Figure 1: Decision matrix for peri-operative cardiac device management.
For use when the device has not been programmed specifically for the operation/procedure.

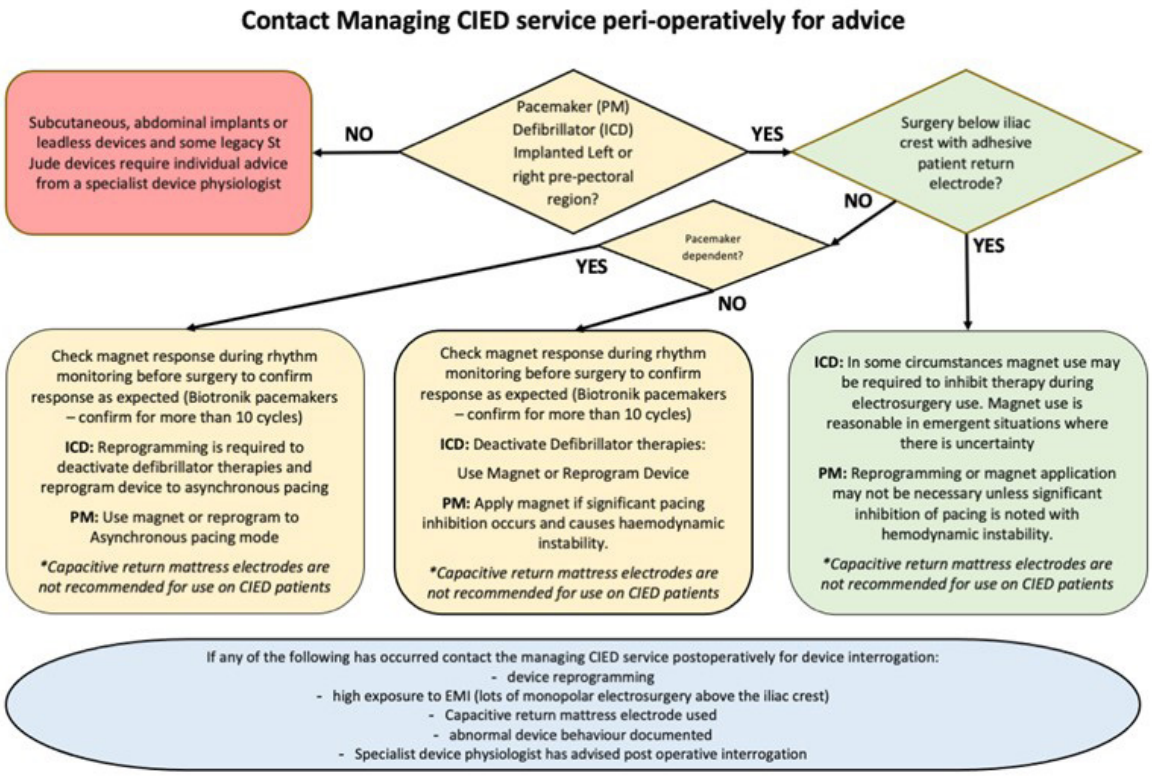
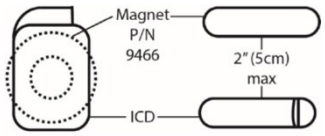
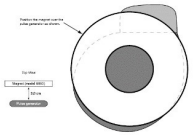
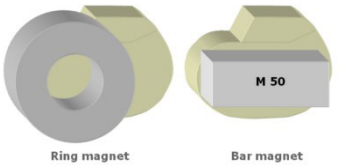


Table 1: Magnet response—defibrillators.

