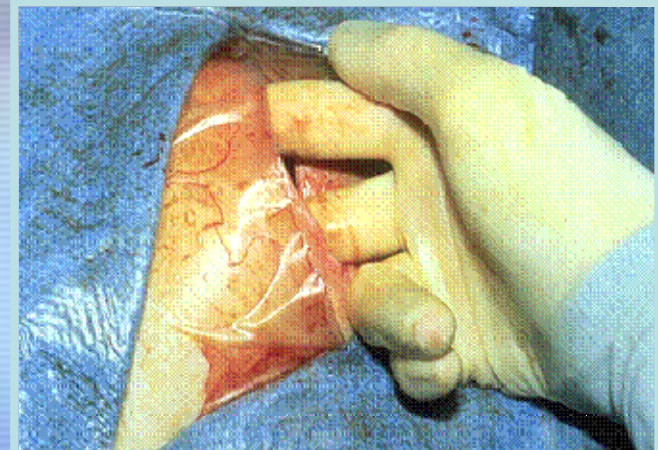
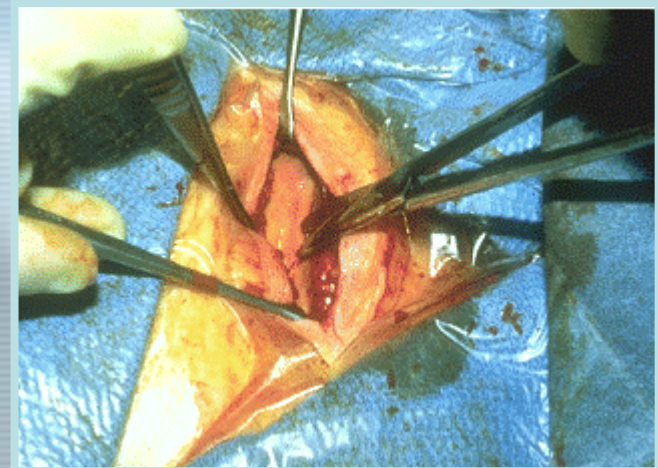
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Questions

Pocket Formation

- The pacemaker incision is approximately 2 inches
- The pocket is made by blunt dissection
- The pocket must be big enough to accommodate the pacemaker and the leads



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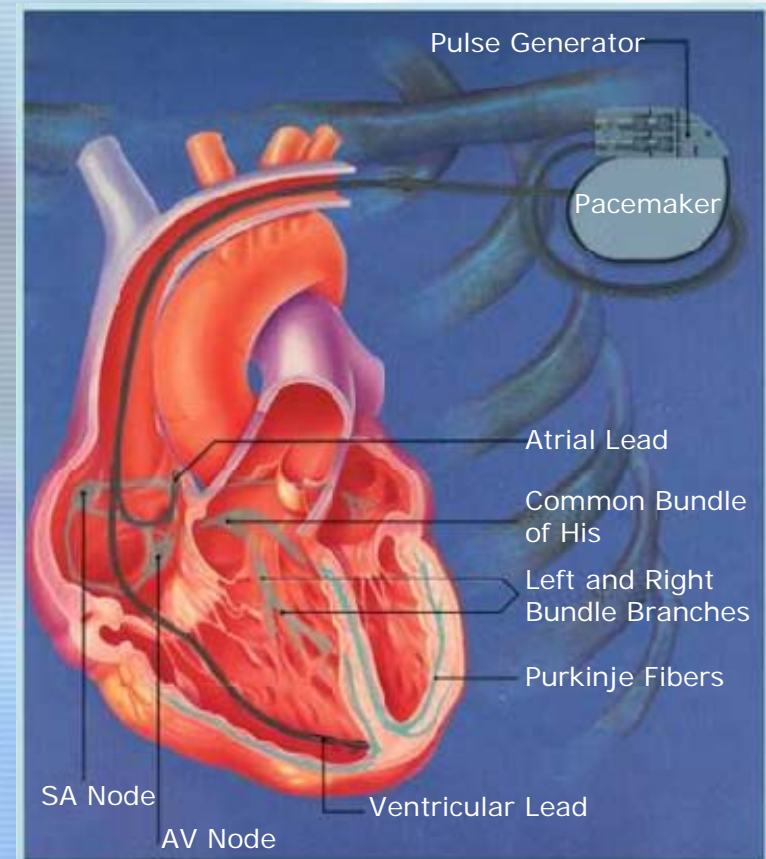
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Questions

