

# ICD Implantation and Follow Up Five Years Registry and Comparative Study With Antiarrhythmic Drugs

*Thesis Submitted by*

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# Abstract

**Background:** The implantable cardioverter-defibrillator (ICD) has emerged as the primary nonpharmacologic option for many patients who are at continuing high-risk for fatal ventricular tachyarrhythmias.

**Aim of the work:** Our aim was to follow-up the patients with implanted ICDs, to assess the efficacy of ICD therapy, its impact on survival, quality of life, and monitor for its related complications.

**Methodology:** The present study included 75 patients (63 males and 12 females), their mean age was  $47.6 \pm 16.1$  years. The mean LVEF was  $43.12 \pm 15.8\%$ . Out of the 75 pts studied, 10 had structurally normal hearts. Of the remaining 65 pts; IHD (without dilatation) was present in 6, ICM in 29, idiopathic DCM in 19, RHD in 3, congenital heart disease in 2, HOCM in 3 and ARVD in 2 pts, and one pt with Brugada syndrome. All patients were followed-up for a mean period of  $54.00 \pm 34.4$  months.

## Results:

• Non-significant change in LVEF% before and after ICD implantation ( $43.12\%$  vs  $45.35\%$ , respectively), however, pts with CRT-D showed significant improvement in LVEF ( $27.29\%$  before vs  $39.5\%$  after implantation,  $p$  value:  $0.02$ ).

• Non-significant improvement in NYHA class before and after ICD implantation. However, pts with CRT-D showed significant improvement in NYHA class ( $p$  value:  $0.05$ ).

• ICD-related complications comprised: (1) *Peri-operative* in  $26.6\%$  of pts, (2) *Short-term* in  $33.3\%$  of pts, and (3) *Long-term* in  $25.3\%$  of pts.

The incidence of inappropriate detection was  $25.3\%$  with the commonest cause is inappropriate settings in  $17.3\%$  of pts. AF comprised the commonest cause of inappropriate therapies ( $10.6\%$ ). Inappropriate cardioversion shocks occurred in  $12\%$  of pts vs.  $9.3\%$  for inappropriate ATP therapies.

$24\%$  of the ICD recipients were non users, with remarkable higher prevalence of ischemia in those who received ICD therapy specially in pts with cardiomyopathy.

Highly significant reduction in frequent hospital readmissions post-implantation compared to pre-implantation ( $41.3\%$  vs.  $96\%$ , respectively).

Follow-up of pts showed 1<sup>st</sup> year survival of  $93\%$ , 2<sup>nd</sup> year survival of  $89\%$ , 3<sup>rd</sup> year survival of  $89\%$ , and 1<sup>st</sup> year freedom of SCD of  $98\%$ . Cardiac death occlusion  $20\%$  of pts ( $12\%$  by pump failure and  $4\%$  by incessant VT, and  $4\%$  combined).

In conclusion: ICDs have no impact on LVEF or NYHA class except in pts with CRT-D, however there was significant reduction in hospital admission following ICD implantation & high survival rate. Regular follow up schedules is the corner stone in management of these pts for detection of problems and appropriate programming.

**Key words:** ICD, VTs, dilated cardiomyopathy.

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*Asaa Ashour*

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# *List of Abbreviations*

<b>AAD(s)</b>	: Antiarrhythmic drug(s)
<b>AADR<sub>x</sub></b>	: Antiarrhythmic drug therapy
<b>ACC/AHA</b>	: American College of Cardiology/American Heart Association
<b>AF</b>	: Atrial fibrillation
<b>AMI</b>	: Acute myocardial infarction
<b>ARVD</b>	: Arrhythmogenic right ventricular dysplasia
<b>ATP</b>	: Antitachycardia pacing
<b>AV</b>	: Atrioventricular
<b>AVID</b>	: Antiarrhythmics Versus Implantable Defibrillator trial
<b>AVR</b>	: Aortic valve replacement
<b>BBB</b>	: Bundle branch block
<b>BEOL</b>	: Battery end of life
<b>BOL</b>	: Beginning of life
<b>bpm</b>	: beat per minute
<b>CABG</b>	: Coronary artery bypass graft
<b>CABG patch</b>	: Coronary Artery Bypass Graft Trial
<b>CAD</b>	: Coronary artery disease
<b>CASH</b>	: Cardiac Arrest Study, Hamburg trial
<b>cc</b>	: cubic centimeter
<b>CHF</b>	: Congestive heart failure
<b>CIDS</b>	: Canadian Implantable Defibrillator Study trial
<b>CMS</b>	: US centers for Medicare and Medicaid Services

<b>COMPANION</b>	: Comparison of Medical Therapy, Pacing, and Defibrillation in Heart Failure
<b>COP</b>	: Cardiac output
<b>CPR</b>	: Cardiopulmonary resuscitation
<b>CPVT</b>	Catecholaminergic polymorphic ventricular tachycardia
<b>CRT</b>	: Cardiac resynchronization therapy
<b>CRT-D</b>	: Cardiac resynchronization therapy with defibrillator
<b>CRT-P</b>	: Cardiac resynchronization therapy with permanent pacemaker
<b>CV</b>	: Cardioversion
<b>CVS</b>	: Cerebrovascular stroke
<b>DAD</b>	: Delayed After Depolarization
<b>DAVID</b>	: Dual chamber and VVI Implantable Defibrillator
<b>DCM</b>	: Dilated cardiomyopathy
<b>DEFINITE</b>	: Defibrillators in NonIschemic Cardiomyopathy Treatment Evaluation
<b>DFT(s)</b>	: <b><i>Defibrillation threshold(s)</i></b>
<b>DINAMIT</b>	: Defibrillator in Acute Myocardial Infarction Trial
<b>DVT</b>	: Deep venous thrombosis
<b>EAD</b>	Early After Depolarization
<b>EAS</b>	: Electronic article surveillance
<b>ECG</b>	: Electrocardiography
<b>EF</b>	: Ejection fraction
<b>EGM(s)</b>	: Electrogram(s)
<b>EMI</b>	: Electromagnetic interference
<b>EOL</b>	: End of life
<b>EP</b>	: Electrophysiology

