Sudden Cardiac Death and Implantable Cardioverter Defibrillations (ICD) and the Older Adult

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Sudden cardiac arrest (SCA) usually results from a hemo-dynamically unstable heart rhythm-ventricular fibrillation or ventricular tachycardia. Failure or absence of resuscitation results in **sudden cardiac death** (**SCD**). There are 450,000 cases of SCD annually in the United States. Rate of survival following SCA has not changed over the past three decades.[1] Survival after hospital discharge, however, has improved, partly due to the development of **implantable cardioverter defibrillators** (**ICDs**). In 2005, the Centers for Medicaid and Medicare Services estimated that 500,000 Medicare beneficiaries were candidates for ICD placement.[2] ICD prescription in elderly patients entails particular considerations, given common co-morbidities and higher rates of non-cardiac mortality. ICD implantation should not be regarded as routine in elders; each case should be considered individually. Geriatricians and other primary care physicians play a key role in the judicious selection of candidates for this potentially life-saving therapy.

Risk of SCD in Elderly

The prevalence of **coronary artery disease** (**CAD**) increases with age, along with risk of SCD. The proportion of CAD deaths attributed to SCD, however, decreases with age. In the Framingham study, 62% in men aged 45-54 years old who died of CAD experienced SCD.[3] This percentage fell to 58% in men aged 55-64 years and to 42% in men aged 65-74 years. Congestive heart failure is responsible for a higher proportion of deaths in the elderly population. Advanced age, however, is associated with a poor outcome following cardiac arrest. In a review of 5,882 cases of out-of-hospital cardiac arrest, octogenarians experienced a hospital discharge rate of 9%, compared to 19% in a younger group.[4] In a second series of 12,000 patients treated by emergency medical service personnel for SCA, every one-year increase in age was associated with a significantly lower likelihood of survival.[1]

Indications for ICD Prescription

Over the past two decades, studies identified ICDs as an effective prevention strategy of SCD. In survivors of SCA, ICDs are the secondary prevention strategy of choice.[5,6] Patients at high-risk also benefit from prophylactic ICD implantation. The MADIT II and MUSTT studies demonstrated a survival benefit in patients with reduced ejection fraction (<35%) and history of CAD when ICDs are utilized as a primary prevention strategy.[7,8] The SCD-HeFT trial expanded this population to include patients with an ejection fraction <35%, irrespective of CAD history.[9] Patients with severe symptomatic heart failure and life expectancies less than 6 months were excluded from these studies. The mean age of participants ranged between 60 and 66 years, and the majority of these patients suffered heart failure symptoms.

Mortality Benefit of ICD Therapy in Elderly

No randomized control studies investigate the role of ICDs specifically in older adults. Major trials include significant numbers of older patients; mean participant age ranged between 60 and 66 ± 10 years. Post-hoc subgroup analysis investigating role of ICD in these patients was performed in two major primary prevention trials. The MADIT-II trial demonstrated a 31% relative risk reduction of all-cause mortality in ICD recipients, compared to recipients of anti-arrhythmic medications.[10] Subgroup analysis of the MADIT-II population indicated that ICD recipients older than 75 years experienced a 46% relative risk reduction in mortality.[8] In the SCD-HeFT trial, despite greater mortality reduction in patients younger than 60 years, ICD implantation was still the superior primary prevention strategy in patients older than 65.[9]

Similar mortality benefit of ICD placement is demonstrated in elderly survivors of cardiac arrest. Two of the three major secondary prevention trials performed post hoc subgroup analyses based on age. In the largest of these trials, **Anti-arrhythmic Versus Implantable Defibrillators** (**AVID**), ICD placement was associated with reduction in mortality, regardless of age at time of device implant.[5] Mean age in the AVID study was 65 ± 10 years. In the **Canadian Implantable Defibrillator Study** (**CIDS**), patients older than 70 derived greatest benefit from ICD implantation.[6]

Patients with terminal diagnoses, multiple co-morbidities and severe symptomatic heart failure were excluded from the above trials. Clinical characteristics of excluded patients have not been published. Although smaller studies demonstrate a reduction in SCD regardless of age, rates of non-cardiac death are higher in the elderly population. In one single center study, ICD placement eliminated risk of SCD in older and younger patients alike. However, survival at four years was 57% and 78% in patients older and younger than 75 years, respectively.[11] In retrospective studies reporting pre-selection of healthy elderly patients with good functional status, overall survival is similar among older and younger ICD recipients.[12] The role of ICD in elderly patients with multiple illnesses has yet to be determined, as they are underrepresented in trials that shape current guidelines.

