Fundamentals of Lower Limb Management

Fran Russell & Martha Williams

Tissue Viability

DAY 1
AIMS AND OBJECTIVES

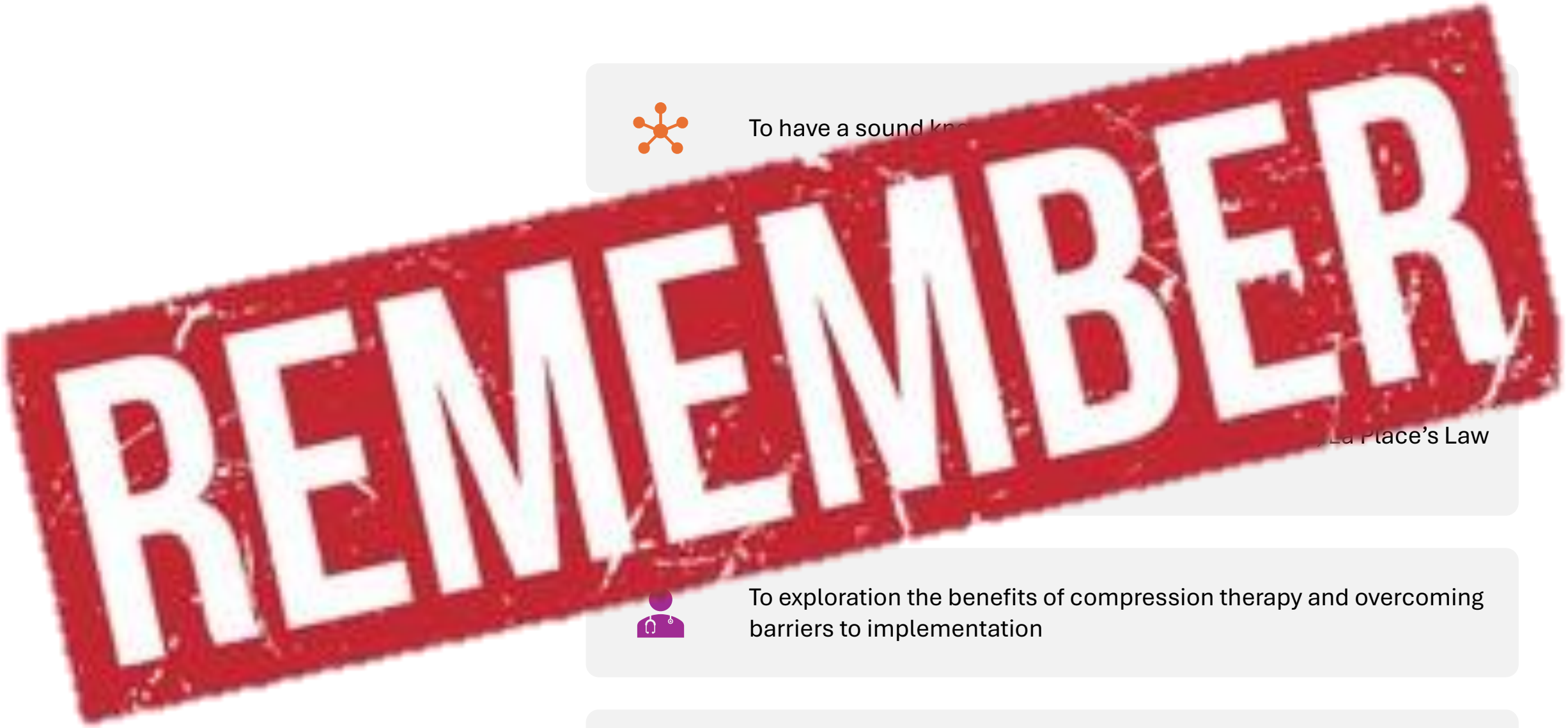
- To understand the anatomy and physiology of the vascular and lymphatic systems
- To identify risk factors for leg ulcers and oedema
- To conduct a holistic assessment
- To identify and modify reasons for delayed healing and poor outcomes
- To understand how patient experiences and clinician attitudes affect care
- To carry out a holistic vascular assessment to diagnose aetiology

To have a sound kn

La Place's Law

To exploration the benefits of compression therapy and overcoming barriers to implementation

To practice effective application technique of below knee Actico, K-Two and Ko-Flex bandaging for venous leg ulceration and thigh high Actico bandaging for chronic, including stump bandaging to toes



Please bring your manual dopplers and sphyggs to day 2!

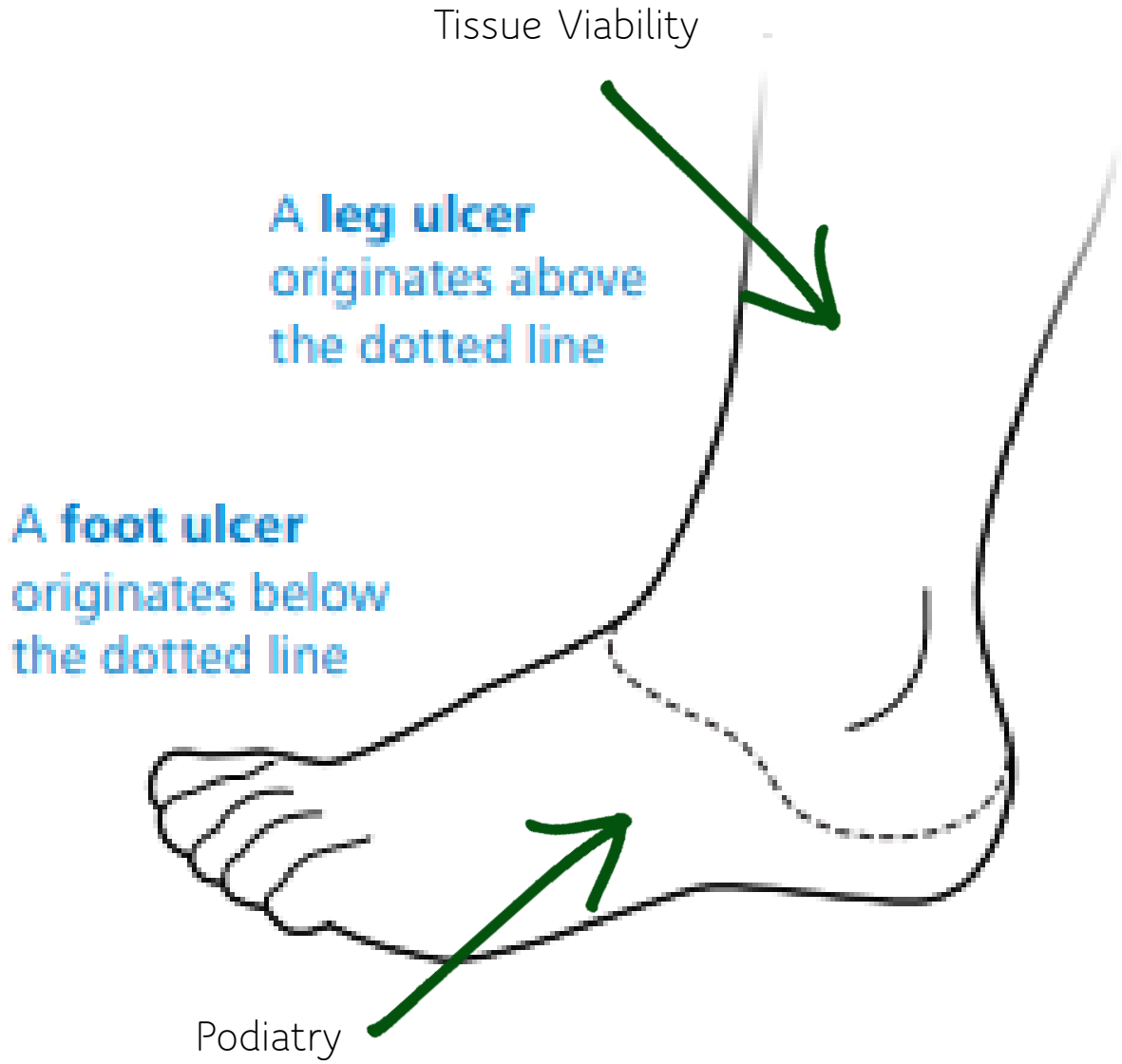
What is a leg ulcer?

