Introduction:

Exercise training has shown to be beneficial in improving health status, survival, and quality of life in those with heart disease (Belardinelli, Capestro, Misiani, Scipione, & Georgiou, 2006; Rogers et al., 2010; Smolis-Bak et al., 2015). However, patients with heart disease who have cardiac implantable devices (CID)s such as implantable cardioverter defibrillators (ICD), cardiac resynchronization pacemakers or defibrillators (CRT-P or CDT-D), or ventricular assist devices (VAD), have additional specific issues when performing exercise. There are few published systematic reviews on exercise training in patients with CIDs: two for ICDs (Bajaj, Biswas, Oh, & Alter, 2015; Isaksen, Morken, Munk, & Larsen, 2011), no reviews specifically for CRTs but many reviews in the HF population (Cornelis, Beckers, Taeymans, Vrints, & Vissers, 2016; Floegel & Perez, 2016; Giuliano, Karahalios, Neil, Allen, & Levinger, 2017; Hsu, Hsieh, Hsiao, & Chien, 2015; Ostman, Jewiss, & Smart, 2016), and one for patients with VADs (Jung & Gustafsson, 2015). The previous reviews for the ICD have shown that exercise training is safe, improves aerobic capacity and is not associated with an increased risk of ICD shock or other adverse events (Bajaj et al., 2015; Isaksen et al., 2011). However there are equivocal findings for the effect of exercise training on anxiety, depression and quality of life (Isaksen et al., 2011). The systematic review for VAD recipients concluded that exercise training improves aerobic capacity, but exercise capacity remains reduced after VAD implantation (Jung & Gustafsson, 2015).

Purpose:

This systematic review identified exercise-based intervention studies in patients with cardiac implantable devices (CID)s: Implantable Cardioverter Defibrillator (ICD), Cardiac Resynchronization Pacemaker or Defibrillator (CRT), or Ventricular Assist Device (VAD), and assessed evidence for the safety and efficacy of exercise-based interventions alone or in combination with psychoeducational components.

Methods:

The databases PubMed, EMBASE, CINAHL Plus, Web of Science, Cochrane, and PEDro databases were searched from database inception to September 2016. This systematic review evaluated all available studies reporting a clinical outcome in CID recipients who underwent some form of exercise-based intervention. A review protocol meeting the “A Measurement Tool to Assess Systematic Reviews” (AMSTAR) tool criteria (Shea, Bouter, et al., 2007; Shea, Grimshaw, et al., 2007; Shea et al., 2009) was developed and implemented. Data were extracted and validity was assessed by 2 reviewers. Study quality was evaluated using the JADAD scale for RCTs (Jadad et al., 1996). A total of 3991 articles for all CIDs (ICD: 1015, pacemaker: 1630, and VAD: 1346) were screened for relevance. Studies were published between the years 1998-2016, with the majority of randomized studies being completed within the last decade. There were 24 unique studies included in this review (ICD: 14, CRT: 4, VAD: 6). Of these, 14 employed a randomized controlled trial (RCT) design, 5 retrospective designs, 3 pre-post test designs, and 1 case control and 1 prospective but non-randomized design.

Results:
There were a total of 5308 study participants, of which 2702 participated in exercise interventions, with a range 10 to 2331. The average age of all study participants was 56.0 ±10.1 years (range 38-66 years), the majority were male and Caucasian. Those in the VAD population were younger than those with an ICD or CRT. The average left ventricular ejection fraction (LVEF)% was 23.7% (range 17-29.4%); those with a VAD had lower LVEF% at the time of study entry. The indication for the device was secondary prevention in the ICD population (64%), HF with bridge to transplant in the VAD population (100%), and HF with LVEF% ≤ 35% in the CRT population (80%). The drop-out rates from all studies averaged 17%, the range was 0-31%. The majority of exercise interventions contained an aerobic component in the form of walking, bicycling, running, or combinations of these. The duration of interventions ranged from 1.5 months-12 months, the average duration was 3 months. Resistance or strength training was used in one study in the VAD population and in two studies in the ICD population, with no studies including a resistance exercise component in the CRT population. Results demonstrated an average increase in peak oxygen consumption (peakVO2) by 2.61 ml/kg/min, (ICD=2.43, VAD=2.2, CRT=3.2) following exercise. These incremental increases were statistically significant when compared to the usual care or other comparison groups. Adverse event rates were very low at 1.1-2.2% for all CID. A total of 15 studies reported quality of life (QOL) outcomes (6 ICD, 5 VAD, 4 CRT), and 10 studies report an anxiety and/or depression outcome (7 ICD, 2 VAD, 1 CRT). The impact of exercise interventions on these outcomes was most often not statistically significant.

Conclusions:

Exercise interventions tested to date in the CID population (ICD, CRT, VAD) indicate that exercise training at moderate to high intensity is safe and effective in improving cardiopulmonary outcomes without significant adverse events. Future investigations can include a more diverse sample of participants, designs that include translation of exercise to routine practice, the destination therapy VAD population, and measurement of costs and patient centered outcomes.

Title:
A Systematic Review of Exercise Training in Cardiac Implantable Devices

Keywords:
cardiac device, exercise and systematic review

References:


**Abstract Summary:**
A systematic review was conducted to determine the safety and efficacy of exercise-based interventions alone or in combination with psychoeducational components in patients with cardiac implantable devices. The results indicate that exercise training at moderate to high levels is safe and effective in improving cardiopulmonary outcomes with few adverse events.

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