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REVIEW

Effects of Exercise Training on Exercise Capacity in Pulmonary Arterial Hypertension: A Systematic Review of Clinical Trials

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Background Pulmonary arterial hypertension (PAH) causes profound functional limitations and poor quality of life. Yet, there is only a limited literature available on the role of exercise training. This paper systematically reviews the effects of exercise training on exercise capacity in PAH.

Methods A systematic search of databases (PubMed, CINAHL, CENTRAL, Web of Science and PEDRo) was undertaken for English language articles published between 1st January 1980 and 31st March 2015. Quality rating for all articles was done using the Downs and Black scoring system.

Results Fifteen articles of good (n=4), moderate (n=6) and poor (n=5) quality were included in the review. Exercise interventions included aerobic, resistance, inspiratory muscle training or a combination, for 6-18 weeks. Improvements were seen in exercise capacity (six minute walk distance (6MWD) and peak VO2) by 17-96m and 1.1-2.1 ml/Kg/min, functional class by one class and quality of life, with minimal adverse events.

Conclusions There is evidence to recommend the use of exercise training as an adjunct to medical treatment in PAH. More clinical trials and research are required to assess the effects of different types of exercise programs in patients with PAH, while focussing on strong exercise endpoints to quantify the improvements seen with exercise training.

Keywords Exercise • Pulmonary arterial hypertension • Quality of life • Rehabilitation • Six minute walk test

Introduction

Pulmonary arterial hypertension (PAH) is a disease with high morbidity and mortality [1]. Intolerance to exercise in PAH is a main finding and is the result of dysfunctions in the cardiovascular (viz., reduced cardiac output due to high pulmonary pressures and septal deviations), pulmonary (viz., ventilation-perfusion abnormalities) and musculoskeletal systems (viz., altered muscle fibre properties, peripheral oxygen extraction dysfunction and respiratory muscle dysfunctions) [2–8]. Thus, it can be inferred that exercise training targeting the cardiopulmonary and

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musculoskeletal systems may prove to be beneficial for patients with PAH.

Over the last few years, there has been a growth in literature on exercise training in PAH – both in terms of published literature [9–13] and on-going studies [14] registered in various clinical trial registries around the world. However, there is a lack of systematic reviews in this area specifically assessing the effects of exercise training on exercise capacity in PAH. Therefore, the aim of this review is to update the available evidence by systematically reviewing the current literature available in the area of exercise training for adults with PH and to summarise the changes that occur with exercise training on exercise capacity and other functional outcomes.

Material and Methods

Search Strategy

A systematic search from 1st January 1980 to 31st March 2015, of PubMed, CENTRAL (Cochrane database for randomised controlled trials), CINAHL (Cumulative Index to Nursing and Allied Health), Web of Science and PEDRo was carried out using various search terms. Medical subject headings (MeSH) terms for pulmonary hypertension, exercise training, resistance training and breathing exercise, along with various terms like rehabilitation, respiratory muscle training, physiotherapy and functional training with Boolean terms like OR and AND. Search strategies were modified for each database to achieve the broadest search. Details of the search strategy are available in the online supplement. The review protocol was registered in the PROSPERO (PROSPERO 2011: CRD42011001238).

Inclusion and Exclusion Criteria

All clinical trials utilising exercise training (aerobic, resistance, inspiratory muscle training or combinations of these) as an intervention for patients with PAH delivered through any setting (i.e., hospital, home, community or a combination of them), in the English language were included. Pulmonary arterial hypertension secondary to lung disease and studies assessing only single response to exercise, exercise testing studies and reviews were excluded from this study. A summary of the selection of articles has been reported as per the PRISMA guidelines (Figure 1) [15].

Quality Assessment

The quality of studies was assessed using the Downs and Black Quality Index (QI) which is rated among the top 14 tools to assess the quality of studies for both randomised and non-randomised trials.[16,17] The scale has five sub-domains which include reporting, external validity, bias, confounding and power being scored out of 11, 3, 7, 6 and 5 respectively. The total score obtained is scored out of 32. The studies were

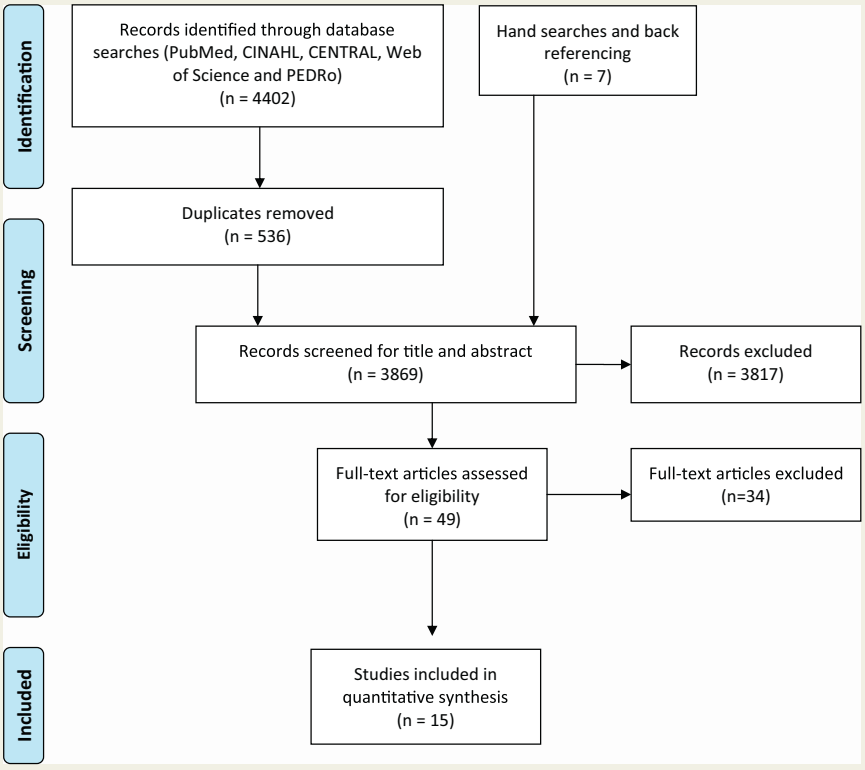

Figure 1 PRISMA flow diagram.