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Benefits of Preoperative Exercise Therapy in Surgical Care; it Does Work, but how do we Need to Continue?

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Opinion

Preoperative physical function is shown to be an independent predictor of post-operative morbidity and mortality [1-3]. Surgical stress often leads to a substantial decrease in physical functioning through different pathways. In addition, prolonged periods of physical inactivity in the postoperative phase induces loss of muscle mass, cardiopulmonary deconditioning, pulmonary complications and psychological distress. These phenomena may result in a decreased quality of life postoperatively, increased morbidity and occasionally premature death [4-7].

In terms of cancer, most forms are prevalent in an elderly population that mainly unfit to undergo major surgery. Lung cancer for instance is one of the leading causes of cancer death worldwide [8]. It is frequently diagnosed at a late stage due to its initial asymptomatic course often leading to a poor prognosis. Surgical removal remains the best [curative] option for patients with stage I and II Non Small Cell Lung Cancer [NSCLC] and for selected patients with locally advanced disease [stage IIIA] [9]. However most patients selected for surgical removal have limited functional capacity, owing to associated comorbidities and/or the stage of the disease [10]. As preoperative physical capacity predicts postoperative recovery, especially in elderly patients, a substantial body of research is directed towards studying the effects of various regimens of Preoperative Exercise Therapy (PET) [11-14]. A number of postoperative outcome measures such as complication rate, length of hospital stay and time of convalescence were previously reviewed [15-17]. However, based on these reviews univocal conclusions cannot be obtained, in terms that PET is able to significantly reduce postoperative complications. PET has been identified as a successful therapy to improve overall physical and psychological well being in some cancer populations [mainly breast cancer] [18]. There is increasing evidence in the field of lung surgery [19-21] and also in other surgical specialties [15,17,22] that a preoperative exercise therapy (PET) program has beneficial effects on the postoperative course, especially on the prevention of postoperative complications, the length of hospital admission, physical fitness and quality of life. With such an increasing body of evidence, why aren't we able to further implement these PET programs in our daily practice? This review will address several aspects.

Definitions of exercise physiological variables

In exercise physiology different terms are used to describe and measure the effect of a PET program. For describing those effects two different terms are often used, physical activity and physical fitness [23]. Physical activity is defined as any bodily movement produced by skeletal muscles, which results in energy expenditure, which can be measured in kilojoules (kJ) or kilocalories (kcal) [23]. Physical capacity/fitness or 'being physically fit' is defined as: 'the ability to carry out daily tasks with vigour and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies [23]. For measuring the effect of PET programs, themost widely used parameters areventilatory threshold and VO_2 peak [24]. VO_2 peak is defined as the highest value of VO_2 attained at a maximal incremental exercise test [24]. The ventilatory threshold is the point during exercise at which pulmonary ventilation becomes disproportionately high with respect to the oxygen consumption. This point is believed to be the onset of usage of the anaerobic pathway (anaerobic threshold) [24].

Implementing problems

There is promising evidence for the effect of PET, but currently there are three problems when appraising the studies performed: 1) heterogeneous patient populations; 2) non-comparable PET programs and 3) lack of guidelines for the use of PET programs and reported outcome measures. The heterogeneity of PET programs makes comparisons difficult and according to several studies [15,25-28] it is not evident as to what the optimal exercise programs should be for this patient population. The timing around surgery is also a point of discussion. Preoperative exercise and postoperative exercise should be considered as separate entities mainly due to the time period available and the physical status of the patient in each setting [29].

Due to the small preoperative time period (from diagnosis to surgery), PET programs were shorter in duration (maximum of 4 weeks) and more intense in prescribed sessions a week to enable the maximum possible benefit. An example is study 1 of Benzo et al. [30] the presumed PET program was to long and health professionals were not willing to delay the surgery date. Studies investigating postoperative exercise programs have a much longer time period [21,29,31-34]. A shorter exercise program with a higher frequency of exercise sessions can be a problem for the relatively unfit patients. In a study of Jones and colleagues is described that their short and intense exercise program may have worsened fatigue due to its intense and demanding nature in a population that was deconditioned and had significant comorbidity [35]. So far the majority of the included studies use the physical activity guidelines for adults, which recommends exercise sessions of 30 minutes five times a week [36].

