Exercise — the need for careful prescription


Summary

Exercise, particularly jogging, has recently been criticised by certain reputable medical practitioners because of its often injurious nature. We contend that regular physical activity, if correctly prescribed and carried out, can be an extremely safe means of acquiring improved health for both the young and the elderly.

Phase I — the exclusion phase

This phase is concerned with the exclusion of contraindications to exercise, the recognition of factors which may contribute to sudden death during physical activity, and the detection of factors which may influence the exact nature of the exercises which are to be prescribed. This is achieved by a comprehensive case history, physical examination, chest radiograph, resting ECG, and routine blood tests — full blood count and a fasting lipogram, estimations of urea and electrolyte, fasting blood glucose and uric acid levels. Special investigations, e.g. echocardiography, are performed if indicated.

Detection of causes of sudden death during exercise is emphasized, viz.: (i) coronary atherosclerosis — most studies2 have concluded that this is the commonest lesion associated with sudden death during exercise; the practitioner must determine which of the risk factors for the development of coronary heart disease (CHD) are present and an attempt should be made to modify these factors where possible; (ii) hypertrophic cardiomyopathy; (iii) aortic stenosis; and (iv) prolapsed mitral valve.

Other conditions which have been associated with sudden death during exercise are dissection of the aorta, emboli from atrial myxoma, congenital abnormalities of the coronary circulation, and an intramural coronary artery (it has, however, been noted by Morales et al.3 that some evidence of intramural dipping of the left anterior descending coronary artery is present in approximately 27% of consecutive autopsies).

Patients suffering from any of the above conditions who are allowed to participate in an exercise programme should be warned of factors which might place them at risk while exercising, i.e. competition (the resultant increased sympathetic stimulation sensitizes the heart to ventricular fibrillation), attempting to exercise too much too soon, physical activity during acute infections, and cigarette smoking.

Contraindications to an immediate exercise programme are the following: (i) active carditis; (ii) cardiac failure; (iii) myocardial infarction within the previous 6 - 8 weeks; (iv) unstable angina pectoris; (v) recent pulmonary embolus or deep venous thrombosis; (vi) large left ventricular aneurysm; (vii) uncontrolled hypertension, diabetes mellitus or epilepsy; (viii) acute pyrexial illness; and (ix) the following ECG abnormalities — ventricular tachycardia, second or third degree atrioventricular block, untreated atrial fibrillation, sick-sinus syndrome, or uninvestigated paroxysmal atrial tachycardia; or the presence of a fixed-rate pacemaker.

During the examination careful note must be made of any other factors which may influence the actual nature of the exercises to be prescribed, such as lateral epicondylitis, a common lesion in the 30+ age group, may prevent exercises involving the forearm extensors from being used.

Phase II — the evaluation phase

The graded exercise test — a screening procedure. It has been recommended by the American Heart Association and the American College of Sports Medicine4 that all individuals over 35 years of age should undergo a graded exercise test as part of

Excerpts from the text include:

- The graded exercise test — a screening procedure. It has been recommended by the American Heart Association and the American College of Sports Medicine4 that all individuals over 35 years of age should undergo a graded exercise test as part of
the medical screening procedure before participating in an exercise programme. At our centre a symptom-limited (SL) exercise ECG is performed using either the Bruce or modified Bruce protocol with continuous monitoring of anterior (V1), lateral (V5) and inferior (aVF) leads by means of a Marquette computer-assisted system. This is performed for a dual purpose — as a screening procedure for underlying ischaemic heart disease, and to determine the heart rate at which the patient can safely exercise, i.e. his working heart rate (WHR).

As it is the intention of this evaluation to mimic as closely as possible those circumstances which will prevail in a later energy-expending situation, the test is carried out with the patient on his usual cardio-active medication. The use of a pulse rate in EP is not possible if the evaluation stress test avoids such drugs as B-blockers or anti-arrhythmic agents, for example. This is an entirely different situation from that in which a stress test is being performed primarily for diagnostic purposes where, because of the prolonged half-life of some of the drugs, considerable drug-free periods may be required before diagnostic testing.