Data are lacking to identify specific co-morbidities, lab criteria or age limits that preclude ICD implantation in older patients. Patients with irreversible terminal prognoses are not considered for ICD implantation. Furthermore, patients with severe symptomatic heart failure were excluded from the landmark trials, and are not considered for routine ICD placement if mean expected survival is less than 6 months. Elderly patients with renal disease are a population that may derive diminished mortality benefit from ICD [13] although chronic renal failure was not an exclusion criterion in major trials. There are no age restrictions on ICD implantation, although octogenarians are underrepresented in trials despite the fact they constitute 28% of possible ICD recipients.[14] As a result, patients with multiple co-morbidities must be considered for ICD placement on an individual basis. Furthermore, for the elderly patient, as with all patients, ICD implantation requires careful assessment of the individual's estimated risk of cardiac arrest based on the patient's risk profile.[15]

Procedural Complications

Peri-operative risks of ICD implantation include, but are not limited to infection, system malfunction requiring a repeat procedure, pneumothorax, tamponade and, rarely, death. A limited number of studies have investigated age differences in complication rates. Available data suggest that safety of ICD implantation in the elderly patient is comparable to a younger population. One observational study from a decade ago reports a similar rate of peri-operative death of 2% and 3% in patients younger and older than 65 years, respectively.[16] Exclusion of older generation devices implanted via a thoracotomy reduces peri-operative death to less than 1% in both groups. A more recent study corroborates these findings; peri-operative mortality was less than 1% in patients younger and older than 70 years[8] Based on these data, placement of this generation of ICDs is considered safe in patients of all ages.

Quality of Life and End-of-Life Issues

Studies investigating quality of life have found either no change or an improvement following ICD implantation.[17,18,19] Numerous ICD shocks, history of anxiety disorders and preexisting poor functional status are associated with poor quality of life following implantation. Advanced age is not identified as an independent predictor of compromised quality of life in the above studies. As a result, a careful review of a patient's co-morbidities and preexisting functional status must be considered prior to ICD implantation. Patients must be counseled about the potential for painful ICD discharges. Despite the discomfort associated with discharges, a high rate of acceptance of ICD therapy is reported in device recipients. Patients should also be informed that ICD therapy is not a permanent prevention strategy, and devices can be explanted or simply deactivated at the patient's discretion. Furthermore, patients and families should be informed that ICDs reduce risk of SCD, but do not prevent death from other causes.

Management of ICD at the end of life requires specific counseling to the patient and family. Frequency of shocks may increase as a result of multiple terminal tachy-arrhythmias. This can be a source of severe discomfort to both patient and family. If the patient or proxy is amenable, ICDs should be deactivated when at the end of life. Unfortunately, this practice is not routinely performed. Interviews conducted with family members of deceased ICD recipients revealed that counseling regarding deactivation of devices did not occur in 75% of cases.[20]

Conclusions

Older patients are at higher risk of SCA, and have low survival rates following an episode. ICDs are the strategy of choice in the primary and secondary prevention of SCD. ICD placement in patients with multiple co-morbidities should be evaluated judiciously, as these individuals are underrepresented in major trials that define accepted guidelines. Complication rates in older patients are similar to younger cohorts. The data also suggest either no impact or an improved quality of life among ICD recipients, regardless of age. In the elderly population, device implantation should not be considered routine. Decisions should be made on a case by case basis, taking into consideration the patient's wishes, co-morbidities and estimated risk of cardiac arrest.

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