# The BASES Expert Statement on Exercise Training for People with Intermittent Claudication due to Peripheral Arterial Disease

Produced on behalf of the British Association of Sport and Exercise Sciences by Dr Garry Tew, Dr Amy Harwood, Prof Lee Ingle, Prof Ian Chetter and Prof Patrick Doherty.

## Introduction

Lower-limb peripheral arterial disease is a type of cardiovascular disease in which the blood vessels (arteries) that carry blood to the legs and feet are hardened and narrowed or blocked by the build-up of fatty plaques (called atheroma). It affects around 13% of adults over 50 years old, and major risk factors for its development include smoking, diabetes mellitus and dyslipidaemia (Morley *et al.,* 2018). The presence of peripheral arterial disease itself is also a risk factor for other cardiovascular problems, such as angina, heart attack and stroke. This is because the underlying disease process, atherosclerosis, is a systemic process, meaning that blood vessels elsewhere in the body may also be affected.

The most common symptom of peripheral arterial disease is intermittent claudication (IC), which is muscle pain or discomfort in the legs and/or buttocks brought on by walking and relieved within minutes on rest (see Figure 1). IC occurs due to an inability to sufficiently increase blood flow (and oxygen delivery) to match the metabolic demands of the lower-limb muscles during exercise and can cause marked reductions in functional capacity and quality of life (Morley *et al.,* 2018). The walking distance or speed at which symptoms occur depends on multiple factors including the severity and site of the arterial disease, walking pace, terrain, incline and footwear.

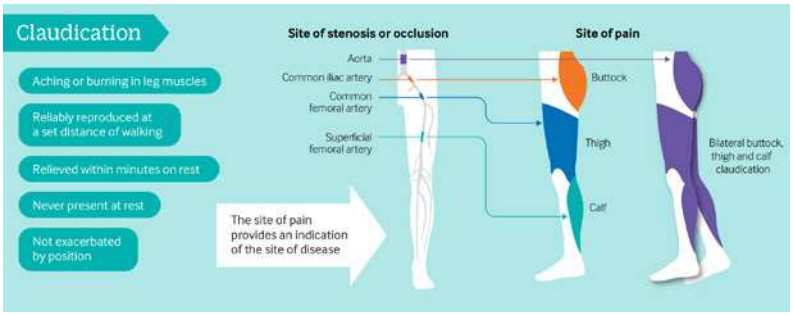


**Figure 1.** Intermittent claudication (IC) due to peripheral arterial disease.
*Reproduced from Peripheral artery disease (Morley et al., 2018) with permission from BMJ Publishing Group Ltd. Note: Iliac or femoral artery disease can cause symptoms at multiple distal muscle sites.*

Treatments for IC, aimed at relieving symptoms and reducing the risk of further cardiovascular disease, include lifestyle changes (e.g. stopping smoking, exercising more), vasoactive drugs (e.g. naftidrofuryl oxalate) and revascularisation (i.e. angioplasty or bypass surgery). In 2012, the United Kingdom's National Institute of Health and Care Excellence (NICE) published a clinical guideline on the management of peripheral arterial disease, which stated that a supervised exercise programme should be offered as a first-line therapy for IC (NICE, 2012). This statement provides an overview of the evidence on exercise training and recommendations for people delivering exercise programmes to this population.

## Evidence on exercise training

### *Core outcome measures*

Walking ability and its impact on quality of life are the most important outcome measures of intervention to clinicians and patients. Measures of walking ability include pain-free and maximum walking distances (or times) obtained during standardised treadmill testing, and the distance covered in the 6-minute corridor walk test. The 'Gardner' treadmill test is commonly used, which involves a constant speed of 3.2 km/h and an increase in gradient of 2% every 2 minutes. Several generic and condition-specific questionnaires have been used to assess quality of life, including the SF-36 and VascuQol, respectively.

### *Effects of exercise training on walking ability and quality of life*

A recent Cochrane review concluded that there is high-quality evidence showing that exercise programmes (a variety of regimes) elicit important improvements in both pain-free and maximum walking distances compared with no-exercise control in people with IC (Lane *et al.,* 2017). A meta-analysis of 9 trials (n=391) showed a mean between-group difference in pain-free walking distance at follow-up of 82 m (95% CI 72-92 m; follow-up ranging 6 weeks to 2 years). The corresponding difference for maximum walking distance was 120 m (95% CI 51-190 m; 10 trials, n=500). Improvements of this magnitude are likely to help with independence.

The same review also reported that there was moderate-quality evidence for improvements in physical and mental aspects of quality of life, as assessed using the SF-36 (Lane *et al.,* 2017). A meta-analysis of data at 6 months of follow-up showed the physical component summary score to be 2 points higher in exercise versus control (95% CI 1-3; 5 trials, n=429). The corresponding difference for the mental component summary score was 4 points (95% CI 3-5; 4 trials, n=343). Again, such differences have the potential to be clinically meaningful.