The patient's WHR is now calculated from the following formula: WHR = 85% of SL heart rate. The patient is instructed how to take his pulse rate and is encouraged to train at an intensity which will enable his heart rate to come as close to his WHR as possible without exceeding it; he must slow down should this occur.

Criteria for terminating the test and for determination of the patient's heart rate are based on:
- Clinical symptoms — chest pain, extreme shortness of breath, fatigue, dizziness, nausea.
- Clinical signs — pallor, ataxia or syncope; inadequate rise in systolic pressure; inadequate rise in heart rate; rise in diastolic pressure to above 110 mmHg; attainment of recommended safe heart rate for patient's age (200 minus age in years).

ECG changes — progressing arrhythmia, multifocal ventricular ectopic beats, horizontal or downward sloping ST depression greater than 1 mm.

Submaximal measurement of the patients' oxygen consumption is performed using a Morgan exercise test system on a separate occasion to the stress test owing to the facilities available — the two tests should ideally be performed simultaneously. Progressive workloads on a Quinton (model 18-60) clinical research treadmill are employed as follows — the patient commences to walk at 3 km/h at a gradient of 2%; the treadmill speed is increased by 1 km/h every 3 minutes until 7 km/h is reached; the gradient is then increased every 3 minutes until the patient's WHR is reached. The maximum oxygen capacity (Vo2_max) is then predicted by the use of regression lines. If the above procedures are followed, exercise can become an indivisualized EP is formulated consisting of a 'warm-up' period consisting of muscular and flexibility exercises with a significant emphasis on duration rather than intensity of aerobic exercise, followed by a relatively low-intensity, long-duration (over 45 minutes), aerobic exercise. Further advantages of long-duration (over 45 minutes), relatively low-intensity (more than 25-35 kJ/min) exercise are that the utilization of fats as a major energy source occurs only after approximately 30 minutes of exercise irrespective of intensity, less stress is placed on a coronary circulation which may already be compromised, and the likelihood of serious musculoskeletal injury is reduced.

Since walking, jogging and cycling do not exercise the upper body musculature to a significant extent, it is recommended that muscular and flexibility exercises be incorporated as a 'warm-up' before aerobic exercise. As the resistance which is provided by body weight in many calisthenics (e.g. press-ups) may be too high for elderly patients, isotonic exercises with light dumbbells (20 - 30% of maximum) and high repetitions, are preferred for muscular conditioning. This particularly applies to arm exercises which are more stressful to the cardiovascular system than leg exercises. Single arm exercises and isometric exercises are avoided. Stretching is also utilized as it has been shown to reduce muscle soreness resulting from exercise, and is thought to play an important role in the prevention of musculoskeletal injuries.

The following points should be emphasized when counselling the aspirant exerciser:
1. The need to check his pulse rate before, during and after exercise; WHR is never to be exceeded.
2. The importance of an adequate 'warm-up' and 'cool-off' period.
3. The dangers of exercise in adverse climatic conditions and the importance of adequate fluid replacement during exercise.
4. The dangers of training while suffering from a pyrexial illness.
5. The correct method of breathing during static exercise.
6. The need for advice on correct footwear and the terrain on which jogging should be performed in order to minimize injury.
7. The need for medical supervision initially for patients at risk e.g. post-myocardial infarct patients.
8. Explanation of primary muscular injury treatment by rest, ice, compression and elevation.

Thus an individualized EP is formulated consisting of a 'warm-up' period consisting of muscular and flexibility exercises followed by a relatively low-intensity, long-duration aerobic exercise, and ending with a 'cool-off' period. The patient now commences with a low-dose EP which is gradually increased as his cardiovascular and musculoskeletal systems adapt to the exercise.

If the above procedures are followed, exercise can become both a safe and useful prescription for medical practitioners and their patients.