Lead Insertion Overview

- 1 The ventricular lead is positioned first
- 2 The atrial lead is then positioned and tested
- 3 The leads are then attached to the pacemaker



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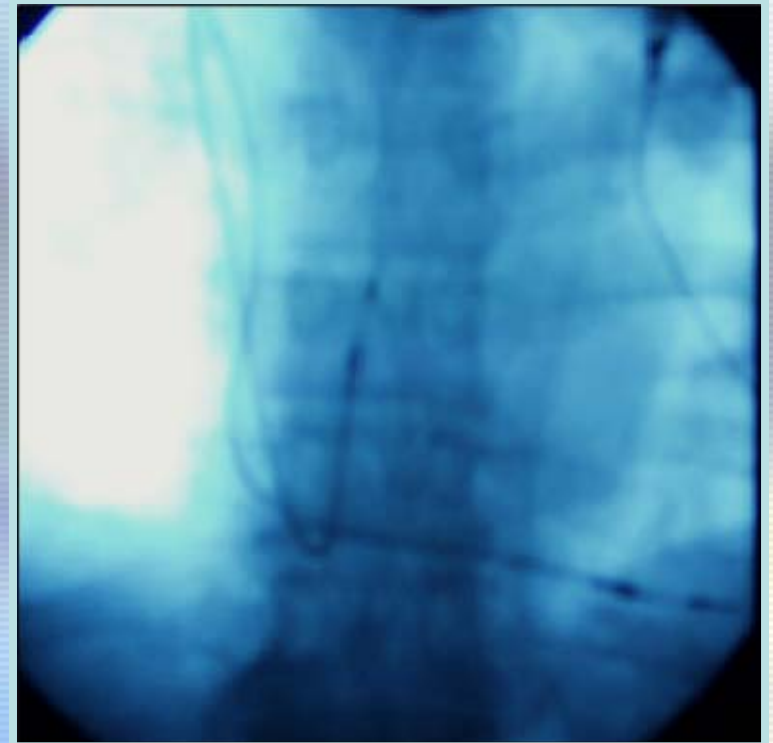
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Device Evaluation

Questions

Fluoroscopic Lead Position

- Fluoroscopic position of ventricular and atrial lead
- The ventricular lead is positioned with the tip in the RV apex, well beyond the spine shadow



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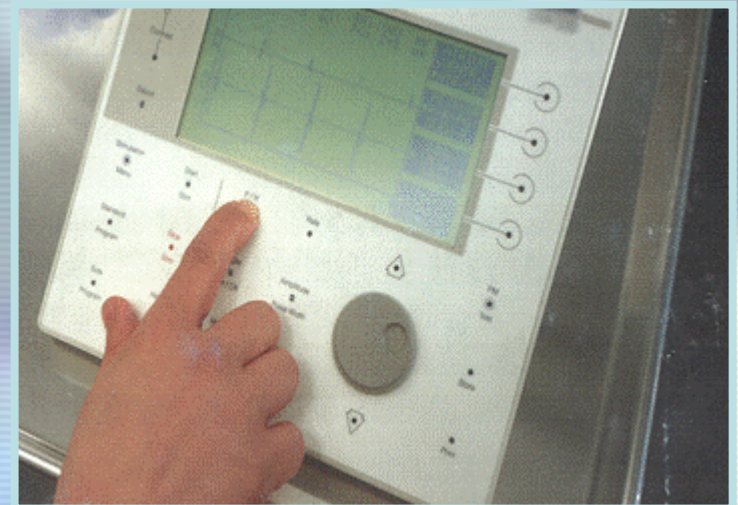
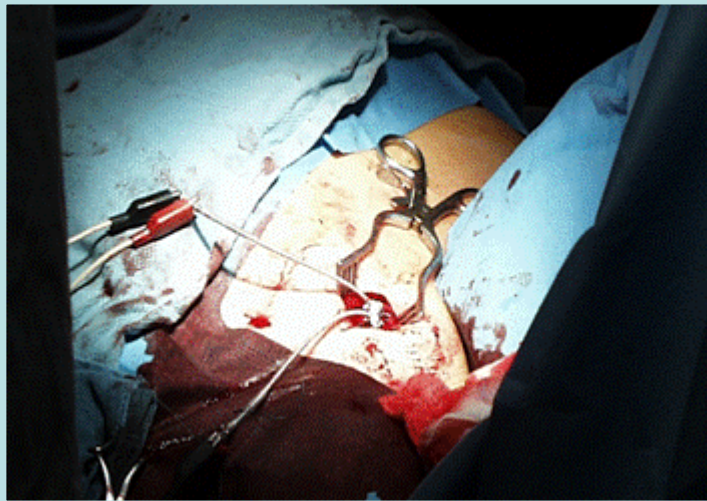
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Device Evaluation