An open wound between the knee and just above the malleolus (ankle joint), which has been present for at least two weeks.

Ulceration in the breakdown of the skin, often caused by trauma or surgery

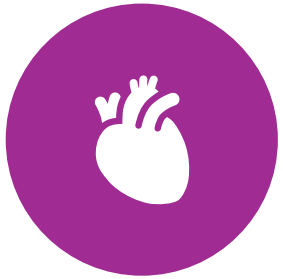
What about wounds on the feet?

- Podiatry are foot specialists and so tend to lead on care of foot ulcers (any wound below the ankle bone)
- Diabetic patients with foot ulcers should be urgently referred to Podiatry
- If a patient has wet, oedematous toes, a referral to TV may be required for stump bandaging



The Statistics

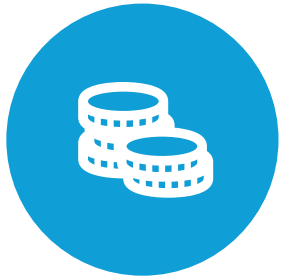
1.5% of the UK adult population (730,000 people) have leg ulcers.



1 in 500 adults have venous leg ulcers (1 in 50 in those over 80 years old)

33-60% of all ulcers are chronic and persist for more than 6 weeks

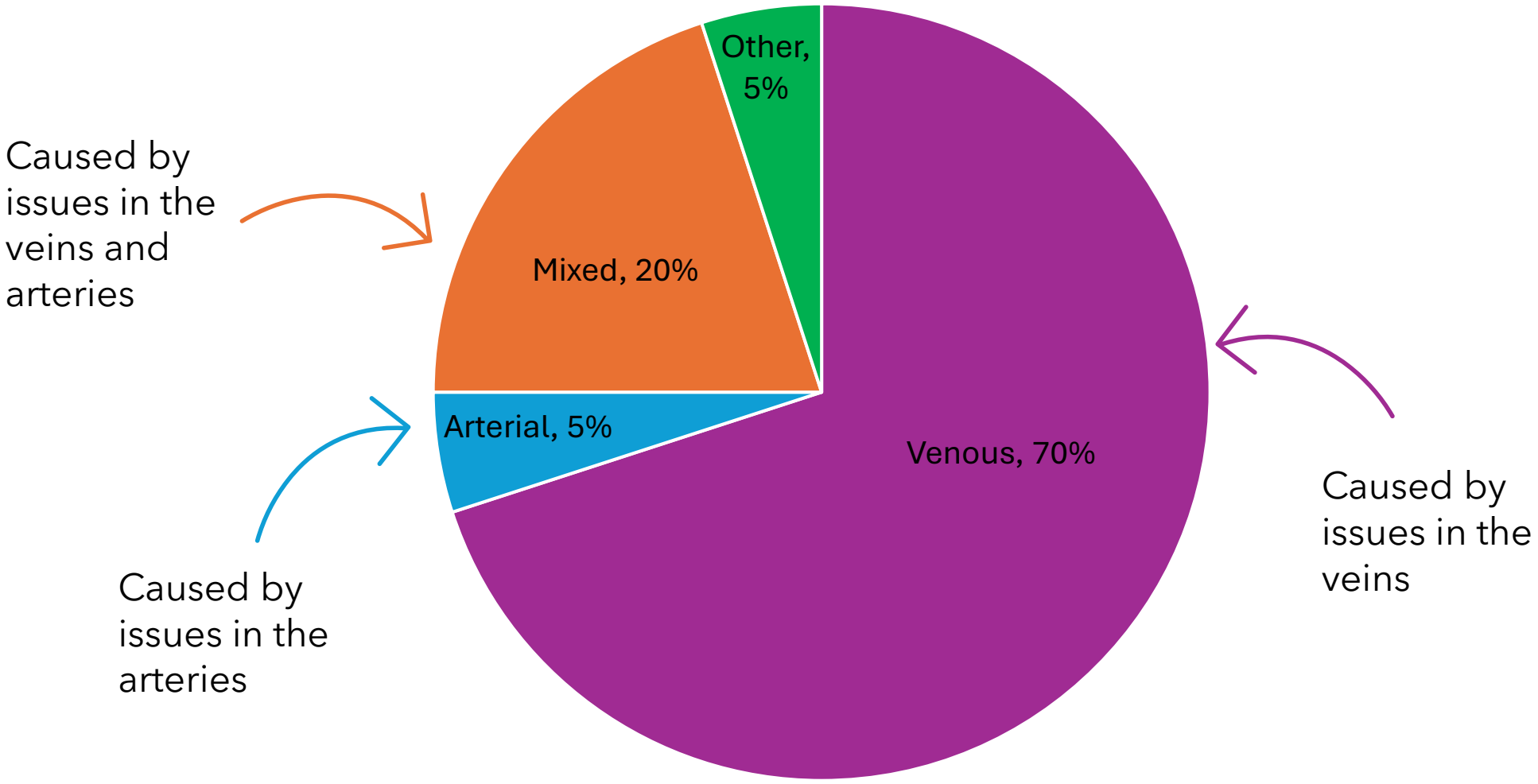
40-60% of community nurses' clinical time is spent on wound care.



Leg ulcer care costs the NHS £3.1 billion every year

Guest, et al (2020)

Causes and prevalence of leg ulcers

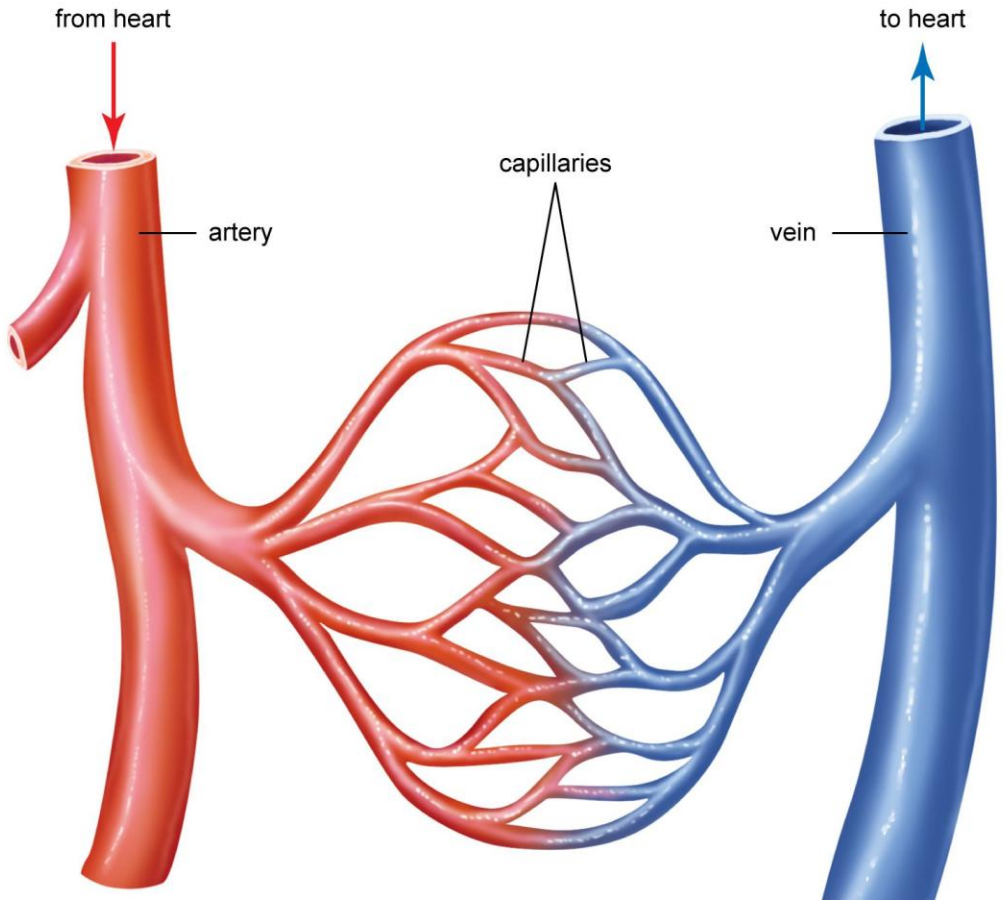


What is the circulatory system?