Summary of magnet application to ICDs—modified from Jacobs et al., Heart Rhythm Society/American Society of Anesthesiologists expert consensus statement on peri-operative management of patients with CIEDs and the European Heart Rhythm Association consensus on prevention and management of interference due to medical procedures in patients with CIEDs.[1,2,14,17]						
Company	**Magnet placement**	**Tachy/shock therapy**	**Tone emitted with magnet**	**Effect on Pacer component of ICD**	**Can ICD be programmed to ignore magnet?**	**Notes**
Medtronic	Directly over device[18]  	Suspended—while magnet *in situ*	Yes Loud and continuous for 30 seconds if normal function Alternating tone indicates an alert warranting a device interrogation	None	No	
Boston Scientific	Directly over device—transvenous and 101 SQ-RX[19]  Emblem subcutaneous ICD. Off-centre over header or lower[19] 	Suspended*—while magnet *in situ* *unless programmed to change therapy	Yes R-wave synchronous tones (very faint, not loud); use stethoscope to hear if required NB: If patient has had an MRI the beeper function may be permanently disabled. Verify beeper function before surgery	None	Yes (but very rare)* *Can be programmed off or to trigger EGM in some legacy models	

2024 Feb 23; 137(1590). ISSN 1175-8716
https://www.nzmj.org.nz/
©PMA

Table 1 (continued): Magnet response—defibrillators.

Biotronik	Directly over device Ring magnets should be offset slightly so that the opening of the magnet rests above the edge of the ICD housing 	Suspended—while magnet *in situ*, limit of 8 hours	None	None	No	Will revert to normal function after 8 hours unless magnet is removed and replaced
St Jude (Abbott)	Curve of donut over left or right side of device 	Suspended*—while magnet *in situ* *unless programmed to ignore	None May vibrate* *If vibrates, device interrogation is warranted	None	Yes (very rare)* *Can be programmed to ignore magnet	

2024 Feb 23; 137(1590). ISSN 1175-8716
https://www.nzmj.org.nz/ ©PMA

Table 1 (continued): Magnet response—defibrillators.

Liva Nova (previously ELA/Sorin)	Magnet should be positioned off-centre, avoiding the header at the top of the device	Suspended—while magnet *in situ*	None	Converts pacer rate to 96–85ppm depending on battery life. Pacing mode unchanged		No option to convert to asynchronous pacing mode

NB: Magnet removal will restore shock and anti-tachycardia therapies

2024 Feb 23; 137(1590). ISSN 1175-8716
https://www.nzmj.org.nz/ ©PMA

Table 2: Magnet response—PPM.

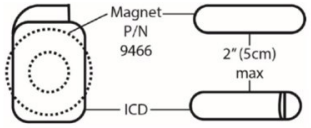
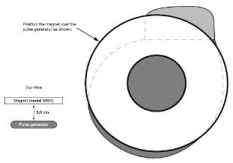
Summary of magnet application to PPM—modified from Jacobs et al., Heart Rhythm Society/American Society of Anesthesiologists expert consensus statement on peri-operative management of patients with CIEDs and the European Heart Rhythm Association consensus on prevention and management of interference due to medical procedures in patients with CIEDS.[1,2,14]					
Company	**Magnet placement**	**Default response**	**Tone emitted with magnet**	**Can PPM be programmed to ignore magnet?**	**Notes**
Medtronic	Directly over device*  	DOO/VOO/AOO—while magnet *in situ* 85ppm if device conditions are normal 65ppm if device is at RRT or device reset has occurred—a full device interrogation is warranted Normal function resumes 2 seconds after removal of magnet *Micra Leadless Pacemaker has no magnet response	No	Magnet operation does not occur if telemetry between device and programmer is established or if MRI Surescan is programmed on	AV delay 100ms in DOO Azure 100ppm for 5 beats then default response Adapta™/Versa™/Sensia™ TMT 100bpm with the amplitude reduced by 20% on the third pulse, then default response. For certain legacy models (Kappa, Enpulse, Adapta, Versa or Sensia), the magnet response is suspended for 1 hour following a device interrogation unless manual "clear data" command is chosen prior to ending the programmer session
Boston Scientific	Directly over device 	DOO/VOO/AOO—while magnet in situ 100ppm if device conditions are normal 90ppm if device is at 1 year or less battery life 85ppm RRT	No	Yes—can be programmed to store EGM Current devices restore magnet function after 1 stored EGM or 60 days elapse. Legacy devices require magnet function to be programmed back on	AV delay 100ms in DOO The third pulse during async magnet response is issued at 50% of the programmed pulse width—consider reassessing safety margin if loss of capture is observed

Table 2 (continued): Magnet response—PPM.

