

Primary care approach to calf cramps

Opening Vignette

Betty, a 60-year-old woman, visited your practice complaining of bilateral calf cramps, which were worse on the left, for the past 6 months. The pain woke her up the night before and there was residual ache till today. She also complained of occasional calf cramps during her daily walks. She asked what she could do to prevent calf cramps.

WHAT ARE CALF CRAMPS?

Calf cramps are episodes of involuntary painful contractions of the calf that occur suddenly and can result in residual pain, lasting minutes or hours after.

HOW COMMON OR RELEVANT IS THIS TO MY PRACTICE?

Calf cramps are very common. Studies done in other countries showed an overall prevalence of resting calf cramps of between 29.9% to 37%, with prevalence increasing with age.^[1,2] Calf cramps may also be a symptom of an underlying condition, which will be discussed further in this paper.

With Singapore's ageing population, calf cramps would likely be an increasingly common complaint to general practitioners (GPs), who are usually the first point of contact for most patients. By familiarising themselves with the different causes of calf cramps and their varying features, GPs can identify key differentials that will aid in the management of patients with leg cramps. GPs play an important role in problem recognition, investigation, treatment and referral to appropriate specialist where necessary, thus improving patients' quality of life.^[3]

WHAT CAN I DO IN MY PRACTICE?

To begin assessment of a patient with calf cramps, it is pertinent to correctly identify non-critical and critical calf cramps.

Critical calf cramps tend to present acutely and/or unilaterally and should not be missed. Deep vein thrombosis (DVT) is suspected if a patient presents with unilateral lower limb oedema associated with calf pain and warmth. In such cases, Well's Criteria may be used as a diagnostic tool to calculate risk of DVT and guide management. Other conditions include rhabdomyolysis, which can occur in an individual who presents with acute muscle pain associated with muscle weakness and tea-coloured urine following an unaccustomed exercise. Occasionally, severe rhabdomyolysis can lead to acute compartment syndrome, where pain is out of proportion to the injury and there is increased pain on passive stretch

of the involved muscles. Other causes to consider for acute compartment syndrome are crush injuries, eschar from burns, casts and prolonged limb compression. In such cases, the patient should be sent to the emergency department immediately for further evaluation.

Guiding questions to ask a patient who presents with calf cramps include:

- Where and when do the cramps occur? Do they occur with activity? Do they happen mostly in the day or at night?
- Describe the nature of the cramp. Sharp or dull?
- What makes the calf cramps worse? What makes it better?
- Are there any associated symptoms? Any numbness? Any limb coldness?

In addition, a review of past medical history and medication use, as well as a thorough physical examination of the vascular and neurological system of the lower limbs should be conducted to establish a proper diagnosis.

For this paper, we will focus on non-critical calf cramps that commonly presents to primary care. Figure 1 gives an overview of the approach to non-critical calf cramps. A simple way to differentiate the causes of calf cramps is to establish if the calf cramps are related to activity. The causes of calf cramps will be further elaborated on as follows. A summary of the conditions is shown in Table 1.

Nocturnal leg cramps

Nocturnal leg cramps usually occur in the calf or foot during sleep, and often results in sleep disruption. It is diagnosed clinically when the patient meets all three of the diagnostic criteria by American Academy of Sleep Medicine (AASM): (1) painful sensation in the leg associated with sudden, involuntary muscle contraction; (2) painful muscle contractions that occur during time in bed, although it can occur when one is awake or asleep; and (3) pain that is relieved by forceful stretching of the affected muscles.

It is most prevalent in the older age groups,^[2] although it has been reported in 7% of children and adolescents.^[4] Older and less physically active adults are more likely to have shortened muscle length, which poses as a risk factor. Most nocturnal leg cramps are idiopathic and there is currently no consensus about the aetiology. No investigations are necessary for nocturnal leg cramps unless history and physical examination suggest an underlying cause.