It comprises of the:

- Heart
- Arteries - supplying oxygenated blood to our tissues and organs
- Veins – return deoxygenated blood back to the lungs and heart

Capillaries are the intersection between arteries and veins where high pressure arterial blood transfers to the venous system causing fluid to leak out of the blood vessels into the interstitium containing nutrients, other substances and debris



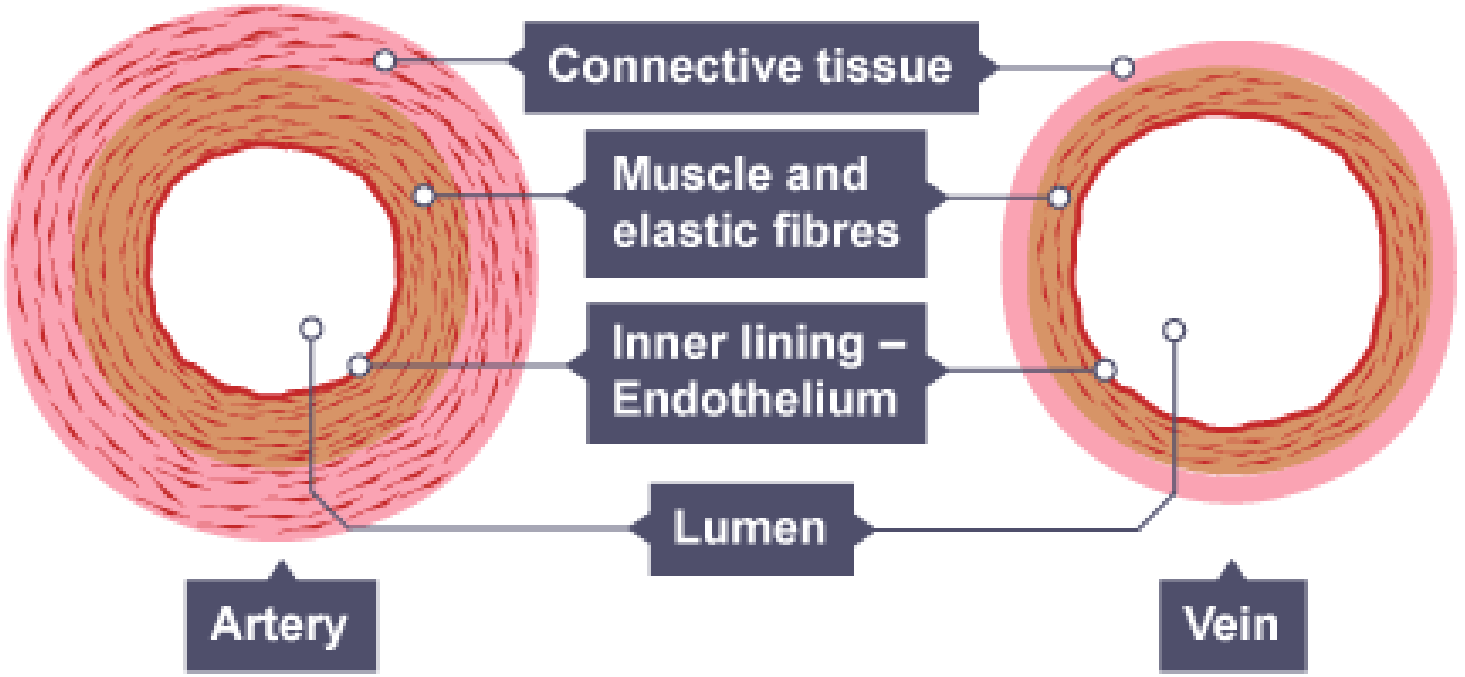
Characteristics of bloods vessels

Arteries:

- Carry blood at high pressure
- Small lumen
- Thick, muscular wall

Veins:

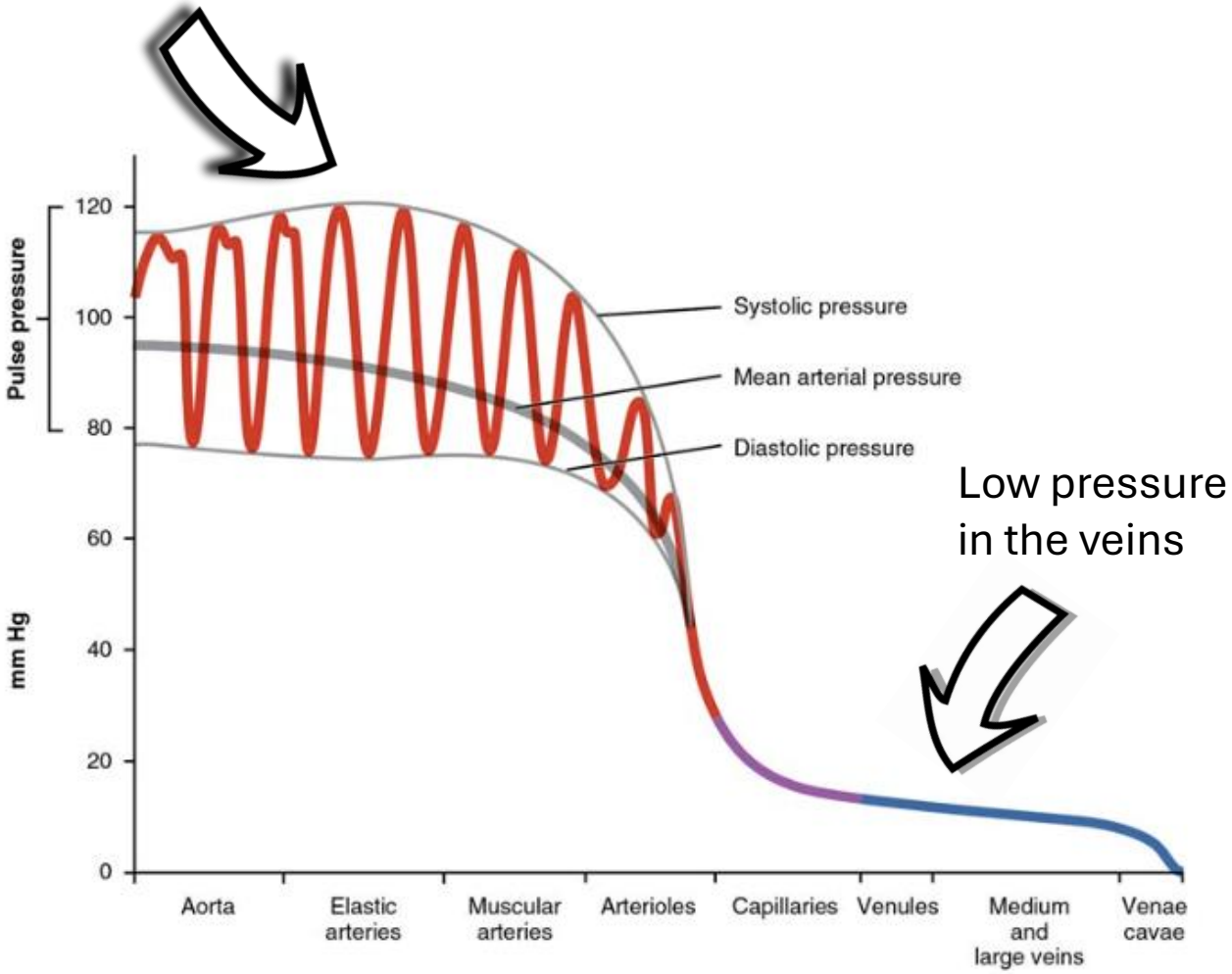
- Carry blood at low pressure
- Big lumen
- Thin walls