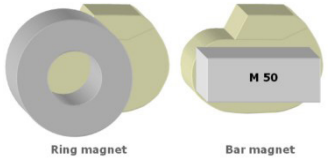
Biotronik	Directly over device  	Magnet response: auto* DOO/VOO/AOO 90ppm for 10 beats (80ppm @ ERI) then programmed mode and rate (PR -11% @ERI) Async* DOO/VOO/AOO 90ppm (80ppm @ ERI)—while magnet *in situ* Sync* programmed mode/rate—stores 10 second EGM (PR -11% @ ERI) rate response disabled	No	*Yes—3 modes available async/sync/auto	
St Jude (Abbott)	Curve of donut over left or right side of device* except leadless devices *Leadless PPM—a magnet applied over the apex of the heart 	DOO/VOO/AOO @100ppm—while magnet *in situ* Magnet rate gradually decreases over time 85ppm ERI *Aveir VOO 100ppm—while magnet *in situ* *Nanostim VOO 90ppm (65ppm @ ERI) —while magnet *in situ*	No	Yes—off, EGM store Vario (legacy devices)	Legacy devices that are subject to a safety alert make them more susceptible to transient anomalous device function during electrosurgery. This refers to a specific subset of legacy generation SJM PPM (SJM Affinity, Entity, Integrity, Identity, Verity, Frontier, Victory, Zephyr)[5] *Leadless PPM: The effectiveness of magnets varies. If one magnet does not cause magnet response, place a second magnet on top of the first or try a different magnet. Pressing firmly on the magnet to decrease the distance between the magnet and the pulse generator can also help

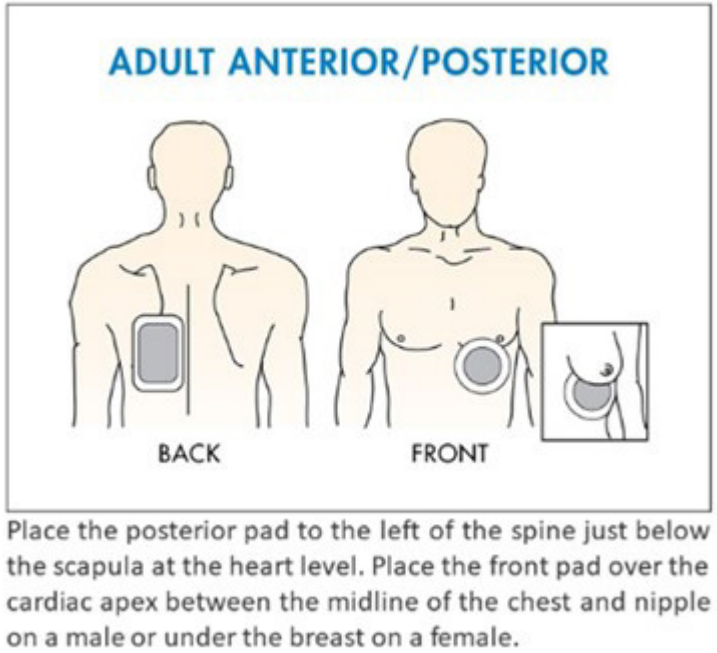
Table 2 (continued): Magnet response—PPM.

Liva Nova (previously ELA/Sorin)	Magnet should be positioned off-centre, avoiding the header at the top of the device	DOO/VOO/AOO 96ppm—while magnet *in situ* Gradual decrease to 80ppm ERI	No	Yes—off	