Medical pathologies associated with nocturnal leg cramps are peripheral vascular disease, coronary artery disease, liver cirrhosis, end-stage renal disease (ESRD) and haemodialysis, cancer treatment, lumbar canal stenosis, peripheral neuropathy,

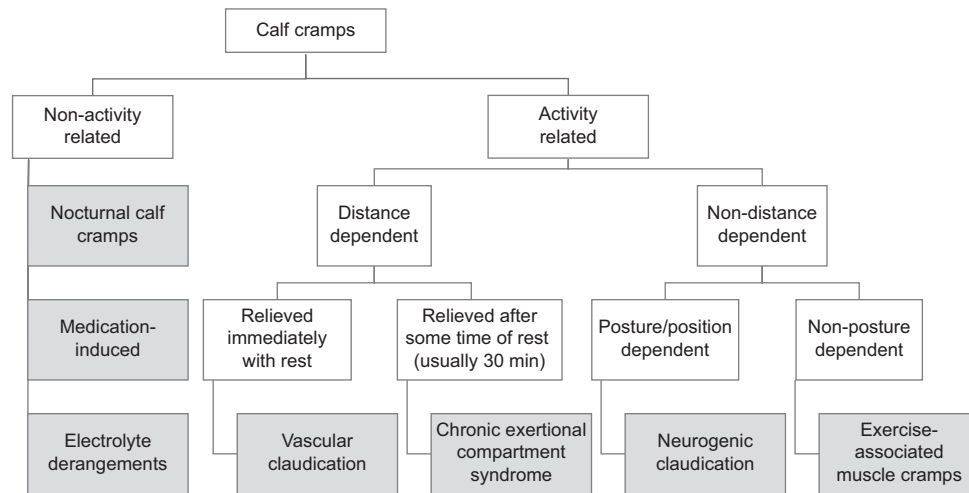


Figure 1: Chart shows an approach to non-critical calf cramps.

Table 1. Summary of common causes of calf cramps.

Aetiology	Features	Investigations	Treatment
Nocturnal leg cramps	<ul style="list-style-type: none"> Occurs at rest and/or in bed Relieved by stretching of muscle May be associated with underlying medical conditions or drug use 	Clinical diagnosis	<ul style="list-style-type: none"> Therapeutic trial of deep massage and stretching exercises
Vascular claudication (peripheral arterial disease)	<ul style="list-style-type: none"> Occurs with same degree of exercise or exertion and is relieved by rest May have reduced/absent pulses with ABPI of <0.9 	More important if revascularisation planned: duplex ultrasound, CT angiography, magnetic resonance angiography)	<ul style="list-style-type: none"> Symptomatic treatment of claudication (exercise programme, pharmacological treatment) Secondary risk reduction of cardiovascular events (antiplatelet therapy, optimal control of cardiovascular conditions, statin therapy, smoking cessation)
Chronic exertional compartment syndrome (CECS)	<ul style="list-style-type: none"> Occurs with specific time of exercise and resolve within minutes to hours of rest Unremarkable physical examination 	Measurement of compartment pressures with needle manometer	<ul style="list-style-type: none"> Avoid aggravating activities. Stretching, strengthening, massage of the hypertonic musculature compartment, NSAIDS Fasciotomy for recalcitrant CECS
Neurogenic claudication (lumbar spinal stenosis)	<ul style="list-style-type: none"> Occurs with lumbar extension and improves with spinal flexion or sitting Straight leg raise test may reproduce symptoms Neurologic examination may be normal 	Radiographic imaging that demonstrates narrowing of lumbar spinal canal: lumbar X-ray, MRI lumbar spine, CT myelography	<ul style="list-style-type: none"> Conservative treatment: pharmacological, physical therapy Surgical treatment
Exercise-associated muscle cramps	<ul style="list-style-type: none"> Occurs after exercise 	Clinical diagnosis	<ul style="list-style-type: none"> Decreasing exercise intensity and altering training load on the distressed muscles Stretching and icing of affected muscles

ABPI: ankle-brachial pressure index, CT: computed tomography, MRI: magnetic resonance imaging, NSAIDS: non-steroidal anti-inflammatory drugs

pregnancy, electrolyte disturbances and dehydration. Medications that have been reported to induce leg cramps include statins, thiazide diuretics, intravenous iron sucrose, raloxifene, conjugated oestrogens, naproxen and teriparatide.^[5-8]

For the treatment of nocturnal leg cramps, systematic reviews have demonstrated the efficacy of quinine in reducing the frequency and intensity of nocturnal leg cramps as compared with placebo. However, the Health Sciences Authority of Singapore has cautioned against the use of quinine for

treatment of nocturnal leg cramps due to the potential risk of serious haematological reactions.^[9,10] There is limited evidence for the use of vitamin B₆, analgesics, vitamin E and verapamil to treat nocturnal leg cramps. Deep massage and stretching can be recommended as a safe and simple management to aid in the relief of nocturnal calf cramps.^[11] The GP can provide an exercise prescription that recommends calf and hamstring stretches sustained for 10 seconds, repeated three times before sleep and during episodes of leg cramps.

