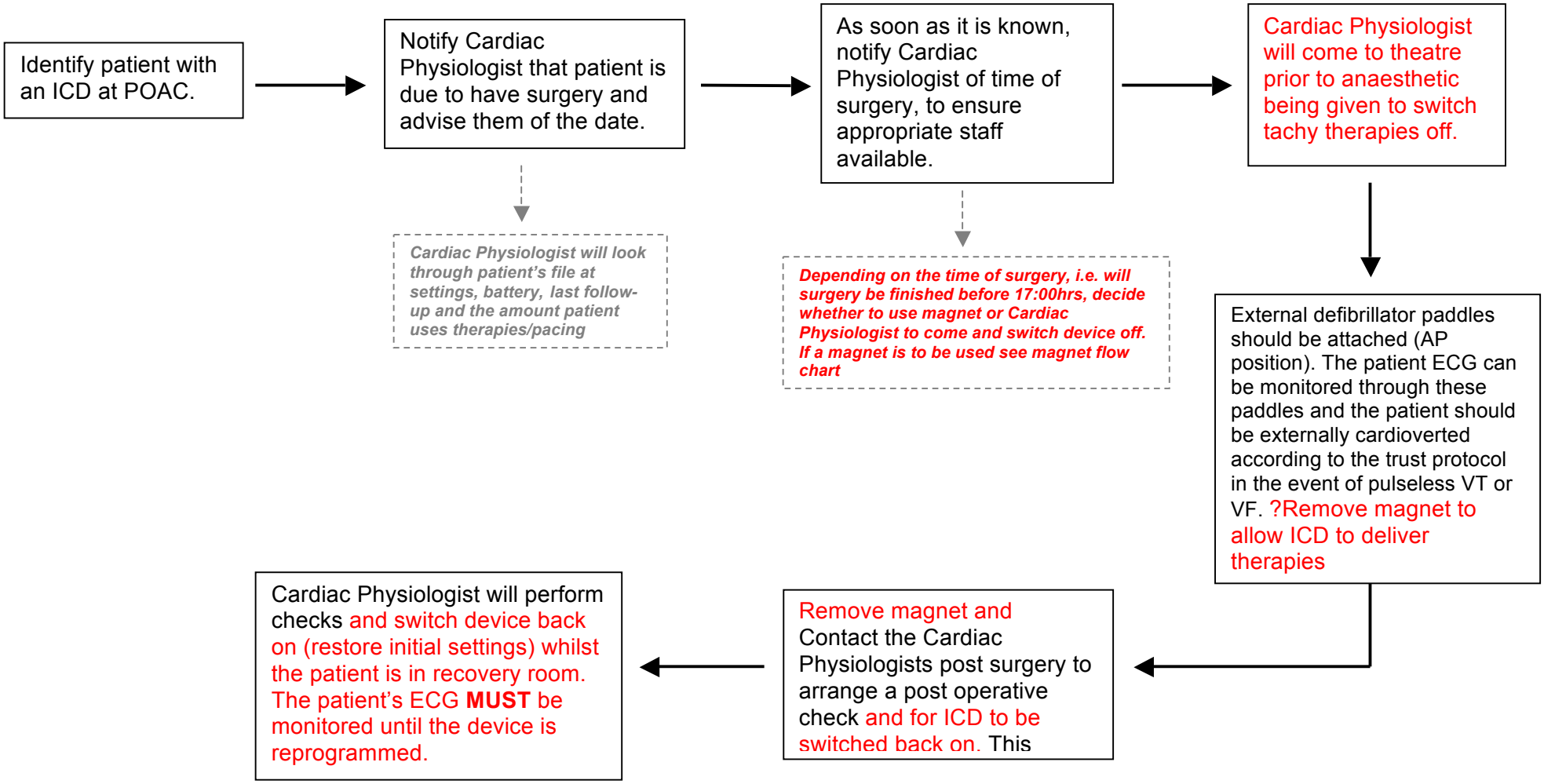
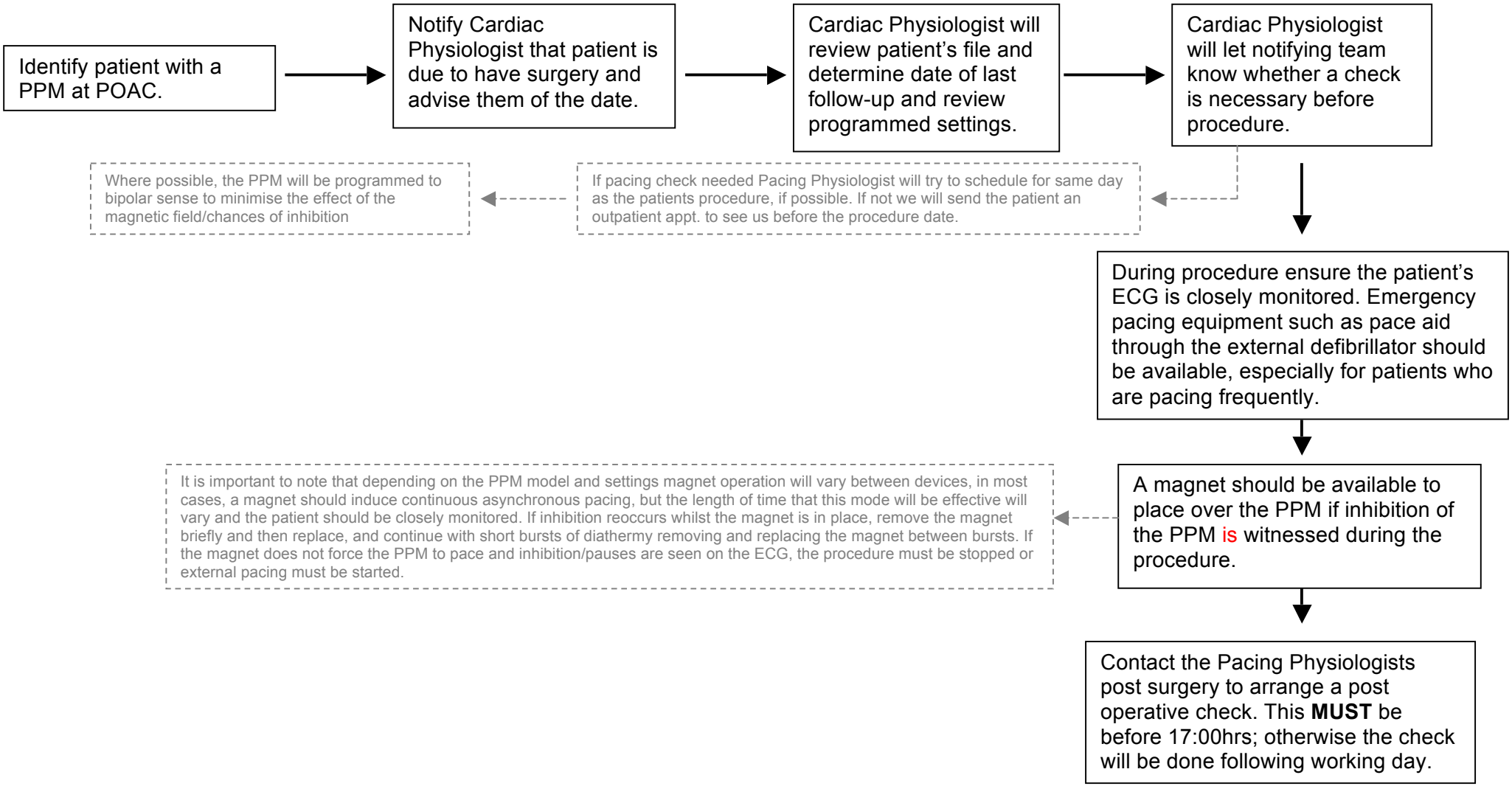
Flowchart for ICD patients undergoing Surgery or procedures involving diathermy/magnetic fields

