Prescribing Exercise for the Older Patient

TERENCE KAVANAGH

From Faculties of Medicine and Physical Education and Health, University of Toronto, Canada

KAVANAGH: ***Prescribing Exercise for the Older Patient.*** *Exercise, as well as all forms of physical activity, is known to provide a wide range of physiologic and psychosocial benefits to older individuals. For this population cardiac rehabilitation offers an improvement in functional capacity, alleviation of symptoms, enhanced mood state and quality of life, and a modification of coronary risk factors. The components of a comprehensive elderly-specific exercise programme are the same as for younger patients. However, the changes, which accompany the aging process, require some modification in both the aerobic and resistance exercise programmes. (J HK Coll Cardiol 2006;14 (Suppl 2):B85-B88)*

Aging, exercise training, training benefits

摘要
運動和其他形式的體育活動，對於老年人能夠提供一系列生理上和心理上的益處。對於心臟病復康治療的人群，可以改善機體功能、緩解症狀、提高心理狀態和生活質量、降低冠心病的危險因素。針對老年病人的綜合運動計劃的組成部分與年輕病人是一致的。然而伴隨著年齡的改變，需要在有氧訓練和阻力訓練中作些調整。

關鍵詞：老年化　運動訓練　訓練益處

Exercise Training

The aerobic benefits of exercise for older individuals are much the same as they are for younger populations (Table 1).[1,2] Peak oxygen intake ($\dot{V}O_{2peak}$) is the best measure of exercise capacity, and this has been shown to decline progressively from age 30 at the rate of approximately 3% to 8% per decade, accelerating rapidly after age 70, regardless of fitness level or habitual physical activity.[3] A $\dot{V}O_{2peak}$ of 15 mL/kg/min has been identified as the threshold below which independent living becomes difficult.[4] Elderly patients frequently show $\dot{V}O_{2peak}$ values which range from 15 to 19 mL/kg/min, suggesting that they already have difficulties living independently. Thus, even a modest improvement in fitness will delay the onset of dependency. In fact, studies show older persons can increase their $\dot{V}O_{2peak}$ by as much as 16% to 29% following exercise training; an improvement similar to or in some cases greater than their younger counterparts.[5,6] Older patients have also exhibited a training-induced reduction in rate pressure product, allowing them to achieve submaximal workloads at reduced ventilation, blood lactate levels, and perception of fatigue.[7,8] Activities such as climbing stairs, completing heavy household chores, or carrying out physical leisure-time activities are completed without angina or shortness of breath. None of the elderly-related studies reported any exercise mishap.

Resistance Training

Older patients should be encouraged to supplement cardiorespiratory endurance activities and an active lifestyle with strength developing exercises. Preferred inclusion criteria are moderate to good left ventricular function and an exercise capacity greater than 5 METs. Contraindications are: unstable angina, uncontrolled hypertension (systolic

Address for reprints: Prof. Terence Kavanagh
Room 306, 901 Lawrence Ave. W., Toronto, ON M6A 1C3, Canada

Tel: (416) 229 6087; Fax: (416) 730 0421

Received October 20, 2006; revision accepted October 26, 2006

Table 1. Benefits of aerobic training [1,2]

- Increase in maximal work capacity as well as a greater tolerance for prolonged submaximal physical tasks.*
- Decrease in rate pressure product and thus myocardial oxygen demand at rest and at the same submaximal levels of effort. The net effect is to increase the threshold for angina and/or ST-segment depression.*
- Reduction in abdominal (visceral) adiposity, with enhanced sensitivity to insulin, improved glucose tolerance and a consequent reduction in the risk of type 2 diabetes.*
- Reduction in triglycerides and an increase in HDL-cholesterol levels.*
- Lowering of systolic and diastolic blood pressure in hypertensive subjects.*
- Enhanced mood state and quality of life.*
- Increase in fibrinolytic activity, a reduction in fibrinogen levels and platelet activity.
- Decrease in resting and exercise plasma catecholamine levels and sympathetic tone with a consequent reduction in the threshold for lethal ventricular arrhythmias.
- Improvement in endothelial function.

** Benefit demonstrated in older patients with coronary artery disease*

pressure >160 mm Hg and/or diastolic pressure >100 mm Hg), uncontrolled dysrrhythmias, uncompensated chronic heart failure, severe stenotic or regurgitant valvular disease and hypertrophic cardiomyopathy. For patients who meet these criteria, the principles of prescription for resistance training are similar to those in younger individuals, with some modifications.[2] A number of studies have demonstrated the value of resistance training in young subjects as well as older individuals with and without coronary heart disease.[9-13] Benefits are observed even among the nonagenarians and frail elderly residing in nursing homes.[14] The specific benefits are shown in Table 2.

The Exercise Programme

Although many older patients have a low fitness level, others have enjoyed an active physical life and aspire to regain their prior functional capacity through exercise rehabilitation. Thus, although it is prudent to start exercise training at a low intensity and to progress cautiously in those who are poorly conditioned, one should allow for individual differences and prescribe accordingly.