It is evident that the setting of the exercise intervention (PET or postoperative exercise) is an important influencing factor. Inpatient studies frequently had supervision during the exercise sessions. It remains questionable if this is feasible in an outpatient setting, due to costs and because of the fact that travel (distance) is an important barrier for attending an exercise session [37,38]. Realistically due to the financial aspects, home-based or outpatient studies may be more manageable in the longer term. Also, in a review by Dalal et al. [37] it was described that home-based cardiac rehabilitation programs have superior adherence rates than centre-based programs.

Adherence/Participation

In cardiac rehabilitation, exercise interventions are the cornerstone of rehabilitation but participation rates remain low. This might be due to three barriers that have been identified in the literature regarding participation; service and system level barriers (physician recommendations and misconceptions about the rehabilitation program], practical barriers (transport and parking), and personal barriers (perceptions of the ability to control the disease) [29,38]. In future research these barriers have to be taken into account to develop a more suitable interventions, which will result in higher adherence rates.

Exercise capacity

Exercise capacity, measured with the VO_2max, is an important consideration in decision-making whether a patient is suitable for surgical resection. Peak VO_2 max is reported as the strongest independent predictors of surgical complications [39]. Poor exercise capacity has been shown to be a major determinant of morbidity and mortality after lung resection surgery [40-42]. Therefore interventions aimed to improve the exercise capacity and VO_2max might lower postoperative complications, length of stay and costs of hospital admissions [15,22,29,43-45]. Interestingly, several of the included studies showed that recruited patients who had impaired exercise capacity at baseline (VO_2max <15ml/kg/min) [46-49], were those who benefitted the most from the exercise intervention.

Directions for future research

The goal of a PET program is to prepare patients for surgery in the best possible way with the objective to reduce post-operative complications, length of stay, and the healthcare costs. The results seem promising, but a necessity for future research remains. To be able to perform high quality research in the near future, definitions of PET, including timing, (acceptable) duration, intensity and exercise training methods should be determined and compared. Also the effects of PET need to be studied in specific patient groups, per example patients with COPD compared to patients without COPD (both scheduled for lung resection surgery). Future improvements in standards of care and optimal pre-operative preparation should not only focus of the surgical team and the hospital organisation but also on incorporating the active role of the patient.

References

1. Thombs BD, Ziegelstein RC, Stewart DE, Abbey SE, Parakh K, et al. (2008) Physical health status assessed during hospitalization for acute coronary syndrome predicts mortality 12 months later. Journal of psychosomatic research 65(6): 587-593.
2. Tosteson AN, Gottlieb DJ, Radley DC, Fisher ES, Melton LJ (2007) Excess mortality following hip fracture: the role of underlying health status. Osteoporosis international : A journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA 18(11): 1463-1472.
3. Cesari M, Onder G, Zamboni V, Manini T, Shorr RI, et al. (2008) Physical function and self-rated health status as predictors of mortality: results from longitudinal analysis in the ilSIRENTE study. BMC Geriatr 8: 34.
4. Bajotto G, Shimomura Y (2006) Determinants of disuse-induced skeletal muscle atrophy: exercise and nutrition countermeasures to prevent protein loss. J Nutr Sci Vitaminol 52(4): 233-247.
5. Kortebein P (2009) Rehabilitation for hospital-associated deconditioning. Am J Phys Med Rehabil 88(1): 66-77.
6. Chetta A, Tzani P, Marangio E, Carbognani P, Bobbio A, et al. (2006) Respiratory effects of surgery and pulmonary function testing in the preoperative evaluation. Acta Biomed 77(2): 69-74.

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7. Walton-Geer PS (2009) Prevention of pressure ulcers in the surgical patient. AORN journal 89(3): 538-548.

8. Sugimura H, Nichols FC, Yang P, Allen MS, Cassivi SD, et al. (2007) Survival after recurrent non small-cell lung cancer after complete pulmonary resection. Ann Thorac Surg 83(2): 409-417.

9. Peddle CJ, Jones LW, Eves ND, Reiman T, Sellar CM, et al. (2009) Effects of presurgical exercise training on quality of life in patients undergoing lung resection for suspected malignancy: a pilot study. Cancer Nurs 32(2): 158-165.

10. Little AG, Rusch VW, Bonner JA, Gaspar LE, Green MR, et al. (2005) Patterns of surgical care of lung cancer patients. The Annals of thoracic surgery 80(6): 2051-2056.

11. Arozullah AM, Khuri SF, Henderson WG, Daley J (2001) Development and validation of a multifactorial risk index for predicting postoperative pneumonia after major noncardiac surgery. Ann Intern Med 135(10): 847-857.

