

# PERIPHERAL ARTERY DISEASE & EXERCISE

## PROFESSIONAL

### WHAT IS PERIPHERAL ARTERY DISEASE?

Peripheral artery disease (PAD) is characterised by stenosis or occlusion of the peripheral arteries. PAD most commonly affects the arteries of the lower limbs, causing a reduction in blood flow to the legs and feet. Many people with PAD may be asymptomatic and unaware of the presence of the disease. Intermittent claudication (IC) is the most common symptom and is usually the first sign of PAD. People with IC typically describe their symptoms as pain or discomfort affecting the muscles of the calf, and sometimes the thigh and buttock, during walking and other forms of physical activity. Individuals may also present with atypical symptoms, where leg pain does not stop them from walking, or is not relieved following rest [1]. In its most severe form, those with PAD may present with critical limb ischemia, which includes pain at rest, ulceration or gangrene.

As PAD is an atherosclerotic disease, people are at an elevated risk of cardiovascular events, including myocardial infarction and stroke. The risk factors for developing PAD include cigarette smoking, diabetes, dyslipidaemia and advancing age. Best medical therapy consists of smoking cessation, antiplatelet agent use, lowering cholesterol, treatment for hypertension and diabetes mellitus, as well as exercise therapy [2]. Clinical guidelines recommend exercise as part of the initial treatment for all people with PAD [2,3]. Alternative treatments also include lower limb revascularisation such as angioplasty or surgical bypass to help restore blood flow. In severe cases people may be required to have an amputation where limb salvage is not possible.

The prevalence of PAD is estimated to be 5.56% in the general population and increases with age to 13% in people aged 50 or older [4,5]. As the general population is ageing, there has been a relative increase in PAD cases around the world of 17.10% in the last decade [4].

### HOW IS PERIPHERAL ARTERY DISEASE DIAGNOSED?

Diagnosis of PAD typically involves an assessment of clinical history, physical examination including pulse palpation at the femoral, popliteal and tibial arteries, haemodynamic assessment and vascular imaging investigations. A claudication walking test, usually performed on a treadmill, may be used to determine the degree of impairment to walking performance and the presence of exercise-induced coronary ischemia [7]. The ankle-to-brachial index (ABI) is a non-invasive measurement for the screening, diagnosis and haemodynamic monitoring of PAD. The ABI is measured as the ratio of the higher systolic blood pressure measured at the ankle arteries (i.e. posterior tibial or dorsalis pedis) relative to the systolic blood pressure at the arm (i.e. brachial) [2]. An ABI <0.90 is indicative of the presence of PAD, and ABI tends to decrease further with an increase in the severity of the blood flow limitation (see table below).

Interpretation	ABI Value
Non-compressible	>1.4
Normal ABI	1.00 - 1.30
Borderline (equivocal)	0.91 - 0.99
Mild to moderate impairment	0.41 - 0.90
Severe impairment (symptoms may occur at rest)	<0.40



### WHY IS EXERCISE IMPORTANT FOR PERIPHERAL ARTERY DISEASE?

People with PAD have reduced functional capacity, poor leg-muscle strength and endurance; reduced cardiorespiratory fitness; limited walking distance and mobility. These physical constraints have a negative impact on the person's mobility and quality of life and are often associated with heightened levels of depression. People with PAD often avoid physical activity because of their discomfort and poor exercise tolerance. Low levels of physical activity further exacerbate the cardiovascular risk associated with PAD.

It is recommended that anyone with mild to moderate PAD should be offered supervised-exercise therapy as part of their initial treatment [6,7]. Exercise has been shown to significantly improve walking distances, cardiorespiratory

fitness, muscle strength and endurance, and quality of life in people with PAD. This is accompanied with a reduction in the severity of claudication pain. In people who undergo revascularisation, exercise after surgery can further enhance the benefits of treatment and further improve walking capacity [8].

## HOW DOES EXERCISE IMPROVE WALKING CAPACITY IN PEOPLE WITH PAD?

Exercise training is unlikely to alter the degree of arterial stenosis, and most research studies have demonstrated that exercise leads to improvements in walking capacity without improving leg blood flow capacity in people with PAD as measured by ABI. The improvements in walking capacity and exercise tolerance with training may be explained by improvements in muscle oxygen economy. This is achieved through an enhanced distribution of blood flow and oxygen to the working muscle fibres, and/or an improvement in the ability of the muscles to utilise oxygen. Improvements in endothelial function, blood viscosity, and the muscle microvascular network have also been demonstrated with exercise training. Furthermore, exercise promotes alterations in muscle morphology and metabolism, including an increase in oxidative enzyme capacity, as well as reduced inflammation and oxidative stress [9].

## WHAT TYPE OF EXERCISE IS RECOMMENDED FOR PEOPLE WITH PAD?

The recommended modality of exercise for people with PAD is walking, although other forms of aerobic exercise may be used. Resistance training can be used as a supplement to walking to improve muscle strength and endurance. In addition, education and counselling about physical activity and other cardiovascular risk factors should be implemented. During a typical exercise session, people will perform intermittent bouts of walking at a speed to bring about moderate to near-maximum claudication pain in 3-5 minutes, and then rest until the pain or discomfort resolves. The level of pain is monitored using a claudication pain scale (see table below). This cycle of exercise-rest is repeated to accumulate the prescribed exercise duration. As the person's exercise tolerance improves, the exercise duration should be progressively increased so that they accumulate 30-45 minutes of walking during a 60 minute session. If the person can walk for  $\geq 10$  min without claudication pain, the speed and/or grade should be increased.