REFERENCES

Phase III — the prescription

The exercise programme is now prescribed in accordance with the above findings. We interpret fitness as 'being fit for life'; since approximately 1 in 4 White males suffers from CHD before the age of 60 years, the major emphasis of our programme is on the attainment of cardiovascular fitness. The patient is thus placed on a programme comprising mainly aerobic exercises such as walking, jogging or cycling according to his preferences, the facilities available and his physical limiting factors.

Studies by Morris et al. and Paffenbarger and Hale, have shown that the threshold level of exercise which provides partial protection against coronary atherogenesis is in the region of 30 kJ/min for 30 minutes (equivalent to walking at approximately 6.5 km/h). Hellerstein suggests that exercise three times weekly may be ideal for creating improved cardiovascular fitness in adults — this is particularly applicable in elderly patients as the alternating day off will help reduce their predisposition to musculoskeletal injuries. For uncomplicated cases we recommend exercise a minimum of 5 days per week with emphasis on duration rather than intensity of aerobic exercise, since energy expenditure is to a certain extent related to the time spent exercising rather than the intensity of the exercise. Further advantages of long-duration (over 45 minutes), relatively low-intensity (more than 25-35 kJ/min) exercise are that the utilization of fats as a major energy source occurs only after approximately 30 minutes of continuous exercise irrespective of intensity, less stress is placed on a coronary circulation which may already be compromised, and the likelihood of serious musculoskeletal injury is reduced.

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REFERENCES
The treatment of craniosynostosis

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Summary
Craniosynostosis produces symmetrical or asymmetrical deformity of the skull, usually detectable at birth. The clinical features are characteristic according to the suture or sutures involved. Surgical treatment should be instituted as early as possible, either by linear craniectomy, lateral canthal advancement or subtotal calvariecotomy.

Craniosynostosis is a surgically correctable deformity of the skull in which one or more of the cranial sutures is prematurely fused. In the common congenital form the sutures are fused before birth and the cosmetic abnormality is detectable immediately after delivery. Acquired sutural synostosis may follow shunting procedures for hydrocephalus.

Enlargement of the cranium is produced by separation of the vault bones at the sutures due to the increasing volume of the underlying brain. A passive or secondary filling in by bone then occurs at the sutures. Transverse growth of the vault takes place at the sagittal suture while anteroposterior growth is allowed by the coronal and lambdoid sutures (Fig. 1). Growth is restricted at right angles to a closed suture and compensatory growth occurs elsewhere. Symmetrical or asymmetrical skull deformities result and are best described by naming the suture or sutures involved.

Symmetrical deformity is caused by sagittal, metopic or bilateral coronal synostosis and also occurs when all vault sutures are affected. An asymmetrical skull (plagiocephaly) is associated with unilateral coronal or lambdoid synostosis. Sagittal synostosis (Fig. 2) restricts transverse growth of the skull, which becomes elongated owing to increased growth at the coronal and lambdoid sutures, producing a boat-shaped or scaphocephalic skull with a midline bony ridge. Premature fusion of the metopic suture is extremely uncommon but gives rise to a keel-shaped forehead with hypotelorism and is called trigonocephaly. Bilateral coronal synostosis results in a brachycephalic skull, short in the anteroposterior diameter but broad due to compensatory growth at the sagittal suture, which may be associated with recession of the mid-face due to lack of forward growth of the anterior cranial fossa and the facial skeleton attached to its undersurface, the so-called craniofacial dysostoses. The two common forms of craniofacial dysostosis, Crouzon’s disease and Apert’s syndrome, are usually inherited according to an autosomal dominant pattern. Apert’s syndrome is associated with polysyndactyly of the hands and feet. When multiple sutures are fused (oxycephaly), blindness and mental retardation may result from raised intracranial pressure.1

Asymmetrical deformity is caused by unilateral coronal synostosis (anterior plagiocephaly) (Fig. 3) with ipsilateral frontal flattening and recession of the supra-orbital margin or by unilateral lambdoid synostosis with ipsilateral occipital flattening (posterior plagiocephaly).

Fig. 1. Direction of growth at vault sutures.

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