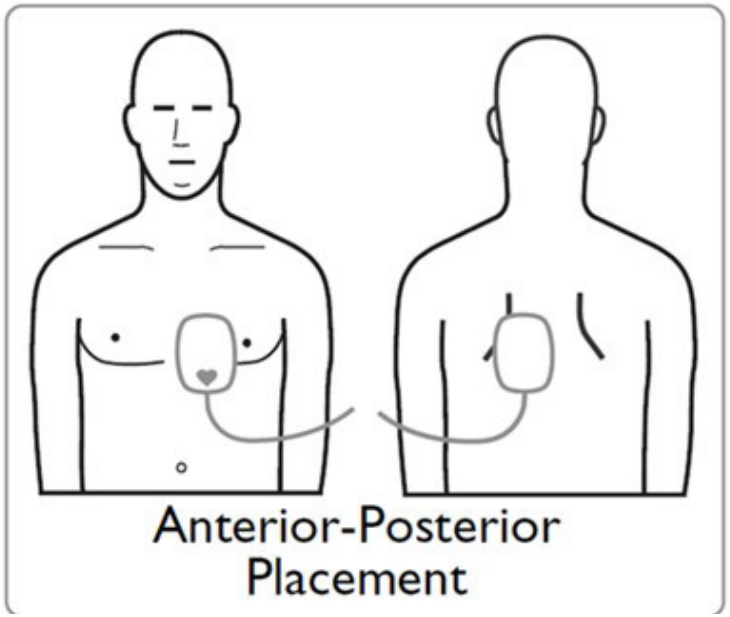
NB: Magnet rate lower than default values indicates battery depletion. Some devices require more eccentric application of magnet in regard to generator casing to optimise magnetic field alignment.

Figure 2: Defibrillator pad placement for cardioversion—adults anterior/posterior.

NB: Pads should always be placed >15cm away from CIED.



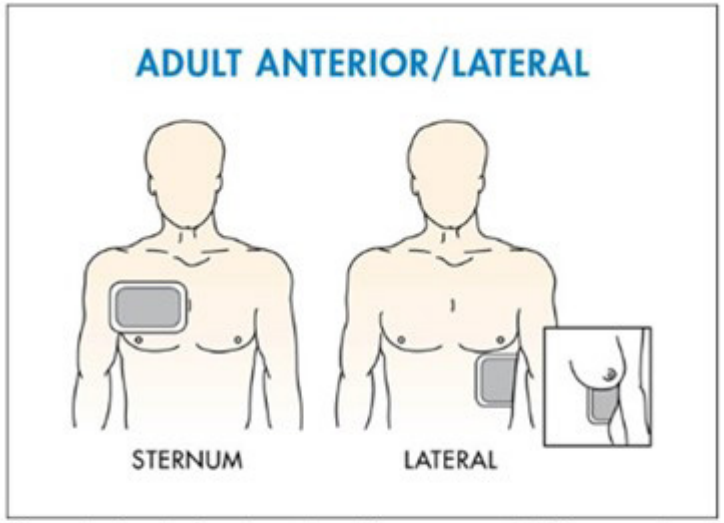
Reproduced with permission from Zoll Medical: Defibrillator Pad Placement, ZOLL Medical.[25]



Reproduced with permission from Philips HeartStart HS1/FRx: AED User Guide.[2]

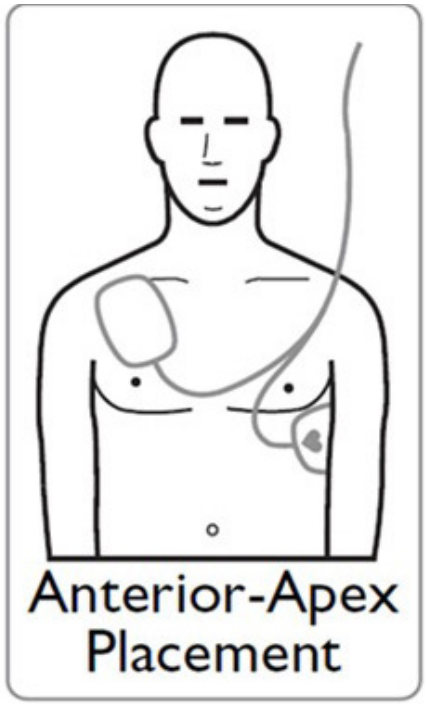
Figure 3: Defibrillator pad placement for cardioversion—adults anterior/anterior lateral.
Some studies have indicated anterior–lateral electrode positioning is more effective for biphasic cardioversion of AF.[23]

NB: Pads should always be placed >15cm away from CIED.



One electrode is placed on the upper right torso above the right nipple, just below the clavicle, and the other (lateral) pad should align with the bottom portion of the left pectoral muscle on a male patient or under the left breast on a female patient with the centre of the electrode in the mid axillary line.

Reproduced with permission from Zoll Medical: Defibrillator Pad Placement, ZOLL Medical.[25]



Reproduced with permission from Philips HeartStart HS1/FRx: AED User Guide [26]