What about GRAVITY

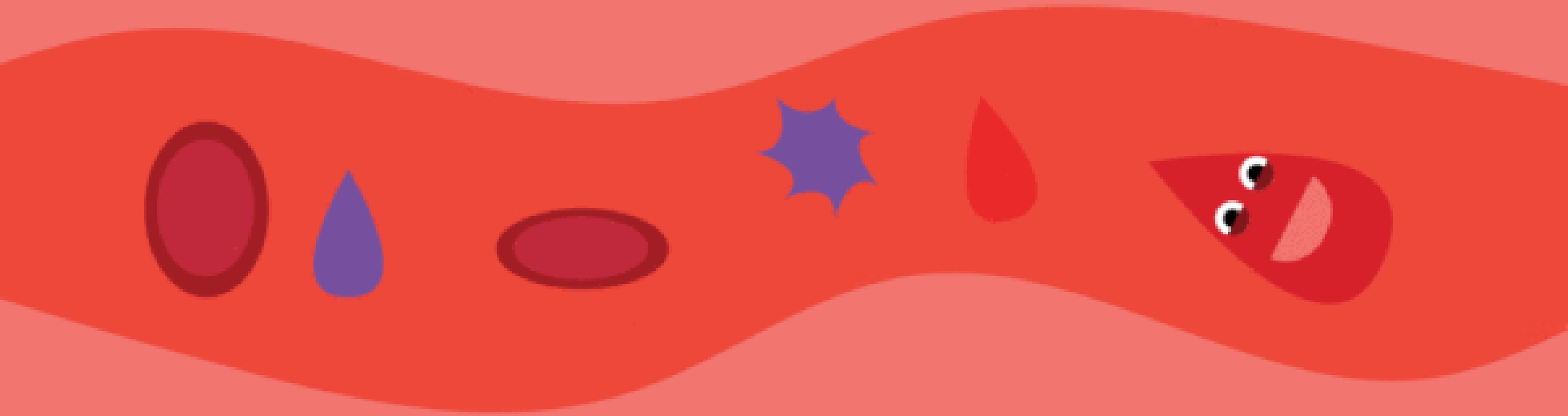
- In our legs, the blood flow in the veins is more sluggish due to low pressure and gravity.
- By the time the blood has gone through the arteries, capillaries and into the veins, the initial pressure that was exerted on it when the heart contracted has now diminished.

High pressure in the arteries



Low pressure in the veins

To return blood, veins need to carry blood upwards against gravity.

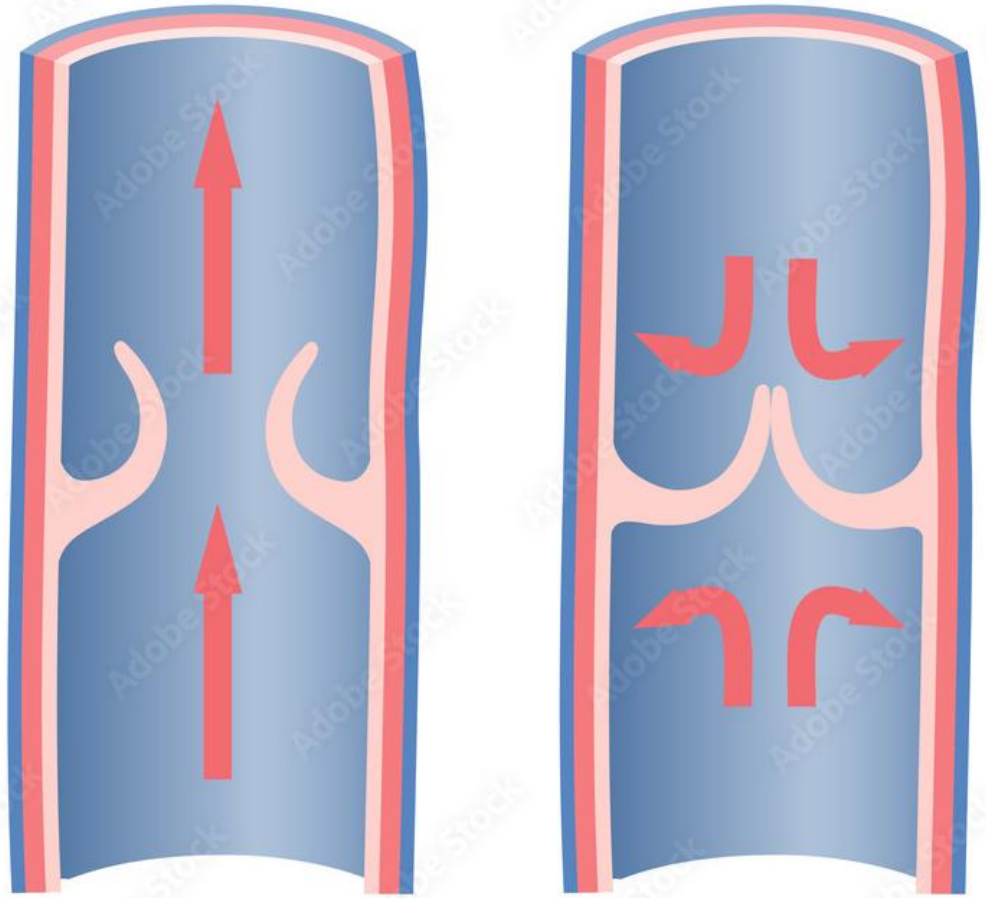


What do you think helps this along?

Valves

•Most veins in the lower limbs contain valves which open and close to prevent backflow of blood, also known as reflux.

•The valves open in one direction only to keep blood flowing in the right direction



