NICE guidelines for use of implantable cardioverter defibrillators

Ventricular arrhythmias are a significant cause of mortality in the western world with over 100 000 deaths per year in the UK alone (National Institute for Health and Care Excellence (NICE), 2014). Since the advent of implantable cardioverter defibrillators and advances in the technology, their use in prevention of sudden cardiac death has increased over the last two decades.

Implantable cardioverter defibrillators

An implantable cardioverter defibrillator is a simple device, with a lead fitted with a shock coil implanted via the transvenous approach into the right ventricular wall. The device senses the electrical activity of the heart in real time, and continuously monitors the electromyogram representing the heart's electrical activity. The device recognizes normal as well as abnormal rhythms, and by using a complex set of computer programmes can detect when a patient's heart enters a potentially life-threatening rhythm. Once it detects such a rhythm, the implantable cardioverter defibrillator charges and delivers a shock through its coil into the ventricular myocardium in an attempt to terminate the arrhythmia and restore the patient's regular underlying rhythm.

Although potentially life-saving in the majority of patients who have them, a major drawback is the delivery of inappropriate shocks which can occur as a result of the device incorrectly interpreting a rhythm as ventricular tachycardia (most commonly atrial fibrillation and supraventricular tachycardia). This can be ameliorated by the use of concomitant medications such as beta-blockers to help control the rate of abnormal rhythms which can be misinterpreted by the implantable cardioverter defibrillator.

Following a review of the studies looking at indications for implantable cardioverter defibrillator use the NICE (2014) published updated guidance on which patients should receive these devices. The newer data have shown that some patients who would previously only have been given medical therapy could actually benefit from implantable cardioverter defibrillator implantation.

Much of the guidance remains unchanged and implantable cardioverter defibrillators are still indicated in patients with the following conditions:

1. Survived a ventricular tachycardia or ventricular fibrillation arrest with no identifiable precipitant
2. Have ventricular tachycardia causing haemodynamic compromise or syncope
3. Have sustained ventricular tachycardia and have a left ventricular ejection fraction of <35% and symptoms no worse than New York Heart Association (NYHA) class III
4. Have a genetic disorder (such as hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy, Brugada syndrome or long QT syndrome) which puts the patient at higher risk of sudden cardiac death.

The majority of the data suggest that giving these patients an implantable cardioverter defibrillator as opposed to medical therapy alone improves overall survival (Connolly et al, 2000).

The main changes to the guidelines become evident when addressing the problem of primary prevention of sudden cardiac death in patients who have had a previous myocardial infarction and have heart failure. New data which have been published since the release of the first NICE guidelines in 2006 suggest broadly that patients with heart failure and previous myocardial infarction can benefit from a device, and the type of device chosen depends upon NYHA class and electrocardiogram findings for all patients with a left ventricular ejection fraction <35%. These patients may be entitled to an implantable cardioverter defibrillator alone, a cardiac resynchronization therapy–implantable cardioverter defibrillator combined, or a cardiac resynchronization therapy–pacemaker device alone.

Cardiac resynchronization therapy

Cardiac resynchronization therapy devices are similar to pacemakers in that they consist of a pacemaker 'box' with leads connecting it to the ventricular myocardium and sending regular impulses to stimulate ventricular contraction. The main difference between the two is the addition of a left ventricular as well as a right ventricular lead in a cardiac resynchronization therapy device. This additional lead acts to restore synchronous contraction of the left and right ventricle, allowing an even flow of blood through both chambers and therefore a more physiological cardiac output.

Asynchronous ventricular contraction is encountered in patients with a very broad QRS complex (>150 ms) and in those with left bundle–branch block. By restoring synchronous ventricular contraction using cardiac resynchronization therapy, clinical trial data have shown an improvement in symptoms of heart failure and a lower number of heart failure-related hospital admissions. A post meta-analysis review by the NICE (2014) committee revealed a reduction in all-cause mortality.

Patients who meet the criteria for cardiac resynchronization therapy devices may also need implantable cardioverter defibrillator therapy, and careful consideration must be given to these patients to ensure the correct device is implanted. As a result of these findings, the 2014 NICE guidelines reflect this change and specify which type of device should be implanted depending on NYHA class and QRS morphology (NICE, 2014) (*Table 1*).

