Exercise-optimized programming after S-ICD implantation contributes to a lower risk of inappropriate shocks in the latest generation S-ICDs

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Background: Implantable cardioverter-defibrillator (ICD) therapy is associated with the risk of inappropriate shocks (IAS). IAS, defined as any shock on a different rhythm than VT or VF, cause psychological stress, decrease the quality of life and may provoke ventricular arrhythmias. In the subcutaneous ICD (S-ICD) the majority of IAS are caused by T-wave oversensing (TWOS), often during exercise. Exercise-optimized programming during an exercise ECG test (X-ECG) after implantation has shown to be successful in reducing IAS in patients known with TWOS. In recent years, new discrimination algorithms in the latest generation S-ICDs have significantly reduced the risk of TWOS. The benefit of performing an X-ECG in these latest generation S-ICDs to reduce IAS is unclear.

Purpose: We aim to describe the effect of exercise-optimized programming after S-ICD implantation on inappropriate shock rate in the latest generation S-ICDs.

Methods: In this retrospective multicenter study, data were collected from two experienced S-ICD hospitals in the Netherlands. All patients underwent an S-ICD implantation of second or third generation between February 2015 and December 2020. Patients younger than 21 years were excluded. Patients with an X-ECG after implantation were compared with patients without X-ECG after implantation. Total number of patients with IAS and cause of the first IAS were evaluated.

Results: In total, 262 patients were included in the X-ECG group and 61 in the no X-ECG group. The median follow-up time was 22 months in the X-ECG group (IQR 9-33) and 23 months in the no X-ECG group (IQR 12-33, P = 0.9). Mean age was 51 ± 15 years and 61 ± 15 years respectively (P< 0.001). Primary prevention indication was similar in both groups (56% for the X-ECG group versus 49% for the no X-ECG group, P = 0.4). A total of 8 patients (3.1%) experienced IAS in the X-ECG group; 3 first shocks (1.15%) were due to TWOS, 2 (0.8%) were given on a SVT and 3 (1.15%) on other non-cardiac activity. In the no X-ECG group, 6 patients (9.8%) experienced IAS; 1 first shock (1.6%) was due to TWOS, 4 (6.6%) were given on a SVT and 1 (1.6%) on other non-cardiac activity. Patients with an X-ECG had a significantly lower risk of IAS compared to patients in the no X-ECG group (hazard ratio 0.32; 95% CI 0.1 to 0.9; P = 0.027). The Kaplan-Meier estimate of IAS-free survival for the X-ECG group was 61 months (95% CI 59 to 62) and 50 months (95% CI 46 to 55) for the no X-ECG group. Results are shown in the figure.

Conclusion: This study shows that, in the latest generation S-ICDs, exercise-optimized programming after S-ICD implantation results in a significantly lower risk of IAS in adults. Patients with an X-ECG after S-ICD implantation were younger, which may have affected the outcome. Further prospective data with more equal groups is necessary. Until then, we recommend considering exercise testing after S-ICD implantation in the latest generation S-ICDs.

Abstract Figure.