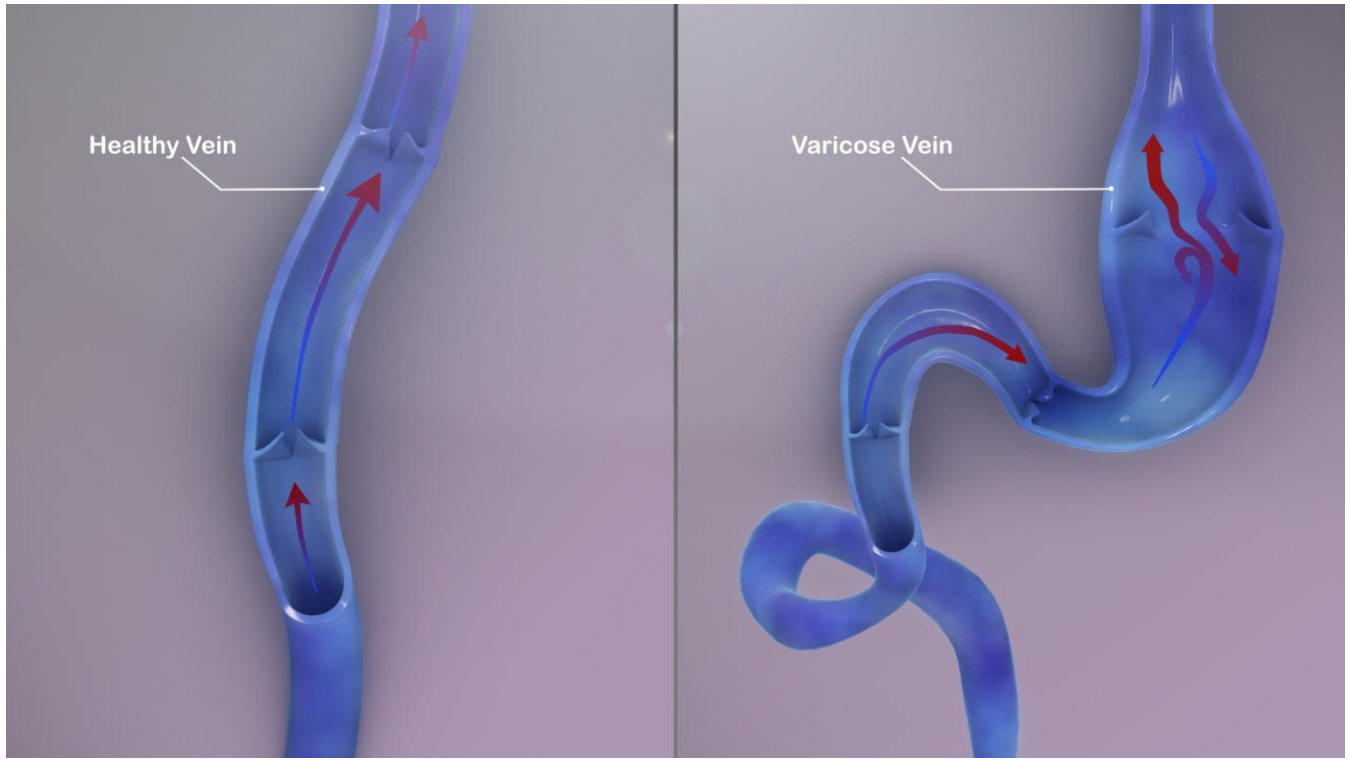
Valve open

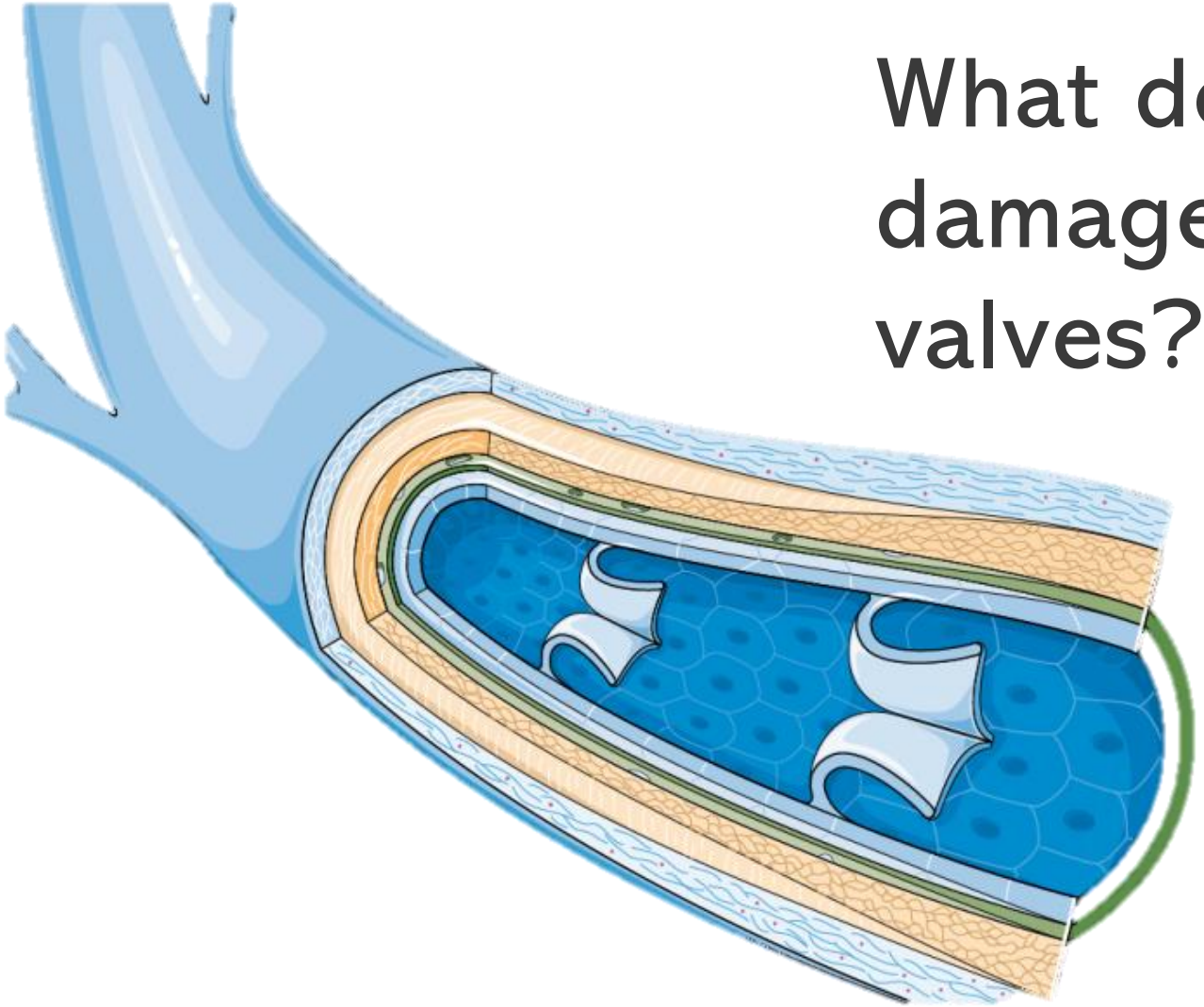
Valve closed

What can go wrong in the veins?

•When the veins become damaged the valves within are unable to close and return the blood back to the lungs and heart. This results in venous reflux and venous hypertension.

•Prolonged venous hypertension leads to leakage of proteins and fluid into the skin, creating inflammation and subsequent tissue breakdown, a venous leg ulcer.