Questions

Lead Measurements

The leads are tested with a pacing system analyzer to verify good position and thresholds before the pacemaker is attached



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Questions

Implant Measurements Include:

- Stimulation Threshold
- Sensing Threshold
- Slew Rate
- Pacing Impedance
- High Output Testing
- Retrograde Conduction

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Questions

Acceptable Electrical Parameters of Lead Placements

	Atrium	Ventricle
Thresholds	≤ 1.5 Volts	≤ 1.0 Volts
Sensed P/R	≥ 1.5 mV	≥ 5.0 mV
Impedance	300-1500* Ω	300-1500* Ω

* for standard impedance leads

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Questions

Stimulation Threshold

Purpose:

- To assure proper lead placement
- To assure pacing system integrity
- To assure an adequate safety margin between the excitation energy threshold and the output of the pulse generator

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Questions

Stimulation Threshold

Affected by:

- Lead maturation
- Lead technology
- Medications
- Lead location

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Questions

Sensing Threshold

- Measurement of the cardiac signal (P & R waves) available to inhibit a demand pulse generator
- Proper sensing depends on:
 - signal amplitude
 - slew rate
 - polarity

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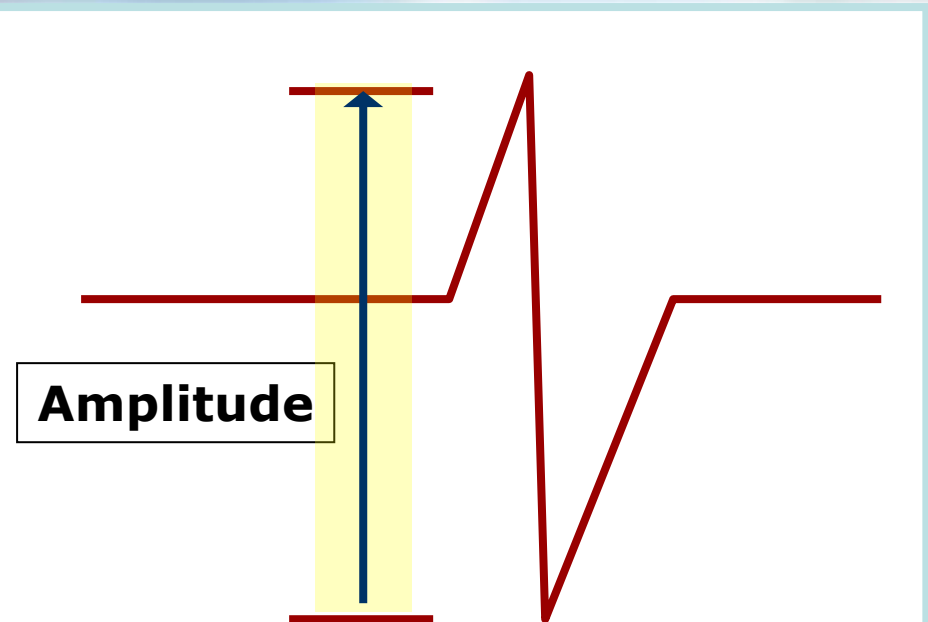
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Questions

Signal Amplitude



Measured voltage of the intrinsic signal

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Device Evaluation

Questions

Slew Rate

$$\text{Slew Rate} = \frac{\Delta \text{ Amplitude}}{\Delta \text{ Time}}$$

Amplitude

The change in R-wave voltage versus the change in time (dV/dt; slope)

Time

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Questions

Pacing Impedance

- Total opposition to current flow in an electrical circuit
- To verify pacemaker system integrity
- Normal range: 300 – 1500 Ohms, average is 300 – 1000 Ohms