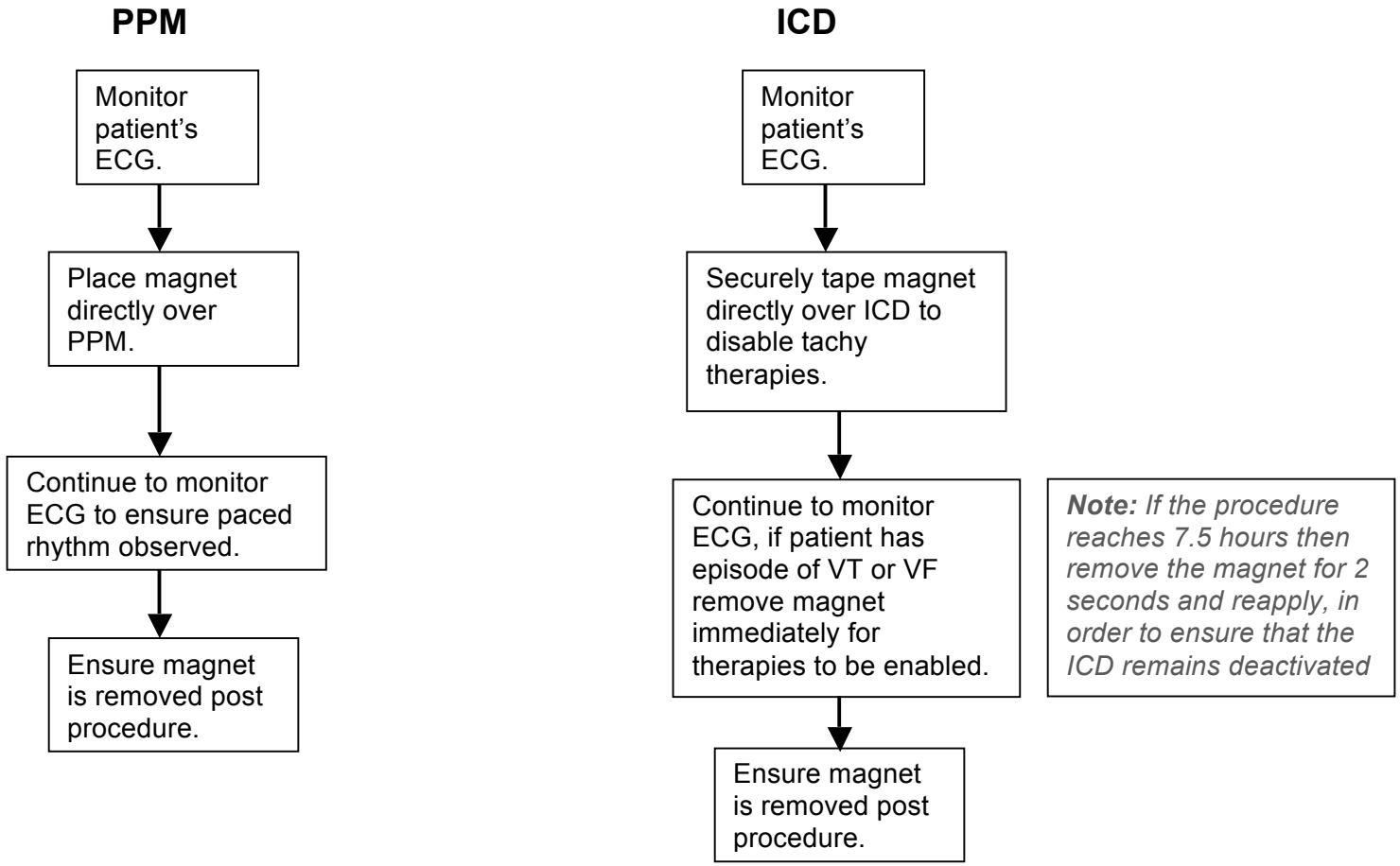


Flowchart for PPM patients undergoing Surgery or procedures involving diathermy/magnetic fields



How to use a magnet

Any magnet will affect the functioning of an ICD or PPM. The Pacemaker clinic will provide 3 magnets so a magnet should always be available in theatre.