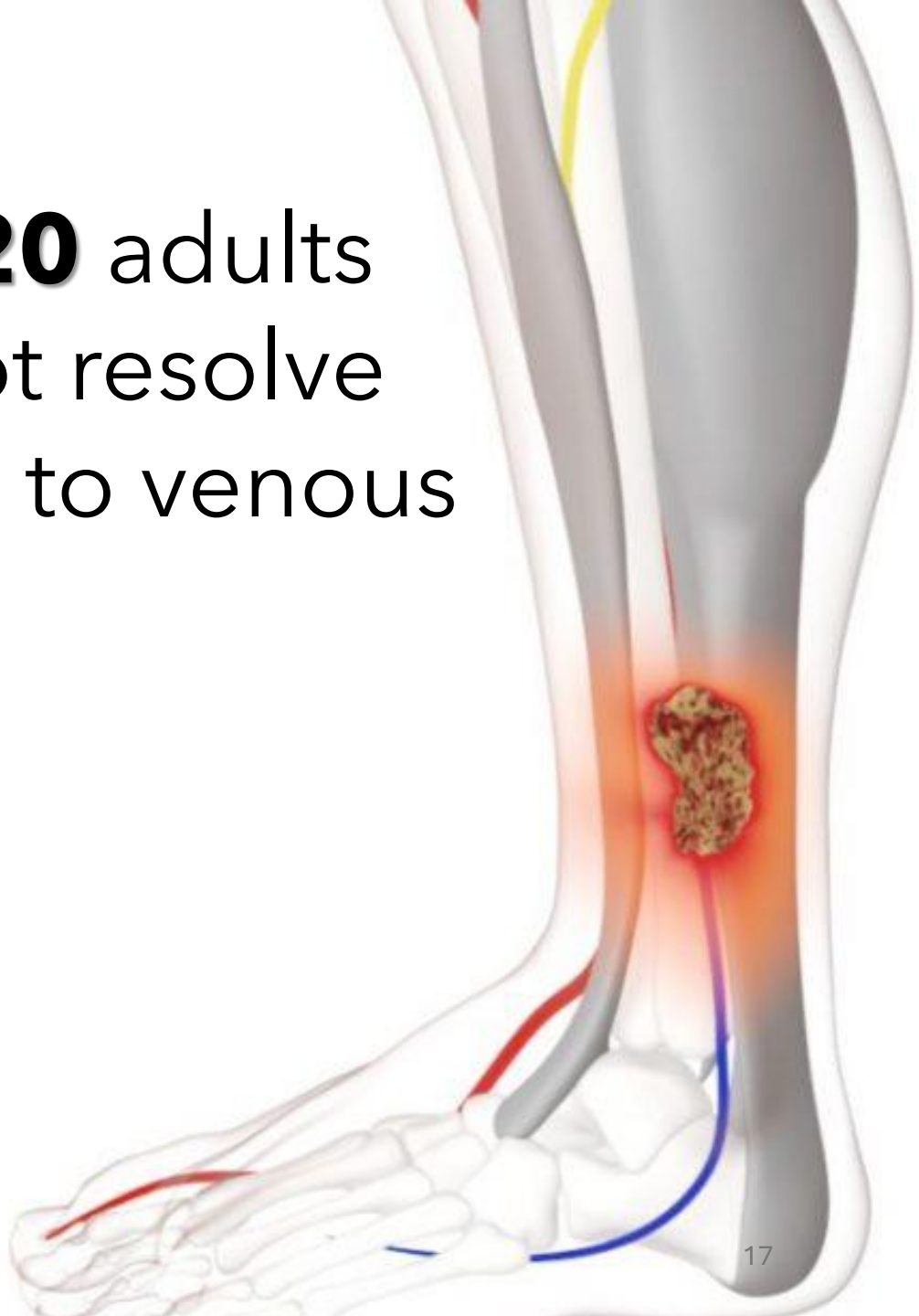




What do you think causes damage to the veins and valves?

Venous disease affects **1 in 20** adults and is **progressive** so will not resolve if left untreated and can lead to venous leg ulceration.

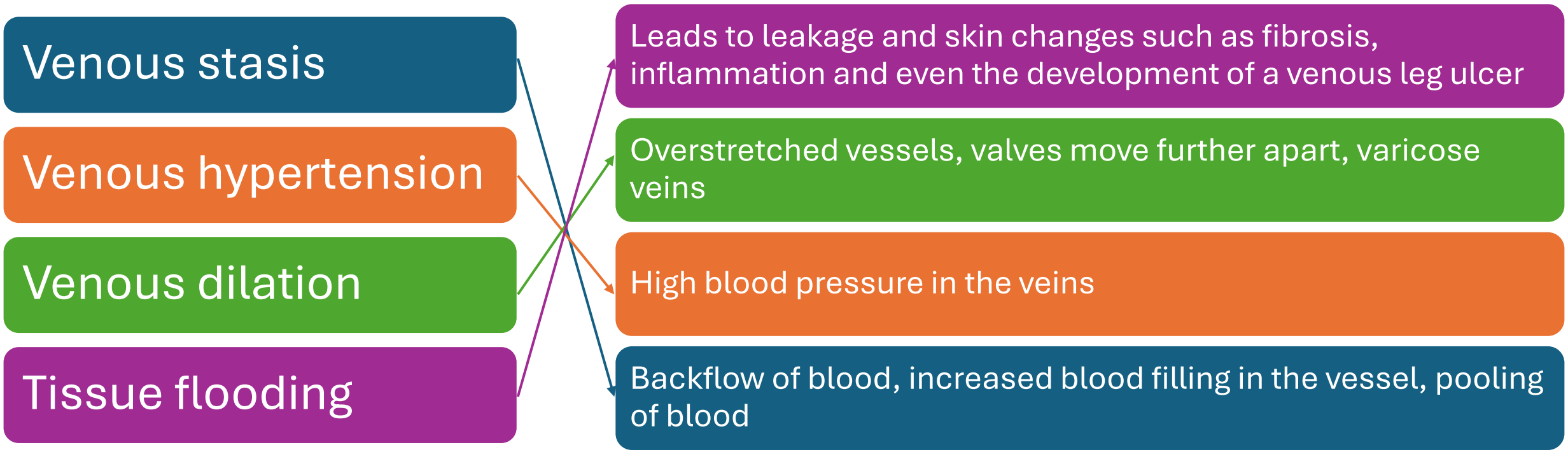
(Patel and Surowlec, 2024)



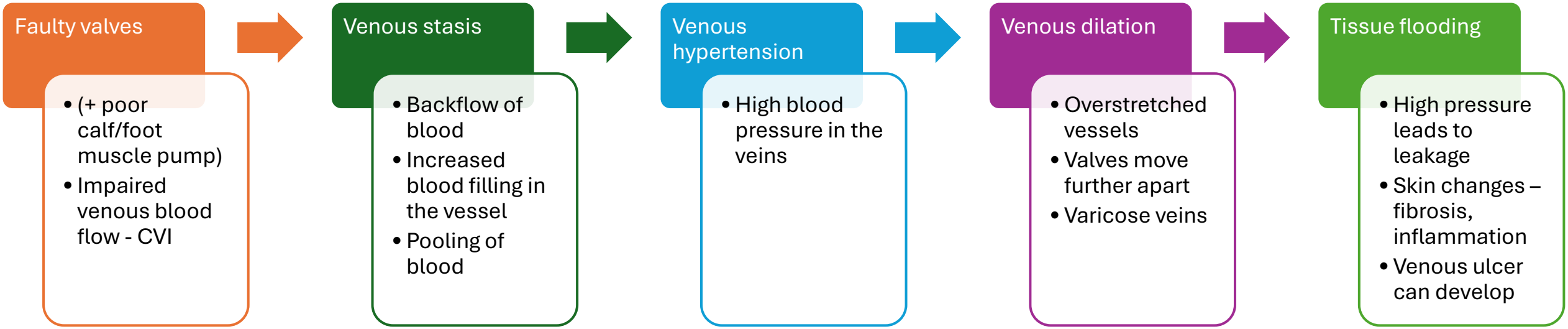
Activity – link these terms to their definitions

Venous stasis	Leads to leakage and skin changes such as fibrosis, inflammation and even the development of a venous leg ulcer
Venous hypertension	Overstretched vessels, valves move further apart, varicose veins
Venous dilation	High blood pressure in the veins
Tissue flooding	Backflow of blood, increased blood filling in the vessel, pooling of blood

Activity – link these terms to their definitions



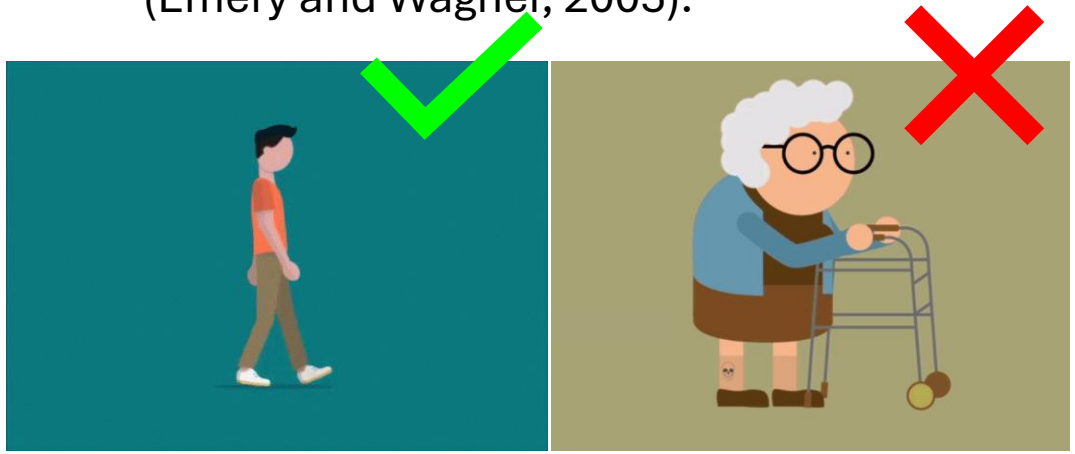
How does a venous leg ulcer develop?