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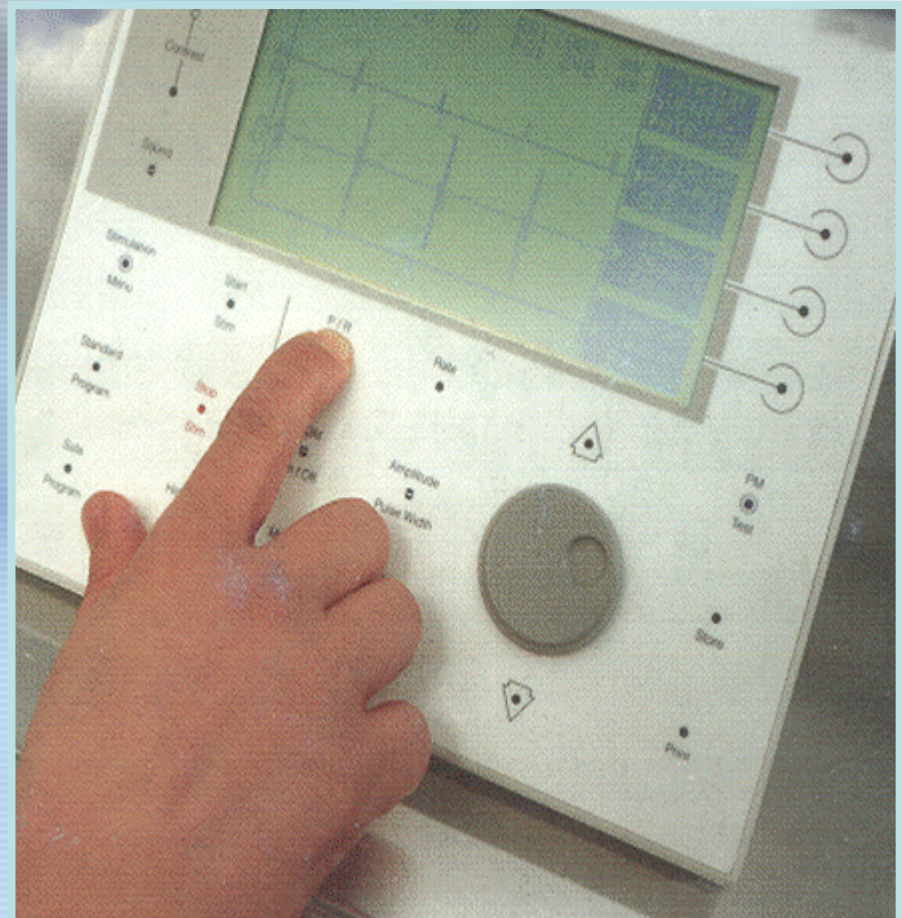
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Device Evaluation

Questions

High Output Testing

- Device is programmed to maximum voltage
- Patient is evaluated for diaphragmatic stimulation
 - Muscle twitching near rib cage
 - Hiccoughing



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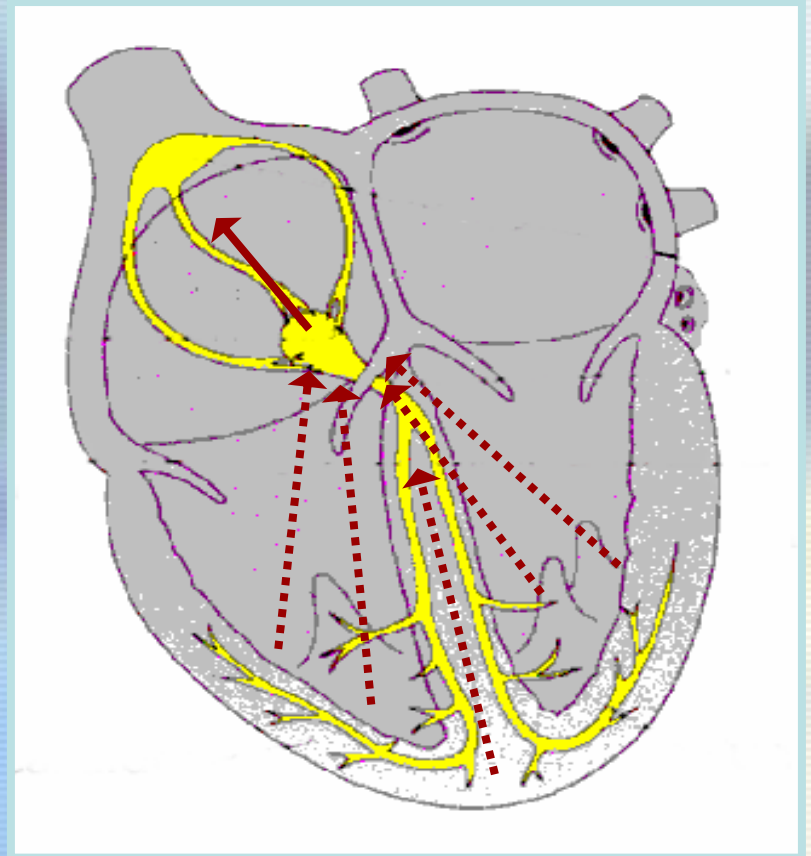
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Questions