The general principles of exercise prescription are similar for both young and old. However some modifications may be required to allow for age-related changes, which may affect the responses to exercise (Table 3). It is also important to individualize the exercise prescription based on clinical status, symptoms and comorbidity. A well-rounded programme should include not only strength and endurance training but also flexibility and balance.

As with younger patients, the exercise prescription is customarily based on the results of an exercise test. The preferred protocol is one in which the initial work rate is low and the subsequent increments

Table 2. Benefits of resistance training [9-13]

- Increases in maximal muscle strength and lifting endurance.
- Improvements, or retarded losses, of bone mineral content and bone mineral density.
- Increase in peak exercise capacity, submaximal endurance, and reduced ratings of perceived exertion during submaximal exercise.
- Reduced arterial pressure during lifting with the trained muscles.
- Improvement in tasks demanding significant arm or leg strength or balance.
- Improvement in quality of life parameters such as total mood disturbance, depression/dejection, fatigue/inertia, and emotional health domain scores.

small, e.g., a modified Bruce or Naughton test.[15] When patient balance is poor, exercise on a cycle ergometer is an alternative to the treadmill. For the very frail elderly, other testing options are electrocardiographic telemetry during submaximal tests such as the six-minute walk,[16] the 10-metre shuttle walk test,[17] or simulated activities of daily living.[18,19] Contraindications to testing and training are similar to those in younger patients. The essential components of the exercise prescription are also similar to those of the younger patient, with appropriate allowances for the aging changes (Tables 4 & 5).

Conclusions

Older patients are more disabled than their younger counterparts, have a lower exercise capacity,

Table 3. Physiological changes that occur with aging

- A gradual decline in maximal heart rate and maximal oxygen intake due to reduced beta-adrenergic sensitivity.
- A slower increase and decrease in heart rate at the onset of exercise and in recovery.
- Elevated systolic blood pressure, the result of an increase in aortic and large vessel wall stiffness.
- Postural hypotension, the consequence of a decrease in baroreceptor responsiveness and postexertional venous pooling. This is common in 30% to 50% of those over 75 years.
- Impaired heat tolerance due to reduced sensation of thirst, an increase in subcutaneous fat (limiting heat loss by radiation) as well as atrophy and loss of sweat glands (reducing evaporation).
- Increase in various conduction defects, e.g., sick sinus syndrome, bundle branch block, atrial ventricular block - because of a decrease in pacemaker cells and bundle branch fibres.
- Atypical adverse drug reactions.
- Increasing tendency to diastolic dysfunction and exertional dyspnea, the result of slow left ventricular relaxation, reduced diastolic distensibility, and increased chamber stiffness.

Table 4. Aerobic exercise prescription for the elderly patient

- **Mode.** By definition, aerobic exercise must be continuous and rhythmic; high impact exercise such as jogging should be avoided. Preferred activities include walking, stationary cycling, low impact or water aerobics, and swimming or arm ergometry. The activity should be accessible, convenient, enjoyable and sociable (group sessions).
- **Intensity.** Commonly this is based on a percentage of $\dot{V}O_2$ reserve *, (% $\dot{V}O_2R$), a percentage of maximal heart rate reserve (%HRR), or on the patient's perceived exertion.
  - $\dot{V}O_2R$. Training intensities range from 40% to 70%, depending on fitness. Older patients, at least initially, will obtain a training effect at the lower intensities, i.e., 40% to 60%.
  - HRR. The preferred training range is 40% to 70%. Note that HR_{max} varies considerably in older individuals and where possible it should be measured rather than age predicted. A common age predicted equation is HR_{max} = 220 - age (yrs). On occasion, meaningful gains in cardiovascular fitness can be obtained at training rates less than 100 bts/min, or where indicated, 10 beats below the heart rate safely achieved at exercise testing.

    * % $\dot{V}O_2R$ = (intensity fraction) ($\dot{V}O_{2peak}$ minus $\dot{V}O_{2rest}$) plus $\dot{V}O_{2rest}$)
    Eg: 40% of HRR for a subject with a HR_{peak} of 160 and a HR_{rest} of 72=(160-72) x 0.40 + 72 = 107 beats per minute

  - Perceived Exertion. In practice, the Borg numerical scale is the most commonly used (range 6 - 20). A rating of 12 is "light", and is equivalent to $\dot{V}O_2R$ 40%, whereas a rating of 15 is " hard" and is equivalent to $\dot{V}O_2R$ 70%.
- **Duration.** Length of workout should start at 20 minutes and progress to 45 minutes. Where the physical limitations are such that the duration is limited to less than 15 minutes, one should aim for two to three sessions daily. Additional time should be allowed for a longer warm-up and cool-down, (e.g., 10 to 15 minutes), which can be spent at light activities and stretching exercises.
- **Frequency.** Workouts should occur three to five times weekly.