<b>ERI</b>	: Elective replacement indicator
<b>FDA</b>	: Food and Drug Association
<b>HD</b>	: Heart disease
<b>HF</b>	: Heart failure
<b>HOCM</b>	: Hypertrophic obstructive cardiomyopathy
<b>HR</b>	: Heart rate
<b>HRV</b>	: Heart rate variability
<b>ICD(s)</b>	: <b><i>Implantable cardioverter-defibrillator(s)</i></b>
<b>ICM</b>	: Ischemic cardiomyopathy
<b>IHD</b>	: Ischemic heart disease
<b>IVF</b>	Idiopathic ventricular fibrillation
<b>J</b>	: Joule
<b>Kg</b>	: Kilogram
<b>LECV(s)</b>	: Low-energy cardioversion(s)
<b>Li/SVO</b>	: Lithium silver vanadium oxide
<b>LQTS</b>	: Long QT syndrome
<b>LV</b>	: Left ventricle
<b>LVEDV</b>	: Left ventricular end-diastolic volume
<b>LVEF</b>	: Left ventricular ejection fraction
<b>LVESV</b>	: Left ventricular end-systolic volume
<b>M</b>	: Meter
<b>MADIT</b>	: Multicenter Automatic Defibrillator Implant Trial
<b>MADIT CRT</b>	: Multicenter Automatic Defibrillator Implant Trial with Cardiac Resynchronization Therapy
<b>MADIT II</b>	: 2 <sup>nd</sup> Multicenter Automatic Defibrillator Implant Trial
<b>MI(s)</b>	: Myocardial infarction(s)
<b>min</b>	: Minute

<b>min<sup>-1</sup></b>	: per minute
<b>MIRACLE ICD</b>	: Multicenter InSync ICD Randomized Clinical Evaluation
<b>MIRACLE ICD II</b>	: 2 <sup>nd</sup> Multicenter InSync ICD Randomized Clinical Evaluation
<b>mL</b>	: Milliliter
<b>mm</b>	: Millimeter
<b>MRI</b>	: Magnetic resonance imaging
<b>ms</b>	: Millisecond
<b>MUSTT</b>	: Multicenter UnSustained Tachycardia Trial
<b>mV</b>	: Millivolt
<b>MVT(s)</b>	: Monomorphic ventricular tachycardia(s)
<b>NASPE</b>	: North American Society of Pacing and Electrophysiology
<b>NIPS</b>	: Noninvasive programmed stimulation
<b>NISCM</b>	: Non-ischemic cardiomyopathy
<b>NSR</b>	: Normal sinus rhythm
<b>NYHA</b>	: New York Heart Association
<b>OMT</b>	: Optimal medical therapy
<b>OMIM</b>	: Online Mendelian Inheritance in Man
<b>PACMAN</b>	: Pacing for Cardiomyopathy
<b>PCI</b>	: Percutaneous coronary intervention
<b>PG(s)</b>	: Pulse generator(s)
<b>Pt(s)</b>	: Patient(s)
<b>PVCs</b>	: Premature ventricular contractions
<b>PVT</b>	: Polymorphic ventricular tachycardia
<b>QoL</b>	: Quality of life
<b>QTc</b>	: Corrected QT

<b>RA</b>	: Right atrium
<b>RBBB</b>	: Right bundle branch block
<b>REVERSE</b>	: Resynchronization Reverses Remodeling in Systolic Left Ventricular Dysfunction
<b>RF</b>	: Radiofrequency
<b>RHD</b>	: Rheumatic heart disease
<b>RRR</b>	: Relative risk reduction
<b>RV</b>	: Right ventricle
<b>RVOT</b>	: Right ventricular outflow tract
<b>RyR2</b>	Ryanodine receptor
<b>SAECG</b>	: Signal-averaged electrocardiogram
<b>SC</b>	: Subcutaneous
<b>SR</b>	Sarcoplasmic reticulum
<b>SCD(s)</b>	: Sudden cardiac death(s)
<b>SCD-HeFT</b>	: Sudden Cardiac Death in Heart Failure Trial
<b>SCV</b>	: Subclavian vein
<b>sec.</b>	: second
<b>SHD</b>	: Structural heart disease
<b>ST</b>	: Sinus tachycardia
<b>SVC</b>	: Superior vena cava
<b>SVT(s)</b>	: Supraventricular tachycardia(s)
<b>T.B.</b>	: Tuberculosis
<b>TCL</b>	: Tachycardia cycle length
<b>ULV</b>	: Upper limit of vulnerability
<b>V</b>	: Volt
<b>V. flutter</b>	: Ventricular flutter
<b><math>V_{\max}</math></b>	Rate of rise of action potential upstroke

<b>VecToR</b>	: Ventricular Resynchronization Therapy Randomized Trial
<b>VF</b>	: Ventricular fibrillation
<b>VO<sub>2</sub></b>	: Oxygen consumption
<b>vs.</b>	: versus
<b>VSD</b>	: Ventricular septal defect
<b>VT(s)</b>	: Ventricular tachycardia(s)
<b>V-V</b>	: Ventricle to ventricle
<b>WPW</b>	: Wolf Parkinson White syndrome
<b>Yr (s)</b>	: Year (s)

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