Recent Advances in Management of Patient Receiving Implantable Cardiac Defibrillator Shocks

An Essay
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By

Asmaa AbdAllah Ali Elshahawy
M.B.B.CH Under

supervision of

Prof.Dr. Mostafa Kamel Reyad
Professor of Anesthesia and Intensive Care Medicine
Faculty of Medicine-Ain Shams University

Dr. Walid Hamed Nofal
Lecturer of Anesthesia and Intensive care Medicine
Faculty of Medicine-Ain Shams University

Dr. Ahmed Salah eldeen omran
Lecturer of Anesthesia and Intensive care Medicine
Faculty of medicine-Ain Shams University

Faculty of Medicine
Ain Shams University

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First of all and above all ….

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Asmaa Abd ALLAH El shahawy

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LIST OF ABBREVIATIONS

ACC/AHA American College of Cardiology/ American Heart Association

AMIOVIRT Amiodarone Versus Implantable Cardioverter Defibrillator Trial

ATP AntiTachycardia Pacing

AVID The Antiarrhythmics versus Implantable Defibrillators

CABG Coronary Artery Bypass Graft

CASH The Cardiac Arrest Study Hamburg

CIDS The Canadian Implantable Defibrillator Study

CRT Cardiac Resynchronization Therapy

CRT_D CRT Defibrillators

DEFINITE Defibrillators in Nonischemic Cardiomyopathy Treatment Evaluation

EMI Electro Magnetic Interference

EPS European Physical Society

ES Electrical Storm

FU Follow UP

HRS Health and Retirement Study

ICD Implantable Cardioverter Defibrillator

LVEF Left Ventricular Ejection Fraction

MADIT	Multicenter Automatic Defibrillator Implantation Trial
MI	Myocardial Infarction
MUSTT	Multicenter Unsustained Tachycardia Trial
NYHA	New York Heart Association
OPTIC	Optimal Pharmacological Therapy in Cardioverter Defibrillator Patient
QOL	Quality of Life
REM	Rapid Eye Movement
S_ ICD	Subcutaneous Implantable Defibrillator
SCA	Sudden Cardiac Arrest
SCD-HEFT	Sudden Cardiac Death in Heart Failure Trial
SMS	Short Massages Service
TENS	Transcutaneous Electronic Nerve Stimulation
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

Introduction

Sudden cardiac arrest (SCA) is the sudden, abrupt loss of heart function generally caused by a rapid, irregular rhythm of the ventricles (ventricular tachycardia [VT] or ventricular fibrillation [VF]). These arrhythmias result in quivering ventricles that cannot pump blood to the body. Loss of consciousness and pulse follow within seconds. In most of cases, SCA is fatal leading to sudden cardiac death (SCD) . SCA, an electrical conduction problem, is not the same as a heart attack (myocardial infarction [MI]), which is caused by a blocked vessel leading to loss of blood supply to a portion of the heart muscle. **(Pell ., ٢٠٠٨)**

The implantable cardioverter-defibrillator (ICD) has revolutionized the treatment of patients at risk for sudden cardiac death due to ventricular tachyarrhythmia's. Initially introduced in humans in ١٩٨٠ and approved by the FDA in ١٩٨٥, the ICD has evolved from a treatment of last resort to a first-line treatment and prophylactic therapy for patients at risk for ventricular tachycardia (VT) or ventricular fibrillation (VF) ***(Moss et al., d).***

Sudden cardiac death (SCD) resulting from fatal ventricular arrhythmias is one of the most common causes of death in the developed world. Patients suffering from a potentially fatal arrhythmia are at risk of death before they even reach medical intervention and out-of-hospital survival rates are low ***(Pell JP., .)***Immediate defibrillation treatment is the only remedy for arrhythmic sudden death

caused by hemodynamic ally compromising ventricular tachycardia (VT) and ventricular fibrillation (VF)*(Moss et al.,*).