Vascular claudication

Vascular claudication refers to muscular pain that develops with exercise as a result of ischaemia and is quickly relieved by rest. It indicates peripheral arterial disease (PAD), where arteries distal to the aortic arch are narrowed secondary to atherosclerosis.

Classically, PAD is diagnosed when an individual presents with painful calf cramps that occur with exercise such as walking or climbing stairs, and are relieved by rest. The patient may have cool or shiny skin, non-healing wounds, absence of hair in the affected area and reduced or absent pulses. An ankle-brachial pressure index (ABPI) of <0.9 is diagnostic of PAD. However, patients with suspected PAD may have a falsely raised ABPI of >1.3 due to calcified vessels, and further evaluation can be conducted using measurement of the toe brachial pressure index. A toe brachial pressure index of <0.7 is generally considered indicative of PAD.

In Singapore, a primary healthcare study of diabetic patients with PAD found that 21.5% of this population presented with intermittent claudication.^[5] Risk factors for vascular claudication and PAD are cigarette smoking and cardiovascular diseases (CVD), including diabetes mellitus, hypertension and hyperlipidaemia.^[6]

Treatment of PAD in primary care is two-pronged: symptomatic treatment of claudication and secondary risk reduction of cardiovascular events.

Symptomatic treatment of claudication includes exercise programmes to increase walking time and speed.^[7] Patients in the outpatient setting are recommended to walk until the onset of moderate intensity cramps, followed by short bouts of rest until cramps subside. It is recommended that they repeat this walk-rest process for a total of 30–45 minutes to stimulate collateral artery formation, improve function and quality of life.^[12] Some medications have been used for symptomatic treatment of claudication. Of these, FDA-approved phosphodiesterase inhibitor cilostazol is well studied and is proven to help with claudication. Cilostazol is a class I recommendation in the 2016 American College of Cardiology/American Heart Association (ACC/AHA) guidelines for improving symptoms of and increasing walking distance of patients with claudication. Notably, cilostazol is contraindicated in patients with heart failure and can cause adverse effects such as palpitations, headache and diarrhoea. Pentoxifylline is another FDA-approved drug and has been used for treatment of symptomatic claudication. However, due to the lack of quality data, the 2016 ACC/AHA guidelines for claudication do not recommend its use.^[13] Naftidrofuryl oxalate is approved for intermittent claudication in the UK and is a recommended treatment under National Institute for Health and Care Excellence (NICE) guidelines. Systematic reviews have shown that naftidrofuryl is effective in proving maximum walking distance^[14]

Secondary risk factor reduction of cardiovascular events is mitigated through smoking cessation, maintaining good control of other cardiovascular conditions such as hypertension and diabetes mellitus, antiplatelet therapy (100 mg of aspirin or 75 mg of clopidogrel) to reduce risk of atherothrombotic events,^[15] and moderate to high intensity statin therapy to target a low-density lipoprotein level of less than 2.1 mmol/L.^[16]

Chronic exertional compartment syndrome

Chronic exertional compartment syndrome (CECS) is a reversible increase in intramuscular pressure within an inelastic fascial compartment.^[17] Typically, patients with CECS can present with calf cramps with pain in a specific location in the lower extremity, and may be associated with altered sensation and weakness. These symptoms occur predictably with increasing pain over the specific region after a specific time of exercise, and are relieved within minutes to hours of stopping the aggravating activity.^[18] On physical examination, muscle tenderness, muscle herniations, active and passive range of motion and strength of the lower extremities should be assessed. CECS is often a diagnosis of exclusion and needle manometry testing can be used to confirm the diagnosis. Based on Pedowitz's criteria, CECS is diagnosed when one of the following is met^[18]: pre-exercise pressure ≥ 15 mmHg; 1-minute post-exercise pressure ≥ 30 mmHg; or 5-minute post-exercise pressure ≥ 20 mmHg.

CECS of the lower limb is often reported in running athletes and military soldiers, with the anterior compartment most commonly affected.^[19,20] The primary pathway is thought to be transient ischaemia in the muscles within a compartment due to repetitive exertion, and other risk factors such as muscle hypertrophy, decreased venous return, microtrauma, myopathies and noncompliant fascia may also contribute to it.^[21]

The first-line treatment for suspected cases of CECS is conservative management. It is recommended that aggravating activities that bring on symptoms should be decreased or ceased.^[17] Low impact activities such as swimming or cycling are effective ways to maintain fitness without increasing pressure in the muscle compartments. Other modalities to be considered include stretching and strengthening of the lower extremity musculature, massage of the hypertonic musculature compartment, icing and the use of anti-inflammatory medications.^[22,23]