12. Biccard B (2005) Relationship between the inability to climb two flights of stairs and outcome after major non-cardiac surgery: implications for the pre-operative assessment of functional capacity. Anaesthesia 60(6): 588-593.

13. Brutsche MH, Spiliopoulos A, Bolliger CT, Licker M, Frey JG, et al. (2000) Exercise capacity and extent of resection as predictors or surgical risk in lung cancer. Eur Respir J 15(5): 828-832.

14. Michota FA, Frost S (2004) The preoperative evaluation: use the history and physical rather than routine testing. Cleve Clin J Med 71(1): 63-70.

15. Pouwels S, Stokmans RA, Willigendael EM, Nienhuijs SW, Rosman C, et al. (2014) Preoperative exercise therapy for elective major abdominal surgery: a systematic review. Int J Surg 12(2): 134-140.

16. Pouwels S, Willigendael EM, van Sambeek MR, Nienhuijs SW, Cuypers PW, et al. (2014) Beneficial Effects of Pre-operative Exercise Therapy in Patients with an Abdominal Aortic Aneurysm: A Systematic Review. Eur J Vasc Endovasc Surg 49(1): 66-67.

17. Valkenet K, van de Port IG, Dronkers JJ, de Vries WR, Lindeman E, et al. (2011) The effects of preoperative exercise therapy on postoperative outcome: a systematic review. Clin Rehabil 25(2): 99-111.

18. McNeely ML, Campbell KL, Rowe BH, Klassen TP, Mackey JR, et al. (2006) Effects of exercise on breast cancer patients and survivors: a systematic review and meta-analysis. CMAJ 175(1): 34-41.

19. Puhan MA, Chandra D, Mosenifar Z, Ries A, Make B, et al. (2011) The minimal important difference of exercise tests in severe COPD. Eur Respir J 37(4):784-790.

20. Lacasse Y, Goldstein R, Lasserson TJ, Martin S (2006) Pulmonary rehabilitation for chronic obstructive pulmonary disease. Cochrane Database Syst Rev 18(4): CD003793.

21. Cavalheri V, Tahirah F, Nonoyama M, Jenkins S, Hill K (2013) Exercise training undertaken by people within 12 months of lung resection for non-small cell lung cancer. Cochrane Database Syst Rev 7: CD009955.

22. Lemanu DP, Singh PP, MacCormick AD, Arroll B, Hill AG (2013) Effect of preoperative exercise on cardiorespiratory function and recovery after surgery: a systematic review. World J Surg 37(4): 711-720.

23. Caspersen CJ, Powell KE, Christenson GM (1985) Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. Public Health Rep 100(2): 126-131.

24. Ghosh AK (2004) Anaerobic threshold: its concept and role in endurance sport. Malays J Med Sci MJMS 11(1): 24-36.

25. Pouwels S, Fiddelaers J, Teijink JA, Woorst JF, Siebenga J, et al. (2015) Preoperative exercise therapy in lung surgery patients: A systematic review. Respir Med 109(12): 1495-1504.

26. Pouwels S, Hageman D, Gommans LN, Willigendael EM, Nienhuijs SW, et al. (2016) Preoperative exercise therapy in surgical care: a scoping review. J Clin Anesth 33: 476-490.

27. Pouwels S, Willigendael EM, van Sambeek MR, Nienhuijs SW, Cuypers PW, et al. (2015) Beneficial Effects of Pre-operative Exercise Therapy in Patients with an Abdominal Aortic Aneurysm: A Systematic Review. Eur J Vasc Endovasc Surg 49(1): 66-76.

28. Pouwels S, Wit M, Teijink JA, Nienhuijs SW (2015) Aspects of Exercise before or after Bariatric Surgery: A Systematic Review. Obesity facts 8(2): 132-146.

29. Crandall K, Maguire R, Campbell A, Kearney N (2014) Exercise intervention for patients surgically treated for Non-Small Cell Lung Cancer [NSCLC]: a systematic review. Surg Oncol 23(1): 17-30.

30. Benzo R, Wigle D, Novotny P, Wetzstein M, Nichols F, et al. (2011) Preoperative pulmonary rehabilitation before lung cancer resection: results from two randomized studies. Lung cancer 74(3): 441-445.