Score	Pain level	Description	Score	Description
0	None	During rest or early exercise	1	No Pain
1	Mild	Onset of pain - just noticeable	2	Onset of pain
2	Moderate	More than mild pain but tolerable	3	Mild pain
3	Severe	Severe pain - barely tolerable	4	Moderate pain
4	Maximum	Maximal - I have to stop	5	Severe pain

It is recommended that exercise programs should be directly supervised by an accredited exercise physiologist or appropriately trained health professional. Supervision ensures the person is appropriately monitored and that the exercise is carried out and progressed optimally. Remotely facilitated programs with telephone-counselling, in-person check-ins or activity monitors are an appropriate alternative for people who are not able to access a supervised program. It may also be appropriate to supplement supervised exercise sessions with home-based exercise to increase total exercise volume or accommodate barriers that might limit attendance at a supervised program (e.g. transport restrictions, work commitments). People should also be advised to transition to self-guided exercise in a home or community setting after completion of a supervised program [7].

People with PAD will normally undergo a treadmill- or corridor-walking test at the beginning of an exercise program. This test provides information about the person's maximum walking capacity and claudication threshold, as well as their exercising blood pressure and heart rate responses, to help plan and monitor the exercise program.



A summary of exercise program recommendations for people with PAD is outlined in the table below [6,7,10].

## WHAT EXERCISE PROGRAMMES CAN PEOPLE WITH PAD DO?

<b>Program duration</b>	At least 3 months, and up to 6 months, of supervised exercise. Aiming to support people to adopt regular physical activity as part of their lifestyle on an ongoing basis.
<b>Exercise mode</b>	<p>Walking is the most effective form of exercise for PAD and treadmill- or track-walking should be included in all programs where feasible. Other forms of aerobic exercise such as cycling or arm-ergometry also offer some benefit.</p> <p>Resistance exercise using the major muscle groups of the body are recommended to improve musculoskeletal fitness (e.g. muscle strength and endurance). Resistance exercise may also contribute to gains in walking capacity, however it should not be used as a substitute for aerobic exercise.</p>
<b>Exercise frequency</b>	3 supervised sessions of aerobic exercise each week, and additional self-guided sessions as appropriate for the person.
<b>Intensity and claudication end-point</b>	People should walk at a speed and grade to induce claudication pain in 3-5 min. If a person can walk for $\geq 10$ min without claudication pain, the speed and/or grade should be increased. People should be advised to walk to the point of moderate to near-maximum claudication (i.e. 4 out of 5 on claudication scale). Preliminary evidence suggests walking only to the onset of ischaemic leg pain may also be beneficial. If people are not limited by ischaemic leg symptoms, exercise should be maintained at an 11-14 rating of perceived exertion (6-20 scale).
<b>Duration per session</b>	During the initial stages of a program, only 10-20 min of accumulated exercise might be achievable. Aim to progress duration as tolerated to 30-45 min of exercise in a 60 min session.



## CONSIDERATIONS BEFORE A PERSON STARTS AN EXERCISE PROGRAM

People should be clinically assessed for comorbidities that might need to be accommodated during the exercise program, and to ensure they do not have any contraindications to exercise therapy. These include:

- Unstable angina
- Decompensated heart failure
- Uncontrolled cardiac arrhythmias
- Severe or symptomatic valvular disease
- Other conditions that could be aggravated by exercise such as severe joint disease, uncontrolled diabetes, or uncontrolled hypertension/hypotension.

Based on the very low risk of adverse events during supervised and home-based exercise in people with PAD—all-cause event rate of one per 10,340 and one per 36,953 patient-hours respectively— routine cardiac pre-screening is not deemed necessary [11,12]. In people with known coronary artery disease, an exercise stress test may be useful to establish the threshold for myocardial ischemia during exercise. It is important to be aware that as people improve their walking capacity with exercise training, there is an increased likelihood that cardiac signs or symptoms may appear. This highlights the importance of appropriate supervision or monitoring, and the need to educate people to recognise and respond appropriately to the signs of cardiac symptoms (e.g. angina).

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## RELATED RESOURCES AND REFERENCES

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Exercise is Medicine Australia [www.exerciseismedicine.org.au](http://www.exerciseismedicine.org.au)

Exercise Right [www.exerciseright.com.au](http://www.exerciseright.com.au)

Find an Accredited Exercise Physiologist [www.essa.org.au](http://www.essa.org.au)

Find a Sport and Exercise Physician [www.acsep.org.au](http://www.acsep.org.au)

If you have any concerns about the safety of your patient in commencing an exercise program, please consider referral to a Sport and Exercise Physician.

PAD exercise training toolkit. Vascular Disease Foundation and the American Association of Cardiovascular and Pulmonary Rehabilitation. Accessed 25 Nov 2021: [https://www.aacvpr.org/Portals/O/Resources/PAD%20Toolkit/pad-exercise-training-toolkit\\_website.pdf](https://www.aacvpr.org/Portals/O/Resources/PAD%20Toolkit/pad-exercise-training-toolkit_website.pdf)

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