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REVIEW

Beneficial Effects of Pre-operative Exercise Therapy in Patients with an Abdominal Aortic Aneurysm: A Systematic Review

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WHAT THIS PAPER ADDS

This review provides an overview of the current evidence on pre-operative exercise therapy in patients with an abdominal aortic aneurysm (AAA; with or without indication for surgical repair). Pre-operative exercise therapy has potential beneficial effects on such variables as physical fitness, reduction in cardiovascular risk factors, post-operative complications, length of stay, and recovery. Further research is needed to investigate the most effective pre-operative exercise program for patients with AAA.

Objective/background: The impact of post-operative complications in abdominal aortic aneurysm (AAA) surgery is substantial, and increases with age and concomitant co-morbidities. This systematic review focuses on the possible effects of pre-operative exercise therapy (PET) in patients with AAA on post-operative complications, aerobic capacity, physical fitness, and recovery.

Methods: A systematic search on PET prior to AAA surgery was conducted. The methodological quality of the included studies was rated using the Physiotherapy Evidence Database scale. The agreement between the reviewers was assessed with Cohen's kappa.

Results: Five studies were included, with a methodological quality ranging from moderate to good. Cohen's kappa was 0.79. Three studies focused on patients with an AAA (without indication for surgical repair) with physical fitness as the outcome measure. One study focused on PET in patients awaiting AAA surgery and one study focused on the effects of PET on post-operative complications, length of stay, and recovery.

Conclusion: PET has beneficial effects on various physical fitness variables of patients with an AAA. Whether this leads to less complications or faster recovery remains unclear. In view of the large impact of post-operative complications, it is valuable to explore the possible benefits of a PET program in AAA surgery.

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INTRODUCTION

The development of an abdominal aortic aneurysm (AAA) is age related, and affects approximately 7.5% of men and 3.0% of women.[1] Surgical intervention (open reconstruction or endovascular) is the only treatment effective in preventing AAA rupture and aneurysm related death. In general, this treatment is reserved for AAAs >55 mm in diameter and >50 mm in men and women, respectively.[2] Surgical intervention, especially open repair, results in significant hemodynamic stress and an increased oxygen demand in the peri- and post-operative period.[3,4] A minimum level of aerobic capacity and physical fitness is required to maintain an adequate response to the physical stress induced by surgical intervention.

The majority of patients with an AAA eligible for repair are >65 years of age. Relatively fit octogenarians presenting with large AAAs are no longer an exception.[5–7] Together with the advancing age of AAA patients comes a poorer

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functional capacity due to multiple co-morbidities and an increased risk for post-operative complications.[7,8]

An extensive cardiopulmonary co-morbidity is present in this population compared with the population requiring non-vascular major abdominal surgery (coronary disease or congestive heart failure, ~50%; hypertension, 30–50%; chronic obstructive pulmonary disease, 30–40%; chronic renal disease, ~5%; cerebrovascular disease, ~6%).[5–8] (5-8) Surgery can also induce a decline in functional capacity (especially in the elderly), which has detrimental effects on general health.[5–8] By improving the physical condition, peri-operative complications might be prevented. In the non-surgical population there is evidence demonstrating the beneficial effects of exercise on improving fitness in patients with cardiorespiratory disease.[9–12] There is increasing evidence that pre-operative exercise therapy (PET) is effective in reducing post-operative complications and length of hospital stay after surgical interventions.[13–16]

However, the effectiveness of PET might vary between different surgical interventions, as well as patient populations.[13–16] A different approach in the design of PET programs seems necessary; however, evidence for a specific design is still lacking.

A recent systematic review by Valkenet et al. (17) showed that PET programs can be effective in reducing post-operative complications and length of hospital stay.[17] However, this study did not include any subgroup analysis between different patient groups and their specific surgical interventions. For example, a patient with colorectal cancer has, owing to pre-operative chemoradiation, a limited pre-operative time span for a PET program compared with a patient scheduled for an elective AAA repair. Also, there is no evidence for the effectiveness of different PET programs. So far, the level of evidence is insufficient to have a preference for an endurance training program or a strength program, or a combination of both. Each specific patient population could need a specific program in a specific time frame.

A systematic review of PET in AAA surgery and the effect on post-operative complications, aerobic capacity, physical fitness, and recovery was carried out in an attempt to answer the following research questions: (1) What is the effect of an exercise program in patients with an AAA or iliac artery aneurysm (IAA) (with or without an indication for surgical repair) on aerobic fitness and physical parameters?; (2) What is the effect of PET in patients with an AAA or IAA scheduled for surgical repair on the post-operative complications and the length of hospital stay?

METHODS

A systematic literature search was performed. The population of interest was patients with an AAA or IAA, and patients scheduled for surgical repair of an AAA or IAA. The intervention studied was PET (in case of patients scheduled for surgical repair) or an exercise program (in case of patients without an indication for surgical repair) compared with standard care (no exercise program). Outcome measures were aerobic capacity, physical fitness, post-operative complications, length of stay, and recovery.

PubMed, Embase, MEDLINE, The Cochrane Library, PEDro, CINAHL, and Web Of Knowledge were searched from the earliest date of each database up to May 2014. The search for publications was performed using the following search string: ([“Abdominal Aortic Aneurysm” {MeSH} OR EVAR OR open repair]) AND (“Physical Therapy Modalities” [MeSH] OR physical therapy OR physiotherapy OR “Exercise” [MeSH] OR exercise).

S.P. and E.M.W., who were both blinded to the authors of papers and titles of journals, separately screened and selected studies on the basis of title and abstract. After primary selection, both authors reviewed the full text of the selected studies and, based on the established selection criteria, determined suitability for inclusion. For further eligible studies, cross references were screened. Disagreements were solved by discussion with each other and the senior author (J.A.W.T.) until consensus was reached.

Inclusion criteria

The inclusion criteria for the studies were as follows: (i) a randomized controlled or prospective cohort trial; (ii) eligible participants were all patients with an AAA or IAA (without indication for surgical repair) and were scheduled for surgical repair of an AAA or IAA; (iii) the intervention consisted of a PET program, which was defined as a structured regimen of physical activities (either a standalone regimen, home based, or supervised) for specific therapeutic goals to gain or increase musculoskeletal and/or cardiovascular and/or respiratory function; (iv) reported outcome measurements were improvement of aerobic capacity and/or physical fitness, post-operative complications, length of stay, and recovery.

Rating of methodological quality was conducted using the Physiotherapy Evidence Database (PEDro) scale.[18,19] The PEDro scale has 11 criteria, with a maximum score of 10 (range 0–10) as the first item (the specification of the eligibility criteria) is not included in the total score. Two authors (S.P. and E.M.W.) separately rated the methodological quality of each included study, according to the PEDro scale, and the following classification was used: a score of <4 indicated poor methodological quality, between 4 and 5 fair quality, 6–8 good quality, and 9–10 excellent quality.[20]

The level of agreement between the authors was assessed by a Cohen’s kappa score, which was determined as follows: <0.20 poor agreement; 0.21–0.40 fair agreement; 0.41–0.60 moderate agreement; 0.61–0.80 good agreement; 0.81–1.00 very good agreement.[21]

Exercise physiology definitions

In exercise physiology and in this systematic review different terms will be used to describe and measure the effect of a PET program. Two different terms are often used: physical activity and physical fitness.[22] Physical activity is defined as any bodily movement produced by skeletal