Neurogenic claudication

Neurogenic claudication, also known as pseudo-claudication, occurs in patients with lumbar spinal stenosis. It can be diagnosed based on a history of typical symptoms, physical examination and radiographic imaging. Typical features include leg cramps, buttock and back pain with walking downhill and/or lumbar extension, which improve with spinal flexion or upon sitting. In patients with neurogenic

claudication, the walking distance before symptoms set in is more variable than in patients with vascular claudication. Symptoms can be unilateral or more commonly bilateral and symmetrical. Patients with lumbar spinal stenosis may also report nocturnal leg cramps and neurologic bladder symptoms.^[24,25] Examination findings include radiculopathy signs with decreased lumbar range of motion especially in extension, focal motor weakness, sensation in affected root distribution, straight-leg tension signs, diminished reflexes and normal distal pulses. However, physical examination may also be non-specific, with normal neurological examination or only mild motor weakness or sensory changes.^[26,27]

Although current evidence for pharmacological treatment or physical therapy alone is deemed limited for the treatment of lumbar spinal stenosis, a period of conservative management is generally recommended as an initial therapy. Therapeutic exercise helps address strength and flexibility deficits, targeting the back, pelvis, abdominals and lower extremities, which lead to improved function, increased mobility and decreased pressure on the spine.^[28] Notably, secondary analysis of the Spine Patient Outcomes Research Trial (SPORT) reported that the use of physical therapy within 6 weeks of enrolment was associated with improved symptoms and function, and reduced likelihood of surgery in the following year.^[27]

Pharmacological treatment for lumbar spinal stenosis follows the treatment guidelines of lower back pain and include medications such as muscle relaxants, non-steroidal anti-inflammatory drugs (NSAIDs) and opioids. Gabapentinoids are used as off-label drugs for back pain, but the number of trials that have investigated its improvement in pain scores is limited.^[29] It is essential for primary care physicians to carefully weigh the risks and benefits of analgesia choices with patients.

Exercise-associated muscle cramps

Exercise-associated muscle cramps (EAMC) occur during or soon after physical activity in healthy individuals with no underlying medical pathology. Clinically, they can present with acute cramps, stiffness, and soreness that can last from a few minutes to several days.^[30]

EAMC is easily recognised, but its underlying aetiology is unknown and controversial.^[31] There are two main theories behind the condition, the ‘dehydration-electrolyte-depletion’ theory and ‘neuromuscular control’ theory. Traditionally, EAMC is thought to be associated with exercising in hot and humid environments, increasing the risk of dehydration and electrolyte imbalance, but more recent evidence supports the neuromuscular aetiology with the focus on muscle fatigue. Other risk factors identified by various studies include older age, higher body mass index, exercising at a higher than usual intensity, endurance sports, shorter stretching time and irregular stretching habits.^[32]

The prevalence of exercise-associated muscle cramps varies amongst different people groups and has been reported in different studies to range between 18%–70% amongst endurance athletes and 50%–56% in the older population. The intensity and duration of cramps vary from person to person.^[32]

The paucity of data on the cause of EAMC has led to anecdotal treatment options,^[33] but in primary practice, the treatment of EAMC is focused mainly on stretching, massage and icing of the affected muscle.^[34] Decreasing exercise intensity and altering training load on the distressed muscles have also shown to be effective.^[35]

It is important for primary care physicians to ensure that evaluation of a patient who presents with lower leg cramps after an activity rules out more serious acute conditions such as gastrocnemius tear or strain.

WHEN SHOULD I REFER TO A SPECIALIST?

Peripheral arterial disease

Surgical revascularisation should be considered in patients who have lifestyle-limiting claudication symptoms not responding to medical treatment. If a patient presents with signs or symptoms of critical limb ischaemia, such as chronic pain at rest, tissue loss, non-healing wounds or ulcers and gangrene, they should be urgently referred for surgical revascularisation. If a patient has signs and symptoms of acute limb ischaemia, such as pain, pallor, poikilothermia, pulselessness, paraesthesia, paralysis (The 6 Ps), they should be sent to the hospital for immediate revascularisation.