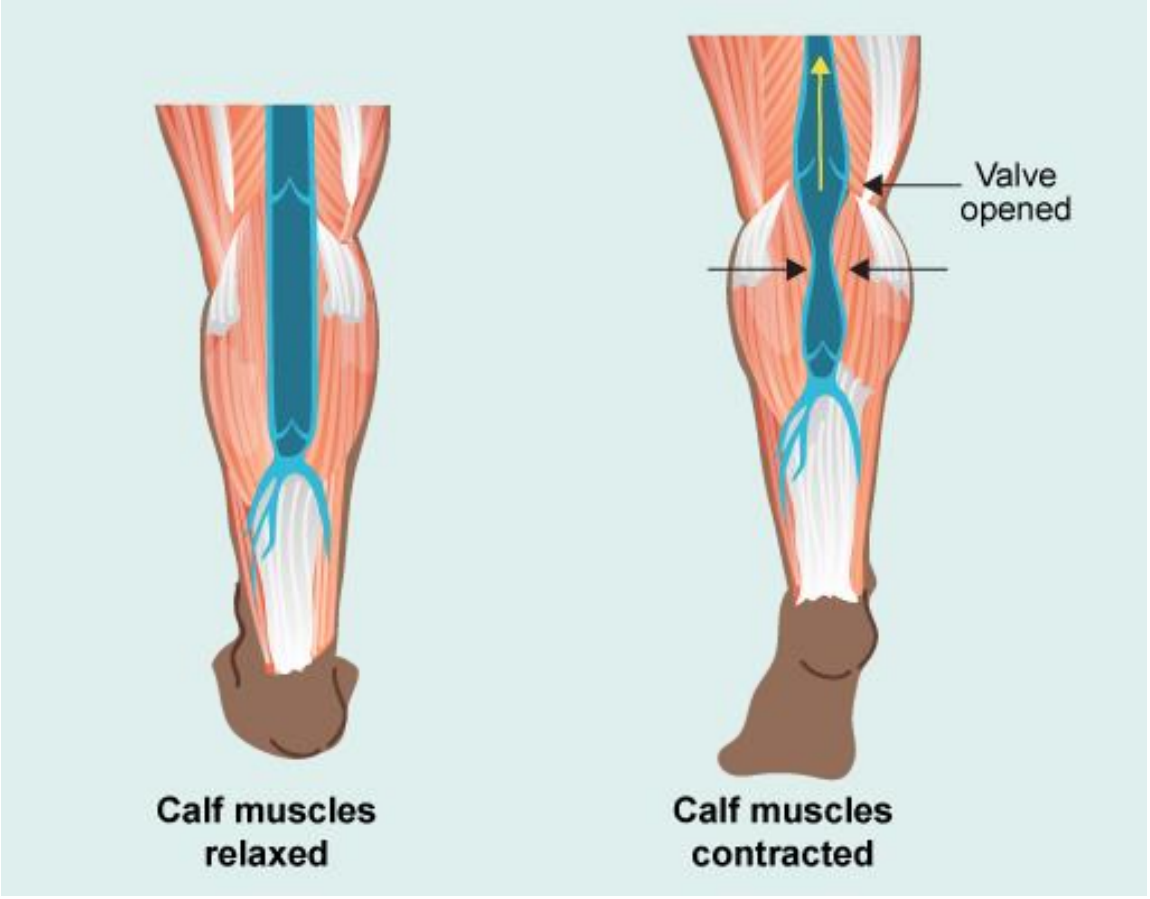


What can we recommend for patients who have chronic venous insufficiency (CVI)?

Calf and foot muscle pumps

- When a muscle contracts it gets shorter and wider squeezing the veins like a pump, increasing blood pressure driving blood towards the heart.
- Deep veins are responsible for 90% of venous return through action of muscle pumps (Messiner, 2005).
- Regular exercise speeds up the wound-healing process in older adults by as much as 25% (Emery and Wagner, 2005).





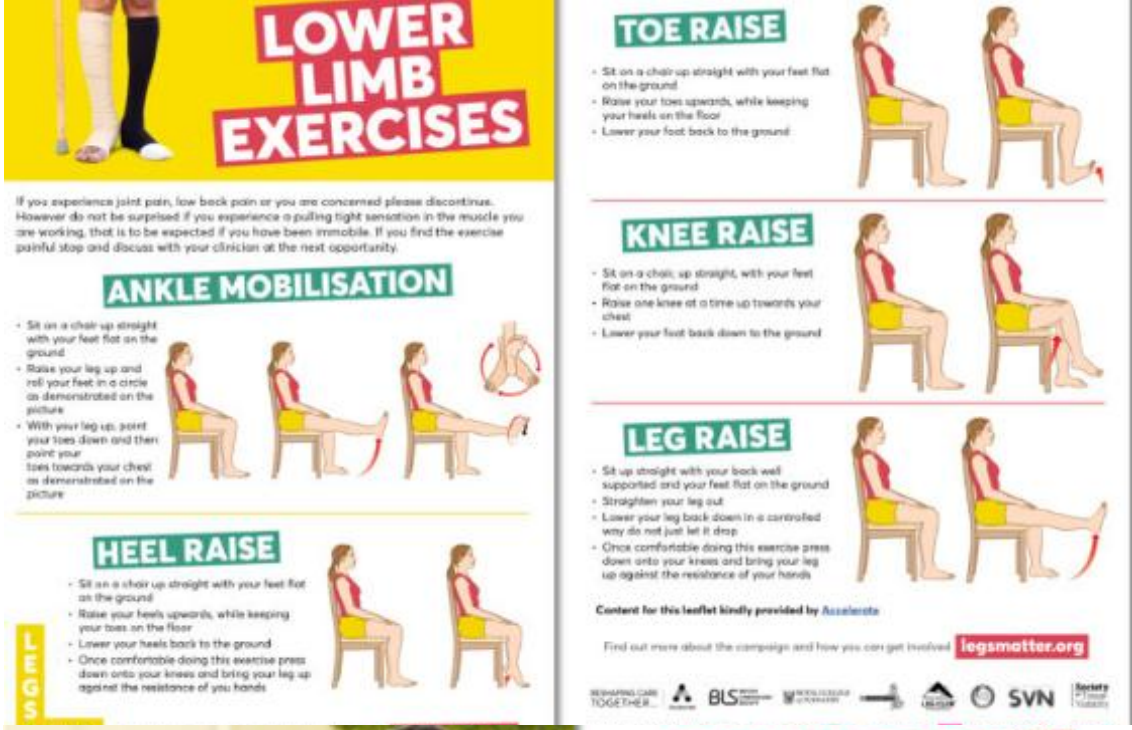
Lower limb exercises

Age UK

- In person/online classes
- Seated exercises
- Mind & Body – Tai Chi, Yoga & Pilates
- Stay Strong & Steady – risk of falls
- Big, Bold & Balance – Parkinson's
- Videos on YouTube
- Free DVD

Legs Matter

- Online simple exercise videos
- How to use a TheraBand for fixed ankles
- Lower Limb exercise leaflet
- Lower leg wound/ lymphoedema exercise records



Leg elevation and sleep in bed overnight

- When not exercising, elevate legs as much as practical to help reduce aid venous drainage from the limb.