Appendix. Detailed explanation of Key points and Management advice

Surgical Diathermy and Cardiac PPMs or ICDs

Devices can be adversely affected by surgical equipment in 2 ways:

1. Diathermy in particular directly interferes with PPM/ICD function if the electrical pulses of the diathermy current are detected by the device, when they will be recognised as heart beats.
2. The generator for the equipment (or any electrical equipment) may generate a sufficient magnetic field to interfere with the PPM programming.

False detection of electrical signals as cardiac signals will suppress PPM function and effectively turn the device off. This does not matter if the patient has a normal underlying rhythm (common in ICD patients), and may not matter much in patients who only have occasional pacing requirements, but some paced patients will be totally dependent upon their device for any cardiac function and others will only have a very slow ventricular escape rhythm with which they may have an extremely poor cardiac output.

False detection of diathermy signals by an ICD can be recognised as a ventricular arrhythmia and trigger ICD activity to attempt to correct it. This activity may be Anti-Tachycardia Pacing or shocks. When ATP occurs inappropriately this may trigger VF and also lead to shocks. Inappropriate shocks can occasionally be fatal.

Pulsatile magnetic fields may re-program the PPM. The precise effects are unpredictable. A continuous magnetic field applied to the device will affect PPMs and ICDs differently. PPMs will generally be switched into a fixed rate continuous pacing mode, which is a safe mode of function. ICDs do not have their pacing function altered but the magnetic field will suspend all anti-tachycardia therapy.

Occasionally powerful external fields can damage the pacing circuitry and alternating fields such as those found in an MRI scanner can heat the leads to dangerous temperatures.

For further information see Salukhe et al. British Journal of Anaesthesia 93 (1): 95-104 (2004), DOI: 10.1093/bja/aeh170.

Detailed Management During Surgery

1. Electrocardiographic monitoring.

2. Remember that most ECG monitors will detect pacing spikes as a heart beat. It is generally the case that if the PPM/ICD was functioning correctly at the outset, pacing spikes will equate to heart beats. However, if the patient becomes very ill, and develops a significant acidosis for instance, this might cause an acute threshold rise, when pacing spikes would not necessarily trigger a cardiac response.

3. Haemodynamic monitoring. This could be just BP or more complex.

   Be aware that 90% of ICD patients and all cardiac resynchronisation therapy (CRT) PPM patients, by definition have very sick hearts with poor function and will need careful monitoring. Simple PPM patients will generally not have very poor LV function otherwise they would have been upgraded to an ICD or CRT.

4. Use bipolar diathermy and try to keep as far away from the device as possible.

5. Use the lowest practicable energy.

6. If unipolar diathermy must be used place the return electrode as far away from the device as possible (usually on the opposite (L/R) leg)

   If interference is observed but diathermy is essential try reducing the power and only use in short bursts.

7. Have a defibrillator with external pacing capability available.

8. Have a magnet available, which can be fixed over the device.

9. Pacing modes could be altered in advance of surgery by liaison with the pacing department.

   For instance a patient who is known to have interacted in the past could have their device temporarily switched to a fixed (continuous) pacing mode, although this would generally produce a less favourable haemodynamic response. ICD patients could have their therapies suspended. However if therapies are suspended the patient will be at risk from untreated ventricular arrhythmia, which may be triggered by the stress of surgery. It is therefore essential for such patients to apply remote external defibrillator pads to the patient during the pre-op preparation.