The implantable cardioverter-defibrillator (ICD) has seen dramatic changes in design to accommodate its role in preventing sudden cardiac death, particularly giving the fact that anti-arrhythmic drug therapy has proven to be of limited use and in some instances increased the risk of death *(Zheng etal.,*). This said, it is still universally accepted that treatment with beta-blockers and ACE-inhibitors reduce the risk of sudden cardiac death and should therefore be administered to those patients that are not contraindicated *(American Heart Association.,*), Of those patients who do survive a potentially fatal arrhythmia, the implantation of an ICD has proved invaluable to their continued survival as these patients are at an especially high-risk of ventricular arrhythmia recurrence *(Moss et al.,*).

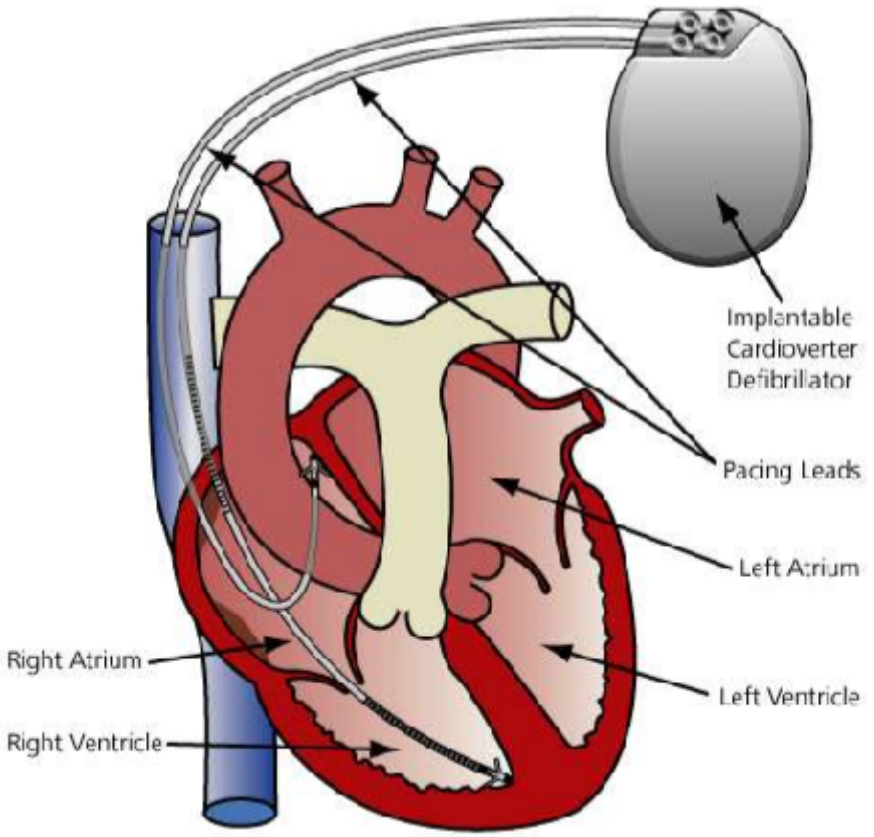
Aim of the Work

To provide guidance for the management of patients who are receiving one or multiple shocks from an ICD, and expresses the view of a multidisciplinary group of experts in the fields of general adult cardiology, ICD treatment, invasive electrophysiology, and psychosomatic medicine. A variety of clinical settings, including emergency medicine, general cardiology, and interventional electrophysiology, are addressed as well as the different groups of clinicians involved in the care of these patients. To cover different levels of expertise in ICD treatment, it is intended to provide comprehensive information ranging from a basic explanation of how an ICD works to specialist advice for device programming.

Back ground of Implantable Cardiac Defibrillator

The Components of implantable cardioverter–defibrillator system

The ICD System



(Figure)

(Mirowski et al., d).