Retrograde Conduction

Conduction of an electrical impulse from the ventricles to the atria through the heart's conduction system



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Questions

Pacemaker Mediated Tachycardia

- Retrograde conduction can lead to pacemaker-mediated tachycardia (PMT)
- To prevent retrograde-induced PMTs, measure the retrograde conduction time at implant and program a longer PVARP

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Questions

Permanent Pacemaker Insertion

- The lead is secured in place after proper lead position has been confirmed
- The pocket is irrigated with antibiotic solution prior to pacemaker insertion



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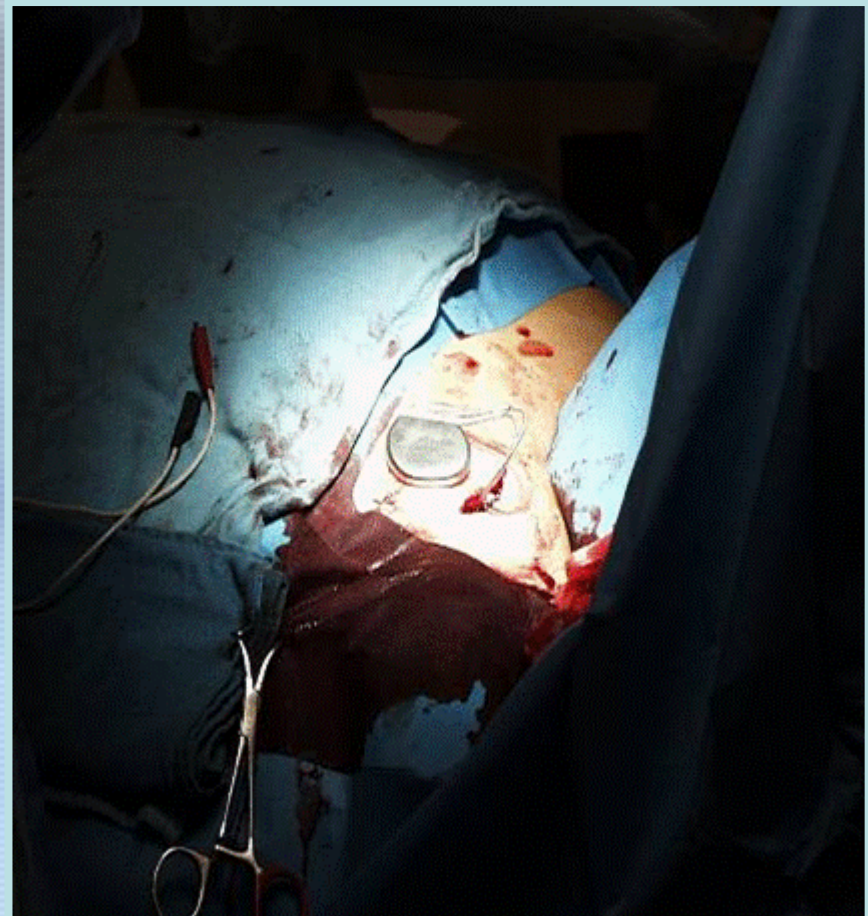
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Device Evaluation

Questions

Attaching the Pacemaker

- The leads are inserted into the pacemaker header
- Visualization of the leads past the distal setscrew
- The setscrews are tightened
- The pacemaker is sutured to the pectoral muscle



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Questions

Pocket Closure

- The pocket is closed with suture
- Steri strips may be used to reinforce the suture
- The wound should be checked in 7 to 10 days



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Questions

Just like a pacemaker except . . .

