

Efficacy of a modified ICD insertion technique in children in protecting against sudden cardiac death

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Introduction:

A variety of aetiopathologies subject children to a high risk of ventricular arrhythmias. Implantable cardioverter defibrillators are life-saving. However, the enormous size of the ICD compared to the small size of children means that innovative techniques are needed to adapt this technology to children.

Methods:

We analyzed 28 children subjected to an epicardial ICD procedure from 2004 to 2014. The median age and weight of the cohort was 12(2.9-20)years and 42(13.5-97)kg. The indications included hypertrophic cardiomyopathy(14), restrictive or dilatative cardiomyopathy(6), electric cardiomyopathy (CPVT, long QT, Brugada syndrome)(10) and other causes(4). In 7 patients ICD was implanted in conjunction with an intra-cardiac procedure (most often resection of hypertrophic obstructive LVOT). The indication was primary prophylaxis in 18 and secondary prophylaxis in 10 patients. A left axillary thoracotomy used to place electrodes onto the left atrial appendage and left ventricle was the preferred approach. A shock electrode was placed across the rib cage so as to ensure that maximum ventricular muscle mass was exposed to the shock vector between the ICD placed in the epigastrium and the shock electrode. In majority of patients, the ICD was placed in a pocket created between the parietal pericardium and the diaphragm (through an epigastric incision).

Results:

1 patient (listed for transplantation for dilatative cardiomyopathy) died. Kaplan Meier survival was $90.9 \pm 8.7\%$ at 12 years follow-up. The atrial and ventricular pacing thresholds were a median of $0.5(0.3-1.75)$ and $1(0.3-4.5)V$ respectively. The respective P and R waves were $5(1.7-16.5)$ and $12.7(5.5-30)mV$ respectively. The pleural coil resistance was $61.5(43-107)$ Ohms. A test induction of ventricular fibrillation (inducible in 25 ICD systems) was recognized and successfully converted with a median of $20(10-30)$ Joule energy. 8 shocks in 4 patients successfully terminated ventricular arrhythmias during follow-up. Inappropriate shocks happened in 2 patients (1 due to broken ventricular electrode). Freedom from complete ICD system replacement was $87.1 \pm 6\%$ and freedom from electrode/coil revision was $61.4 \pm 9.3\%$ at 10 years (Figure).

Conclusions:

Modern ICD technology can be adapted to the paediatric demands. Our epicardial/pleural modified approach leads to excellent short and midterm results with regards to procedural success, efficacy as well as overall patient outcome.