### *Modes of exercise*

In most studies, exercise programmes have involved treadmill or track walking of sufficient intensity to bring on claudication pain. There is a strong evidence base for this type of training and clinical guidelines around the world cite it as the preferred modality (e.g. NICE, 2012). Alternate exercise modalities have not been extensively studied. However, a randomised trial of 104 participants provided evidence that both cycling and arm-cranking are viable alternatives for improving walking distances (Zwierska *et al.,* 2005). These modalities may be useful for patients who are unwilling or unable to walk because of the pain encountered. Resistance training may have a complementary role (e.g. for improving muscular strength); however, it should not be used as a substitute for aerobic exercise because its impact on walking distances appears modest (e.g. McDermott *et al.,* 2009).

### *Supervision*

The systematic review of Gommans *et al.* (2014) reports the relationship between the 'intensity' of supervision of an exercise programme and the extent to which walking distances were improved. Thirty studies involving 1,406 people with IC were included. Study treatment arms were categorised according to type of support: no exercise, walking advice, home-based exercise and supervised exercise. The results indicated that the intensity of supervision was directly related to treatment effect, with supervised exercise training being superior to all other categories with respect to improvement in walking distances at all follow-ups

(6 weeks, 3 months and 6 months). An economic evaluation to inform the NICE guidelines (NICE, 2012) also indicated that supervised exercise is more cost-effective than either unsupervised exercise or angioplasty.

### *Safety*

Gommans *et al.* (2015) explored the safety of supervised exercise training in people with IC by reviewing adverse event data from clinical trials. Seventy-four trials were included, representing 82,725 hours of training in 2,876 participants. Eight adverse events were reported, six of cardiac and two of non-cardiac origin, resulting in an all-cause complication rate of one event per 10,340 patient-hours. The authors concluded that supervised exercise training is safe for people with IC due to a low all-cause complication rate, and routine cardiac pre-screening is not required.

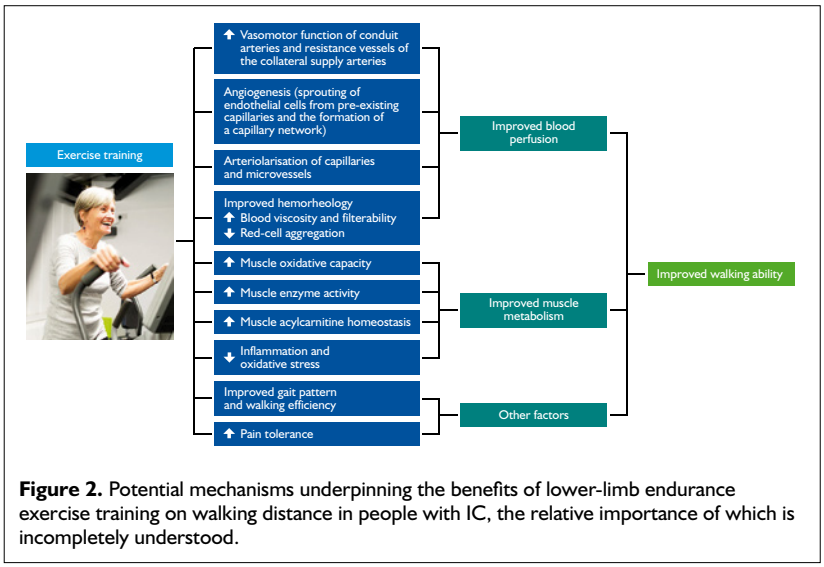


**Figure 2.** Potential mechanisms underpinning the benefits of lower-limb endurance exercise training on walking distance in people with IC, the relative importance of which is incompletely understood.

### *Mechanisms*

The mechanisms underpinning the benefits of exercise training are incompletely understood. Regression of arterial stenoses appears unlikely to be implicated (Lane *et al*., 2017), whereas there are potential roles for improvements in maximum oxygen uptake, endothelial function, systemic inflammation and skeletal muscle oxidative capacity (Harwood *et al*., 2016). A summary of potential mechanisms is presented in Figure 2.

### Conclusions

- Exercise training is a safe, effective and low-cost intervention for improving walking ability in people with IC. Additional benefits may include improvements in quality of life and cardiovascular health.
- Clinical guidelines advocate exercise training as a primary therapy for IC. These guidelines also state that revascularisation or drug treatment options should only be considered if exercise training provides insufficient symptomatic relief.

### Recommendations

- Patients should be clinically assessed and risk stratified to ensure that they do not have any contraindications to the exercise therapy and to document comorbidities that may need to be accounted for in the exercise programme.
- Exercise should ideally be delivered through an on-site supervised programme with clinical oversight. However, a facilitated, self-managed exercise programme involving behaviour change techniques is a reasonable alternative for people who prefer this approach or are unable to access supervised exercise.
- Walking is the primary mode of exercise for improving walking ability and claudication symptoms. A structured programme of walking exercise at an intensity that elicits moderate-to-strong claudication pain should be conducted for a minimum of 3 months, involving at least three, 30-60 minute sessions per week.
- Further recommendations on exercise training are provided in a Supplementary Table, which can be accessed in the online version of this expert statement available at: www.bases.org.uk/spage-resources-bases_expert_statements.html.
- Acute responses to exercise should be monitored to inform the exercise prescription, including heart rate, blood pressure, perceived exertion and claudication pain.
- Programme entry and exit assessments should be performed to determine changes in patient-important outcomes, including walking distances and quality of life. ■



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