In broad terms, those patients with mild to moderate symptoms of heart failure (NYHA class I–III) and significant interventricular conduction delay causing dyssynchrony (defined as a QRS >150 ms or left bundle–branch block) should be offered a cardiac resynchronization therapy–implantable cardioverter defibrillator. The caveat is a patient who is NYHA class

I with a QRS duration <150 ms since the benefit here is not definite. Since the evidence primarily looked at patients with class II symptoms, class III patients can be offered either device on a case-by-case basis since the data still support either therapy in this population (NICE, 2014).

Patients with non-ischaemic or dilated cardiomyopathy do not benefit from implantable cardioverter defibrillator therapy in the same way as those described so far. Clinical trials looking at the benefit of implantable cardioverter defibrillator therapy *vs* medical therapy in this group of patients (DEFINITE (Kadish et al, 2004) and AMIOVERT (Strickberger et al, 2003) trials) found no significant difference in all-cause mortality. Although a meta-analysis of these clinical trials revealed a decrease in sudden cardiac death in the implantable cardioverter defibrillator group, the recommendation remains not to implant implantable cardioverter defibrillators into these patients as there is not enough evidence supporting this.

Conclusions

Implantable cardioverter defibrillator therapy has come a long way since its introduction in the 1980s. New advances in technology allow for combination therapy with implantable cardioverter defibrillators and heart failure devices, and the current literature has proven their usefulness. Careful consideration must be given to the treatment modality selected for each patient by taking an accurate history of symptoms, interpretation of electrocardiogram findings and determination of left ventricular function using echocardiography. BJHM

Bunny Saberwal
Specialist Registrar
North Middlesex University Hospital
London N18 1QX
(b.saberwal@nhs.net)
Syed Ahsan
Consultant Cardiologist and Electrophysiologist
The Heart Hospital
London

Table 1. Treatment options with implantable cardioverter defibrillator or cardiac resynchronization therapy for patients with heart failure

	New York Heart Association class			
QRS duration	I	II	III	IV
<120 ms	ICD if there is high risk of sudden cardiac death			Device not clinically indicated
120–149 ms without left bundle–branch block	ICD	ICD	ICD	CRT-P
120–149 ms with left bundle–branch block	ICD	CRT-D	CRT-D or CRT-P	CRT-P
>150 ms with or without left bundle–branch block	CRT-D	CRT-D	CRT-D or CRT-P	CRT-P

From National Institute for Health and Care Excellence (2014). CRT-D = cardiac resynchronization therapy device with defibrillator; CRT-P = cardiac resynchronization therapy device without defibrillator; ICD = implantable cardioverter defibrillator.

Connolly SJ, Hallstrom AP, Cappato R et al (2000) Meta analysis of the implantable cardioverter defibrillator secondary prevention trials. AVID, CASH and CIDS studies. Antiarrhythmics vs Implantable Defibrillator study. Cardiac Arrest Study Hamburg. Canadian Implantable Defibrillator Study. *Eur Heart J* **21**(24): 2071–8 (doi: 10.1053/euhj.2000.2476)

Kadish A, Dyer A, Daubert JP et al; Defibrillators in Non-Ischemic Cardiomyopathy Treatment Evaluation (DEFINITE) Investigators (2004) Prophylactic defibrillator implant in patients with non-ischemic dilated cardiomyopathy. *N Engl J Med* **350**: 2151–8 (doi: 10.1056/NEJMoa033088)

National Institute for Health and Care Excellence (2014) Implantable cardioverter-defibrillators and cardiac resynchronisation therapy for arrhythmias and heart failure (Review of TA95 and TA120). Nice Technology Appraisal Guidance 314. www.nice.org.uk/guidance/ta314/chapter/1-Guidance (accessed 19 March 2015)

Strickberger SA, Hummel JD, Bartlett TG, AMIOVERT Investigators (2003) Amiodarone versus implantable cardioverter-defibrillator: randomized trial in patients with nonischemic dilated cardiomyopathy and asymptomatic nonsustained ventricular tachycardia-AMIOVIRT. *J Am Coll Cardiol* **41**: 1707–12 (doi: 10.1016/S0735-1097(03)00297-3)

KEY POINTS

- Ventricular arrhythmias are a significant cause of mortality in the western world.
- Implantable cardioverter defibrillators are proven to reduce mortality in patients at high risk of sudden cardiac death.
- Cardiac resynchronization therapy devices combined with implantable cardioverter defibrillators are used to treat patients with heart failure, and more patients will now benefit from these devices given the new guidelines.