31. Bradley A, Marshall A, Stonehewer L, Reaper L, Parker K, et al. (2013) Pulmonary rehabilitation programme for patients undergoing curative lung cancer surgery. European Journal of Cardio-thoracic Surgery 44(4): e266-e271.

32. Brocki BC, Andreasen J, Nielsen LR, Nekrasas V, Gorst-Rasmussen A, et al. (2014) Short and long-term effects of supervised versus unsupervised exercise training on health-related quality of life and functional outcomes following lung cancer surgery-a randomized controlled trial. Lung cancer 83(1): 102-108.

33. Cavalheri V, Tahirah F, Nonoyama M, Jenkins S, Hill K (2014) Exercise training for people following lung resection for non-small cell lung cancer-a Cochrane systematic review. Cancer Treat Rev 40(4): 585-594.

34. Crisafulli E, Venturelli E, Siscaro G, Florini F, Papetti A, et al. (2013) Respiratory muscle training in patients recovering recent open cardiothoracic surgery: a randomized-controlled trial. BioMed Research International 2013(2013): 1-7.

35. Jones LW, Eves ND, Peddle CJ, Courneya KS, Haykowsky M, et al. (2009) Effects of presurgical exercise training on systemic inflammatory markers among patients with malignant lung lesions. Applied Physiology, Nutrition, and Metabolism 34(2): 197-202.

36. Oja P, Bull FC, Fogelholm M, Martin BW (2010) Physical activity recommendations for health: what should Europe do? BMC Public Health 10: 10.

37. Dalal HM, Zawada A, Jolly K, Moxham T, Taylor RS (2010) Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis. BMJ 340: b5631.

38. Neubeck L, Freedman SB, Clark AM, Briffa T, Bauman A, et al. (2012) Participating in cardiac rehabilitation: a systematic review and meta-synthesis of qualitative data. Eur J Prev Cardiol 19(3): 494-503.

39. Loewen GM, Watson D, Kohman L, Herndon JE, Shennib H, et al. (2007) Preoperative exercise Vo2 measurement for lung resection candidates: results of Cancer and Leukemia Group B Protocol 9238. J Thorac Oncol 2(7): 619-625.

40. Win T, Jackson A, Sharples L, Groves AM, Wells FC, et al. (2005) Cardiopulmonary exercise tests and lung cancer surgical outcome. Chest 127(4): 1159-1165.

41. Spyratos D, Zarogoulidis P, Porpodis K, Angelis N, Papaiwannou A (2014) Preoperative evaluation of lung resection candidates. Preface. J Thorac Dis 6(1): S162-S166.

42. Brunelli A, Kim AW, Berger KI, Addrizzo Harris DJ (2013) Physiologic evaluation of the patient with lung cancer being considered for resectional surgery: Diagnosis and management of lung cancer, 3rd ed:

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American College of Chest Physicians evidence-based clinical practice guidelines. Chest 143(5): e166S-e190S.

43. Hulzebos EH, Helders PJ, Favié NJ, Bie RA, Brutel de la Riviere A, et al. (2006) Preoperative intensive inspiratory muscle training to prevent postoperative pulmonary complications in high-risk patients undergoing CABG surgery: a randomized clinical trial. JAMA 296(15): 1851-1857.

44. Valkenet K, de Heer F, Backx FJ, Trappenburg JC, Hulzebos EH, et al. (2013) Effect of inspiratory muscle training before cardiac surgery in routine care. Physical Therapy 93(5): 611-619.

45. Nagarajan K, Bennett A, Agostini P, Naidu B (2011) Is preoperative physiotherapy/pulmonary rehabilitation beneficial in lung resection patients? Interact Cardiovasc Thorac Surg 13(3): 300-302.

46. Bobbio A, Chetta A, Ampollini L, Primomo GL, Internullo E, et al. (2008) Preoperative pulmonary rehabilitation in patients undergoing lung resection for non-small cell lung cancer. Eur J Cardiothorac Surg 33(1): 95-98.

47. Coats V, Maltais F, Simard S, Frechette E, Tremblay L, et al. (2013) Feasibility and effectiveness of a home-based exercise training program before lung resection surgery. Can Respir J 20(2): e10-e16.

48. Divisi D, Di Francesco C, Di Leonardo G, Crisci R (2013) Preoperative pulmonary rehabilitation in patients with lung cancer and chronic obstructive pulmonary disease. European Journal of Cardio-Thoracic Surgery 43(2013): 293-296.

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