Neurogenic claudication

Patients with persistent symptoms impairing function despite physical therapy and medications should be referred to an orthopaedic surgeon for consideration of decompressive laminectomy. Patients with myelopathic or cauda equina symptoms must be referred to an orthopaedic surgeon urgently to prevent neurologic decline.^[27]

Chronic exertional compartment syndrome

Patients with persistent symptoms despite initial conservative management should be referred to a Sports Medicine physician for compartment testing. Further management include gait analysis, gait retraining, extracorporeal shockwave therapy and an individualistic training programme prescription.^[22,36,37] Operative management such as fasciotomy is reserved for recalcitrant CECS.^[38,39]

Exercise-associated muscle cramps

Referral to a Sports Medicine physician should be considered if symptoms are recurrent and debilitating. The sports physician will work with the patient to recognise early warning signs of EAMC, as well as identify contributing risk factors i.e., training intensity, type, technique, volume, terrain, nutrition and hydration to treat this complex condition.^[40]

TAKE-HOME MESSAGES

1. The differential diagnosis of calf cramps is varied and can range from musculoskeletal to neurologic to vascular. Hence, an evaluation of a patient with calf cramps requires careful history taking, medications review and an examination of the lower limbs, including the vascular and neurological system.
2. PAD reflects atherosclerosis in the body and should be managed as a CVD risk factor. A low ABPI of <0.9 independently predicts future cardiovascular events.
3. Treatment of PAD in primary care includes smoking cessation, lifestyle modification, use of antiplatelet (therapy), statin therapy and physical activity.
4. Neurogenic (pseudo) claudication is a symptom of lumbar spinal stenosis. Symptoms worsen with lumbar extension and is relieved with lumbar flexion. An initial management with analgesia and physical therapy can be prescribed in primary care.
5. Nocturnal leg cramps are mostly idiopathic but can be associated with lumbar spinal stenosis, peripheral vascular disease, pregnancy, liver cirrhosis, ESRF and haemodialysis and certain medication use. A careful review of medication and past medical history with physical examination may help with assessing the underlying cause.
6. There is insufficient evidence that vitamin B₆, analgesics, vitamin E, or verapamil reduces nocturnal leg cramps. The use of quinine has been cautioned against due to its potential risks. Stretching of the hamstring and calf muscles can aid in the relief of nocturnal leg cramps.
7. CECS should be considered if calf cramps occur after a specific duration of exercise and resolve completely within minutes to hours of rest. Patients may be referred to a specialist for compartment testing to confirm the diagnosis.

Closing Vignette

After careful history taking and physical examination, you diagnosed Betty, a non-smoker, with calf cramps secondary to PAD. She had an ABPI of 0.8 and distal pedal peripheral pulses were reduced. You started her on moderate-dose statin therapy and antiplatelet therapy and referred her for a supervised exercise programme. You reviewed and found that she had satisfactory control of her underlying condition of hypertension. She returned for a review 3 months later and reported an improvement in walking distance and reduced frequency of calf cramps.

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Conflicts of interest

There are no conflicts of interest.

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SMC CATEGORY 3B CME PROGRAMMEOnline Quiz: <https://www.sma.org.sg/cme-programme>**Deadline for submission: 6 pm, 03 February 2023**

Question	True	False
1. An evaluation of a patient with calf cramps should include history taking, past medical history, medication review and examination of the vascular and neurological system of the lower limbs.		
2. All causes of calf cramps are non-critical.		
3. Using American Academy of Sleep Medicine criteria, nocturnal leg cramps are diagnosed when all three diagnostic criteria are met.		
4. Nocturnal leg cramps only occur when one is asleep.		
5. Medications reported to induce leg cramps include statins and thiazide diuretics.		
6. Quinine is recommended for the treatment of nocturnal leg cramps.		
7. Peripheral arterial disease (PAD) can cause nocturnal leg cramps.		
8. An ankle-brachial pressure index (ABPI) of <1.1 is diagnostic of PAD.		
9. Risk factors for PAD include cigarette smoking.		
10. Exercise programmes for patients with PAD improve walking speed.		
11. Patients with PAD should have a low-density lipoprotein target of <2.6 mmol/L.		
12. Antiplatelet therapy does not have a role in the treatment of PAD.		
13. Chronic exertional compartment syndrome is a diagnosis of exclusion.		
14. The first-line treatment for chronic exertional compartment syndrome is surgery.		
15. Lumbar spinal stenosis symptoms are usually worse with lumbar extension and relieved with lumbar flexion.		
16. The distance walked before symptoms of lumbar spinal stenosis set in is always constant.		
17. A person with lumbar spinal stenosis may have normal neurological examination.		
18. Conservative management is recommended as the initial therapy for lumbar spinal stenosis.		
19. Risk factors for exercise-associated muscle cramps include endurance sports.		
20. A sports physician should be consulted if exercise-associated muscle cramps symptoms are debilitating.		