Implanted Cardiac Devices: Pacemakers, ICDs and Wearable Defibrillators

Pacemaker codes and failures, ICD shocks, S-ICD and WCD limits, magnets, cautery and MRI, and discharge teaching

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WHICH DEVICE DOES WHAT

DEVICE	DOES	CANNOT
Pacemaker	Senses and paces atrium, ventricle or both	Shock VT or VF
Leadless pacemaker	Capsule in the RV; VVI or VVIR	Pace the atrium; some ignore a magnet
CRT-P or CRT-D	Paces both ventricles (LV lead via coronary sinus); CRT-D also shocks	Help unless it paces nearly every beat
Transvenous ICD	ATP, cardioversion, defibrillation, backup pacing; stores electrograms	Prevent arrhythmias
S-ICD	Lead under the skin beside the sternum; shocks VT and VF	Bradycardia pacing, ATP or CRT (30 s post-shock pacing only)
Wearable defibrillator (WCD)	Detects and shocks VT and VF for a limited time	Pace (see WCD below); protect when not worn

SAFETY Unstable bradycardia with an S-ICD or a vest: atropine or transcutaneous pacing as for anyone; neither device paces.

PACEMAKER MODES

MODE	USE	WATCH FOR
DDD(R)	First choice in sinus node disease; AV block in sinus rhythm	Mode switch in AF; pacemaker-mediated tachycardia
VVI(R)	Slow AF; frail elderly; leadless	Pacemaker syndrome (lost AV synchrony)



Ventricular pacing: every spike is followed by a wide QRS.

WHO GETS WHICH DEVICE

SITUATION	DEVICE
Symptomatic sinus node dysfunction	Pacemaker
Acquired third-degree, high-grade or Mobitz II block, not reversible	Pacemaker, even without symptoms
Asymptomatic or sleep-only bradycardia	No pacemaker; check for sleep apnea (CPAP)
VF arrest or unstable VT, no reversible cause	Secondary-prevention ICD whatever the EF, if survival over 1 year expected
Ischemic cardiomyopathy, EF 35% or less, NYHA II to III	ICD at least 40 days after MI and 90 days after revascularization
New cardiomyopathy, or early after MI with very low EF	Medical therapy first; a WCD may bridge
HFrEF, EF 35% or less, wide QRS (esp. LBBB), symptoms	CRT (CRT-D if an ICD is also indicated)

PACEMAKER PROBLEMS AT THE BEDSIDE

PROBLEM	WHAT YOU SEE	FIRST STEPS
Failure to capture	Spike with no QRS (or no P wave)	Check patient and BP; transcutaneous pacing if unstable; device check, chest x-ray
Undersensing	Spikes on or right after the patient's own beats	Report (spike-on-T risk); device check
Oversensing	Pauses with no spikes when pacing is expected	Remove the interference; a magnet gives asynchronous pacing in most pacemakers
Failure to pace	No spikes, slow rhythm	Treat the bradycardia; urgent device check



Failure to capture: some spikes are not followed by a QRS.

ICD SHOCKS

SITUATION	ACTION
One shock, feels fine	Call the device clinic for a check that day or the next
Several shocks in a short time, or chest pain, dyspnea, fainting	Call 911 or go to the ED
Shocks while awake and talking; sinus tachycardia or noise on the monitor	Likely inappropriate: magnet over the ICD, continuous monitoring, external defibrillator ready, call the device team
Electrical storm: 3 or more VA episodes in 24 h, at least 5 min apart, each needing an intervention	Sedation, nonselective beta-blocker (propranolol) plus amiodarone, fix triggers (ischemia, K, Mg, HF); ablation if it persists

SAFETY Do not switch off shocks for appropriate therapy in VT storm; suspend detection only for inappropriate shocks, monitored, pads ready.

MAGNETS, CAUTERY AND CARDIOVERSION

DEVICE	MAGNET ON (EFFECT ENDS WHEN REMOVED)
Most pacemakers	Asynchronous pacing (AOO, VOO or DOO) at the maker's magnet rate
Transvenous ICD	Suspends tachy detection and shocks in most brands; no asynchronous pacing
S-ICD	Suspends shocks; tone for about 60 s
Micra leadless	No magnet response; reprogram

- Highest risk: monopolar cautery above the umbilicus or within 15 cm of the generator.
- Dependent patient: asynchronous pacing. ICD: tachytherapies off. Transcutaneous pacing and a defibrillator ready.
- Interrogate and restore settings before the patient leaves monitoring.
- Cardioversion: pads anterior-posterior, away from the generator; interrogate afterward.

MRI WITH A DEVICE

- MR-conditional means the whole system (generator and leads, usually one maker) is labeled; scan only under its conditions.
- Device check, then MRI mode: VOO or DOO if pacing dependent, ICD therapies off; ECG and SpO2 monitoring, defibrillator and pacing at hand; restore and recheck after.
- A magnet is not MRI preparation, and pacing is never just switched off in a dependent patient.

WEARABLE DEFIBRILLATOR (WCD)

- For patients at risk of sudden arrest who are not (yet) ICD candidates, e.g. early after MI or new cardiomyopathy.
- Vest electrodes watch the rhythm; on VT or VF it vibrates, alarms and speaks, releases gel and shocks (up to 5).
- Awake patient holds both response buttons to stop an unneeded shock; if unconscious, the shock is delivered.
- Worn day and night, off only to shower or bathe.
- No pacing for bradycardia or asystole is described in the FDA or review sources; not used with an active ICD.

AFTER IMPLANT: TEACHING

TOPIC	TEACHING
Arm	Below shoulder level for several weeks (4 to 6 on the ICD sheet)
Lifting	Nothing over 10 to 15 lb, no heavy push or pull, 2 to 3 weeks
Incision	Dry 4 to 5 days, then shower; report redness, swelling, drainage, fever
Phones	At least 6 inches away; opposite ear; not in a chest pocket
Tools, magnets	Power tools and speakers 12 inches away; no magnets near it
ID	Carry the card; tell every provider (cautery, MRI, lithotripsy)

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