Table 5. Prescribing resistance training

- Patients should take part in two to four weeks of aerobic training prior to doing resistance training. Pretraining instructions should emphasize correct lifting and breathing techniques. Training should be carried out twice weekly and include one set of 10 to 15 repetitions of eight to 10 exercises designed to train all major muscle groups.
- Begin using light weights, which should result in moderate levels of fatigue by the end of a set of lifting. Once patients can complete their final lift with ease, the weights can be increased by two pounds for the arms and five pounds for the legs.
- Equipment can include springs, elastic bands, free weights and an assortment of machines. The likelihood of dropping a weight is greater in older patients and therefore machine weights may be preferable.
- Blood pressure can be monitored in a nonengaged limb. Note that pressures measured immediately after lifting do not reflect the increase during lifting, and may even be below the resting values. Artifact from muscle contraction limits the value of electrocardiographic telemetry.

and have a greater prevalence of comorbid conditions. Nevertheless, there is convincing evidence that this population can benefit from an exercise programme in terms of improved effort tolerance, enhanced ability to live independently, alleviation of depression and anxiety, modification of coronary risk factors, and an increase in quality of life measures. Despite this, there is a perceptible gap between the number of older patients, particularly women, who are potential candidates for cardiac rehabilitation and the number of patients actually referred. Health professionals should keep this in mind and strongly encourage older patients to participate in rehabilitation programmes.

References

1. Kavanagh T. The role of exercise training in cardiac rehabilitation. In: Cardiac Rehabilitation. Eds: R West, D Jones. BMJ Publishing Group. London 1995;54-82.
2. American College of Sports Medicine. ACSM's guidelines for exercise testing and prescription. Lippincott Williams & Wilkins, Baltimore, MD, 2006.
3. Fleg JL, Morrell CH, Bos AG, et al. Accelerated longitudinal decline of aerobic capacity in healthy older adults. Circulation 2005;112:674-82.
4. Paterson DH, Cunningham DA, Koval JJ, et al. Aerobic fitness in a population of independently living men and women aged 55-86 years. Med Sci Sports Exerc 1999;31:1813-20.
5. Williams MA, Maresh CM, Esterbrooks DJ, et al. Early exercise training in patients older than age 65 years compared with that in younger patients after acute myocardial infarction or coronary artery bypass grafting. Am J Cardiol 1985;55:263-6.
6. Lavie CJ, Milani RV, Littman AB. Benefits of cardiac rehabilitation and exercise training in secondary coronary prevention in the elderly. J Am Coll Cardiol 1993;22:678-83.
7. Ades PA, Waldmann ML, Poehlman ET, et al. Exercise conditioning in older coronary patients. Submaximal lactate response and endurance capacity. Circulation 1993;88:572-7.
8. McConnell TR, Laubach CA 3rd. Elderly Cardiac Rehabilitation Patients Show Greater Improvements in Ventilation at Submaximal Levels of Exercise. Am J Geriatr Cardiol 1996;5:15-23.
9. McCartney N. Role of resistance training in heart disease. Med Sci Sports Exerc 1998;30(10 Suppl):S396-402.
10. Hung C, Daub B, Black B, et al. Exercise training improves overall physical fitness and quality of life in older women with coronary artery disease. Chest 2004;126:1026-31.
11. Pollock ML, Franklin BA, Balady GJ, et al. AHA Science Advisory. Resistance exercise in individuals with and without cardiovascular disease: benefits, rationale, safety, and prescription: An advisory from the Committee on Exercise, Rehabilitation, and Prevention, Council on Clinical Cardiology, American Heart Association; Position paper endorsed by the American College of Sports Medicine. Circulation 2000;101:828-33.
12. McCartney N, McKelvie RS, Haslam DR, et al. Usefulness of weightlifting training in improving strength and maximal power output in coronary artery disease. Am J Cardiol 1991;67:939-45.
13. Braith RW. Exercise training in patients with CHF and heart transplant recipients. Med Sci Sports Exerc 1998;30(10 Suppl):S367-78.
14. Fiatarone MA, Marks EC, Ryan ND, et al. High-intensity strength training in nonagenarians. Effects on skeletal muscle. JAMA 1990;263:3029-34.
15. Fletcher GF, Balady GJ, Amsterdam EA, et al. Exercise standards for testing and training: a statement for healthcare professionals from the American Heart Association. Circulation 2001;104:1694-740.
16. Guyatt GH, Sullivan MJ, Thompson PJ, et al. The 6-minute walk: a new measure of exercise capacity in patients with chronic heart failure. Can Med Assoc J 1985;132:919-23.
17. Steele B. Timed walking tests of exercise capacity in chronic cardiopulmonary illness. J Cardiopulm Rehabil 1996;16:25-33.
18. Cress ME, Buchner DM, Questad KA, et al. Continuous-scale physical functional performance in healthy older adults: a validation study. Arch Phys Med Rehabil 1996;77:1243-50.
19. Reuben DB, Siu AL. An objective measure of physical function of elderly outpatients. The Physical Performance Test. J Am Geriatr Soc 1990;38:1105-12.