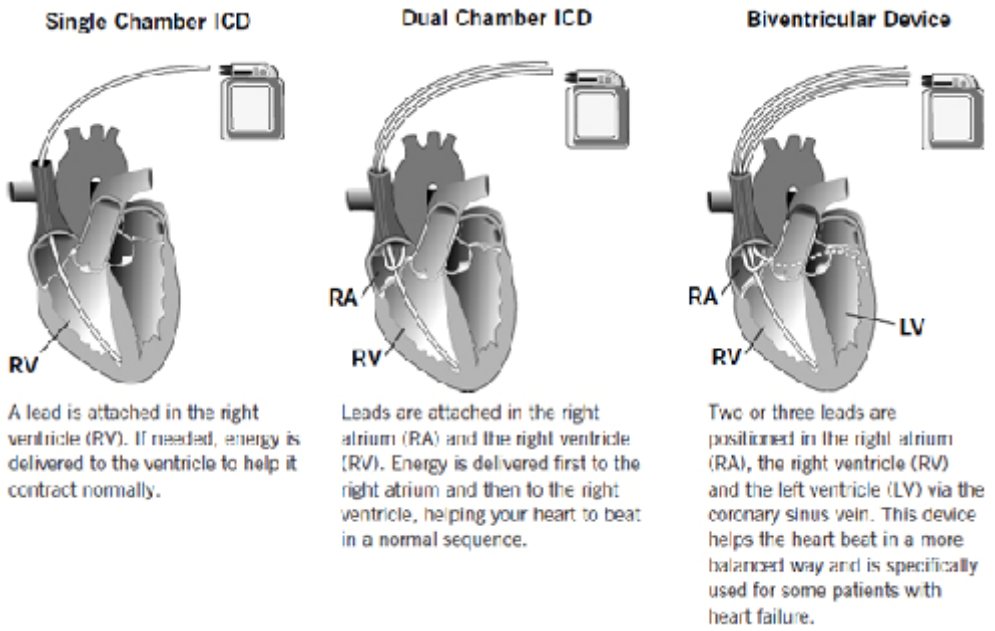
An **implantable cardioverter-defibrillator** (**ICD**) is a small battery-powered electrical impulse generator which is implanted in patients who are at risk of sudden cardiac death due to ventricular fibrillation and ventricular tachycardia. The device is programmed to detect cardiac arrhythmia and correct it by delivering a jolt of electricity. In current variants, the ability to revert ventricular fibrillation has been extended to include both atrial and ventricular arrhythmias as well as the ability to perform biventricular pacing in patients with congestive heart failure or bradycardia(***Mirowski et al.,*** ***).

An implantable cardioverter–defibrillator system comprises a pulse generator and one or more leads for pacing and defibrillation electrodes.***(Tchou et al.,*** ***)***.

Figure ,Implantable cardioverter defibrillator)

(Tchou et al., ***)***.

Types of ICDs



(Figure ٣)

(Swerdlow et al., [illegible]).

How does an ICD work?

ICDs constantly monitor the rate and rhythm of the heart and can deliver therapies, by way of an electrical shock, when the heart rate exceeds a preset number. More modern devices can distinguish between ventricular fibrillation and ventricular tachycardia (VT), and may try to pace the heart faster than its intrinsic rate in the case of VT, to try to break the tachycardia before it progresses to ventricular fibrillation. This is known as fast pacing, overdrive pacing, or anti-tachycardia pacing (ATP). ATP is only effective if the underlying

rhythm is ventricular tachycardia, and is never effective if the rhythm is ventricular fibrillation ***(Swerdlow et al.,*** ***).***

Many modern ICDs use a combination of various methods to determine if a fast rhythm is normal, ventricular tachycardia, or ventricular fibrillation.

The defibrillation lead contains a coil at the level of the right ventricle and, optionally, another one in the superior vena cava (called the proximal coil). For shock treatment, electrical current (energy ranging from <١ to ٤٢ J) is delivered between the ventricular defibrillation coil, the device can, and the proximal defibrillation coil ***(Swerdlow et al.,*** ***).***

The ICD works by monitoring of the following:

Rate discrimination evaluates the rate of the lower chambers of the heart (the ventricles) and compares it to the rate in the upper chambers of the heart (the atria). If the rate in the atria is faster than or equal to the rate in the ventricles, then the rhythm is most likely not ventricular in origin, and is usually more benign. If this is the case, the ICD does not provide any therapy.

Rhythm discrimination will see how regular a ventricular tachycardia is. Generally, ventricular tachycardia is regular. If the rhythm is irregular, it is usually due to conduction of an irregular rhythm that originates in the atria, such as atrial fibrillation.

Morphology discrimination checks the morphology of every ventricular beat and compares it to what the ICD believes is a normally conducted ventricular impulse for the patient. This normal ventricular