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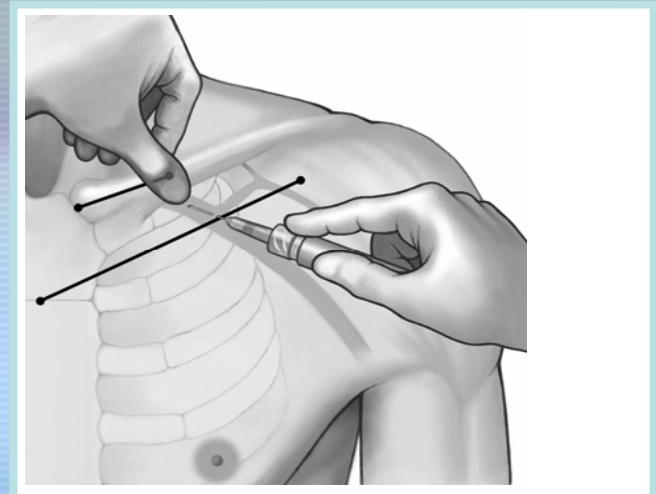
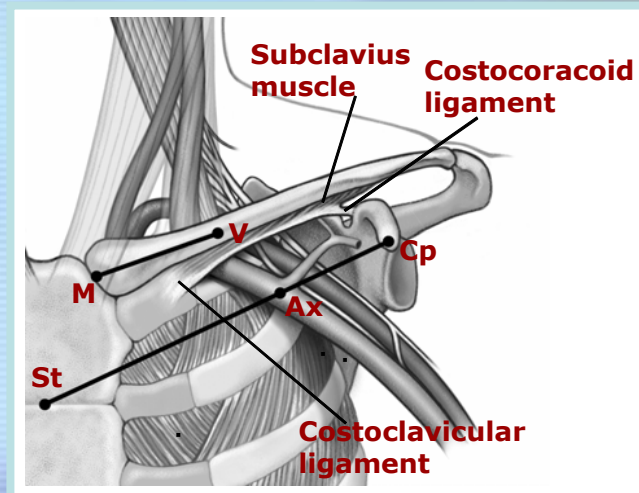
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Device Evaluation

Questions

Just like a pacemaker except . . .

- Implant ICD shocking lead
- Implant atrial pacing/sensing lead, if applicable
- Use fluoroscopy to verify lead position
- Take baseline lead measurements with PSA
- Create a pocket for device



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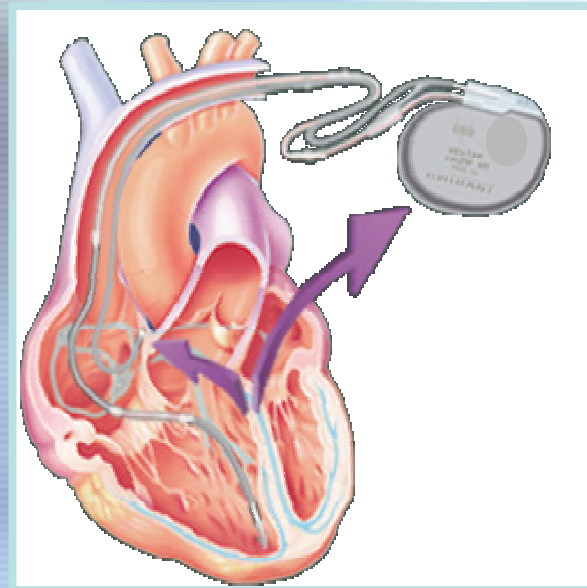
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Device Evaluation

Questions

Just like a pacemaker except . . .

- Induce the patient into arrhythmia
- Have the device shock patient
- Assess device performance during episode



Testing

Defibrillation Threshold Tests (DFTs)

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Device Evaluation

Questions

- Assesses the ability of the implanted ICD system to terminate ventricular fibrillation
- Usually includes 2 tests at an output determined by the physician
- Safety margin should be at least 10 J

Device Evaluation

Pacemaker or ICD Evaluation

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▶ Device Evaluation

Questions

The patient should have an evaluation of the device prior to leaving the OR using the programmer to establish an immediate baseline



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▶ Questions

