Patient

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# Implantable cardioverter defibrillators

## What are implantable cardioverter defibrillators?

Implantable cardioverter defibrillators (ICDs) are battery-powered devices that deliver an electrical shock to restore normal sinus rhythm when a life-threatening arrhythmia is detected.[1]

They can also record abnormal rhythms, which is helpful once a shock has been delivered. They tend to be used in conjunction with anti-arrhythmic drugs. The first ICD was implanted in 1980. ICDs are:

- Similar in size to a pacemaker.
- Placed under the skin in the pectoral region.
- Have a lead in the right ventricular apex.

ICD devices are being improved daily and newer devices can also function as a pacemaker.

### Risk factors for sudden cardiac death

These include:[2]

- Previous ventricular arrhythmia (ventricular tachycardia - VT).
- Coronary artery disease.
- Familial cardiac conditions (for example, long QT syndrome).
- Poor cardiac function (low ejection fraction).

**NB**: people who survive a first episode of a life-threatening VT are at high risk of further episodes.[1]

# Indications[3]

National Institute for Health and Care Excellence (NICE) guidance recommends that ICDs should be considered for patients in the following categories: [1]

### Primary prevention

- Previous myocardial infarction and either:
    - Left ventricular ejection fraction (LVEF) <35% and non-sustained VT on Holter monitoring and inducible VT; or
    - LVEF < 30% and broadened QRS duration (>120 milliseconds).
- Familial conditions associated with sudden cardiac death (for example, long QT syndrome, hypertrophic cardiomyopathy, Brugada's syndrome or arrhythmogenic right ventricular dysplasia). This may also include those who have had a surgical procedure for congenital heart disease.

### Secondary prevention

- Survived a VF- or VT-induced cardiac arrest.
- Spontaneous sustained VT associated with haemodynamic compromise or syncope.
- Sustained VT without syncope or cardiac arrest with LVEF <35%.

These are similar to the indications advocated in the USA.[4]

The ICD leads are inserted via a vein, under local anaesthesia. During implantation the unit is tested under conscious sedation. ECG storage provides a retrievable record of the onset and termination of arrhythmias. Programming changes are made with a unit placed over the defibrillator.

# Device details

Current ICD devices use tiered pacing, recognising cycle length, and can initiate the following appropriate therapy, all via single lead: [1]

- Anti-bradycardia pacing (like a normal pacemaker).

- Pacing pulses (may cause brief palpitations or a feeling of dizziness) - adaptive bursts to end a VT.
- Cardioversion shocks for persisting VT (if pacing pulses fail, low-energy cardioversion shocks are given to terminate VT with the minimum of pain).
- Defibrillation shocks (high-energy shocks - feels like being kicked in the chest unless unconscious). Observers will notice the jolt. No harm comes to anyone touching the patient when they receive the shock.

# Patient information

### Postoperatively

- It is safe to have a bath or shower after 3-4 days.
- Keep the arm on the same side as the defibrillator below shoulder level until after the first ICD check-up (there is a small chance the leads can move).
- Do gentle arm and shoulder exercises to keep the arm mobile.
- Following recovery (4-6 weeks) increase your level of activity if possible.
- A programmer is used to check device settings (takes about 15 minutes).
- CXR is used to check lead positions.
- Battery lifespan is 6-7 years.

### Further patient information

- Change of ICD is like having a first ICD fitted, except new leads are not put in.
- You may have some warning that your ICD is about to deliver a shock (palpitations, or feeling dizzy). Afterwards you should recover quite quickly.
- After the first shock, contact the implant centre to have the device checked.

- It is not necessary to have the device checked after every shock unless you feel unwell.
- If the device gives several shocks, dial 999/112/911 for an ambulance - the ICD will be checked to find out why.

### Lifestyle changes

- Keep your ICD card with you at all times (make, model and settings of the device).
- Sexual activity - the device will not cause any harm, even if a shock is delivered to you during intercourse.
- Electrical equipment (such as drills) can be safely used. Electromagnetic interference (radios, fridges, cookers, computers and microwaves) will not affect your ICD.
- Travel: the ICD may set off the airport security alarm. Your ICD will be unharmed provided you walk briskly through the arch. Many ICD clinics carry a list of ICD-friendly insurance companies.
- Arc welding - should be avoided.
- Mobile phones - keep handsets six inches away from the ICD (hold the phone over the ear on the opposite side to the device).

### Driver and Vehicle Licensing Agency (DVLA)

The DVLA rules are subdivided according to whether the ICD inserted for ventricular arrhythmias is associated with or without incapacity. The rules include:[5]

#### Associated with incapacity

- Cannot drive for six months after the procedure.
- Cannot drive for a further six months after any shock therapy and/or symptomatic anti-tachycardia pacing.

- A period of two years if after device implantation incapacity results (this could be from the device or an arrhythmia) unless:
    - It is proven to be an inappropriate shock (eg, atrial fibrillation); or
    - The shock was appropriate but measures to prevent it have been undertaken (can drive after six months).
- Can not drive for one month after any alteration of the leads or change to anti-arrythmics.
- Cannot drive for one week following a change of the ICD box.

**Not associated with incapacity**

- Can drive after one month if stable, non-sustained VT provided LVEF >35%, no inducible fast VT and any induced VT is terminated (needs to be shown twice).
- If, subsequently, the ICD provides a shock then the driving rules revert to the same as those 'associated with incapacity'.
- For ICDs inserted prophylactically, patients can drive one month after implantation - if, however, they subsequently receive a shock then they too fall under the 'associated with incapacity' rules.

Group 2 drivers (eg, lorry or bus drivers) - there are no subdivisions that apply and they are permanently barred.

# Adverse events

Serious adverse events due to ICDs are reported infrequently. However, recorded complications include:[6]

- Inappropriate ICD discharge is reported between 8-29%.[7] [8]
- Infection.
- Haematomas and bleeding.
- Leads which may dislodge and migrate.
- Cardiac perforation.

- Pleural effusion and pneumothorax.
- Device dysfunction/malfunction of the generator.

Additionally, some people, for whom defibrillation is initiated while they remain conscious, report that they become fearful of the severe jolt to the thorax occasioned by device activation.

## Outcomes [3] [4]

ICDs have been shown to reduce mortality in secondary prevention in a number of large, prospective, randomised controlled trials compared with anti-arrhythmic medications.

The data, however, are less robust for primary prevention, although benefit is apparent with lower LVEF, thus inclusion of this criteria in the recommendations.

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## Further reading

- Guidelines for the perioperative management of patients with implantable pacemakers or implantable cardioverter defibrillators where the use of surgical diathermy/electrocautery is anticipated; Medicines and Healthcare products Regulatory Agency (2006)
- Zeppenfeld K, Tfelt-Hansen J, de Riva M, et al; 2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. Eur Heart J. 2022 Oct 21;43(40):3997-4126. doi: 10.1093/eurheartj/ehac262.

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