- Sitting with legs dependent might cause swelling and make compression bandaging feel uncomfortable.

- Sitting in a chair with legs on a foot stool will not help as there will continue to be venous hypertension in the foot, and the position puts additional pressure on the sacrum and buttocks, increasing the risk of pressure ulceration.

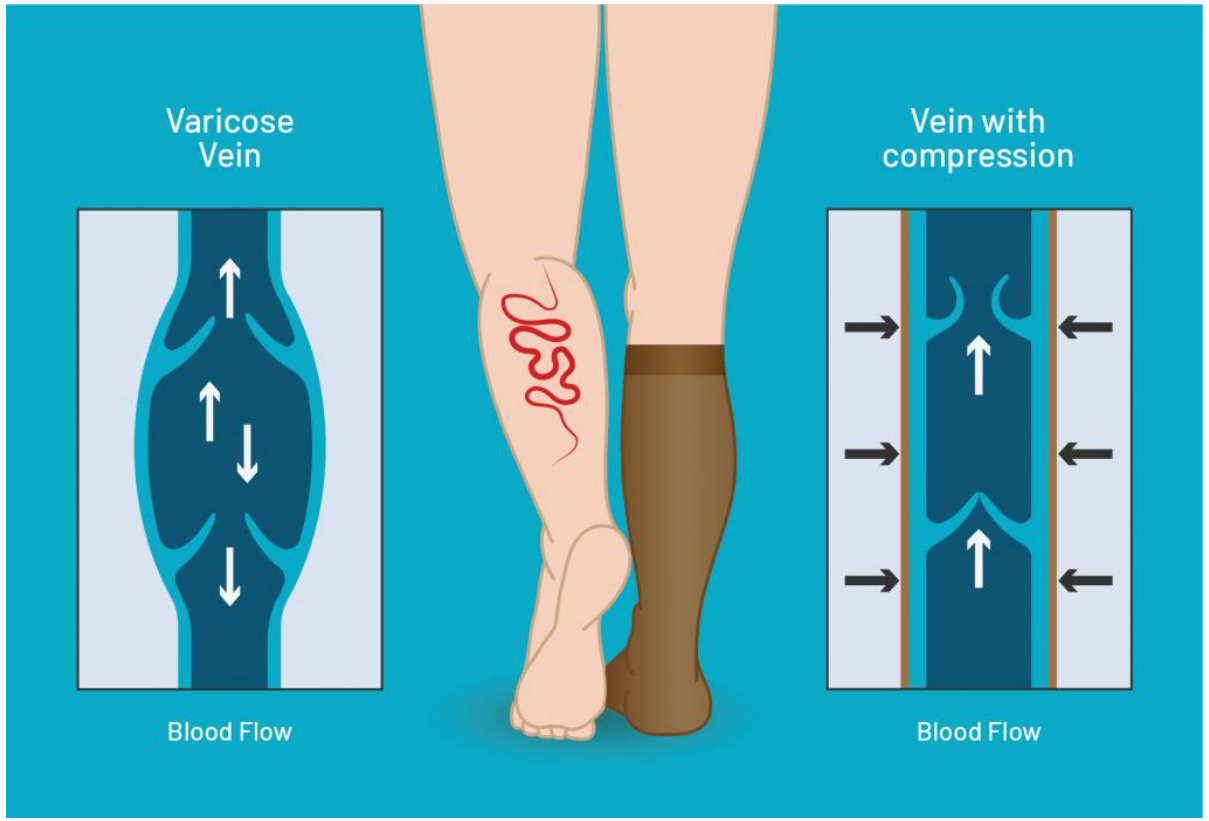
- Leg elevation will need to be at the same level as the head in order to facilitate blood circulation.

How can compression help?

•Compression works by applying external pressure on the skin, thus compressing the veins.

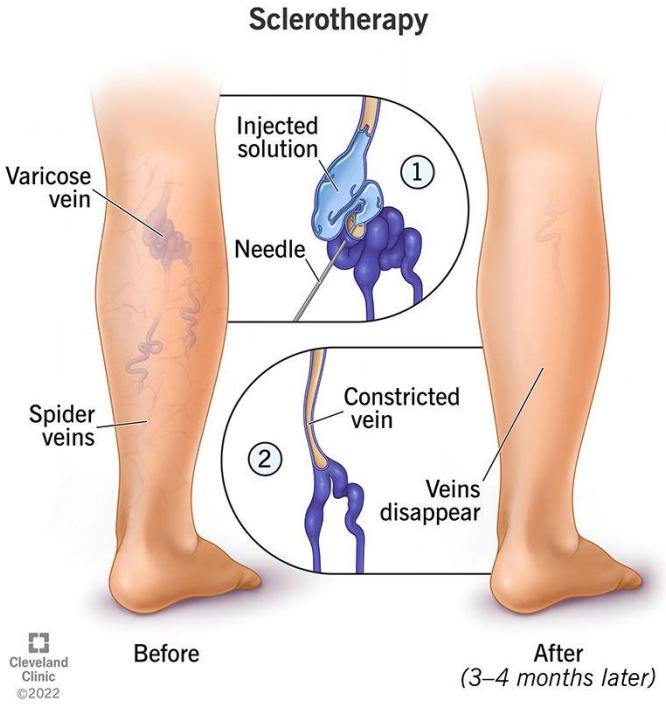
•This force helps to improve the function of the valves within the veins, which reduced the amount of fluid that leaks out of the veins and into the tissues.

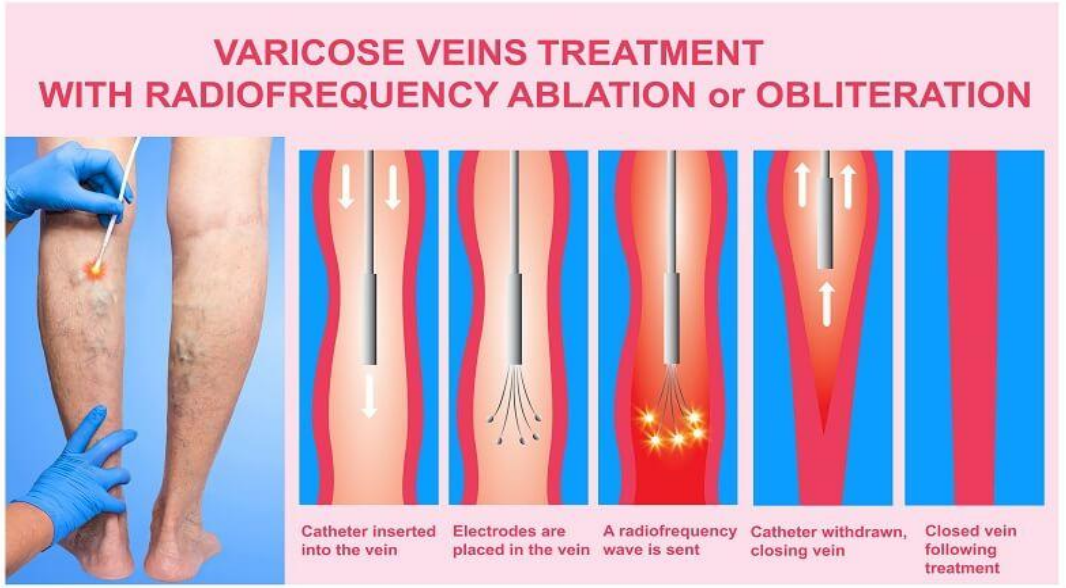
•Compression also supports the muscles, which helps to create a force to push blood through the venous system.

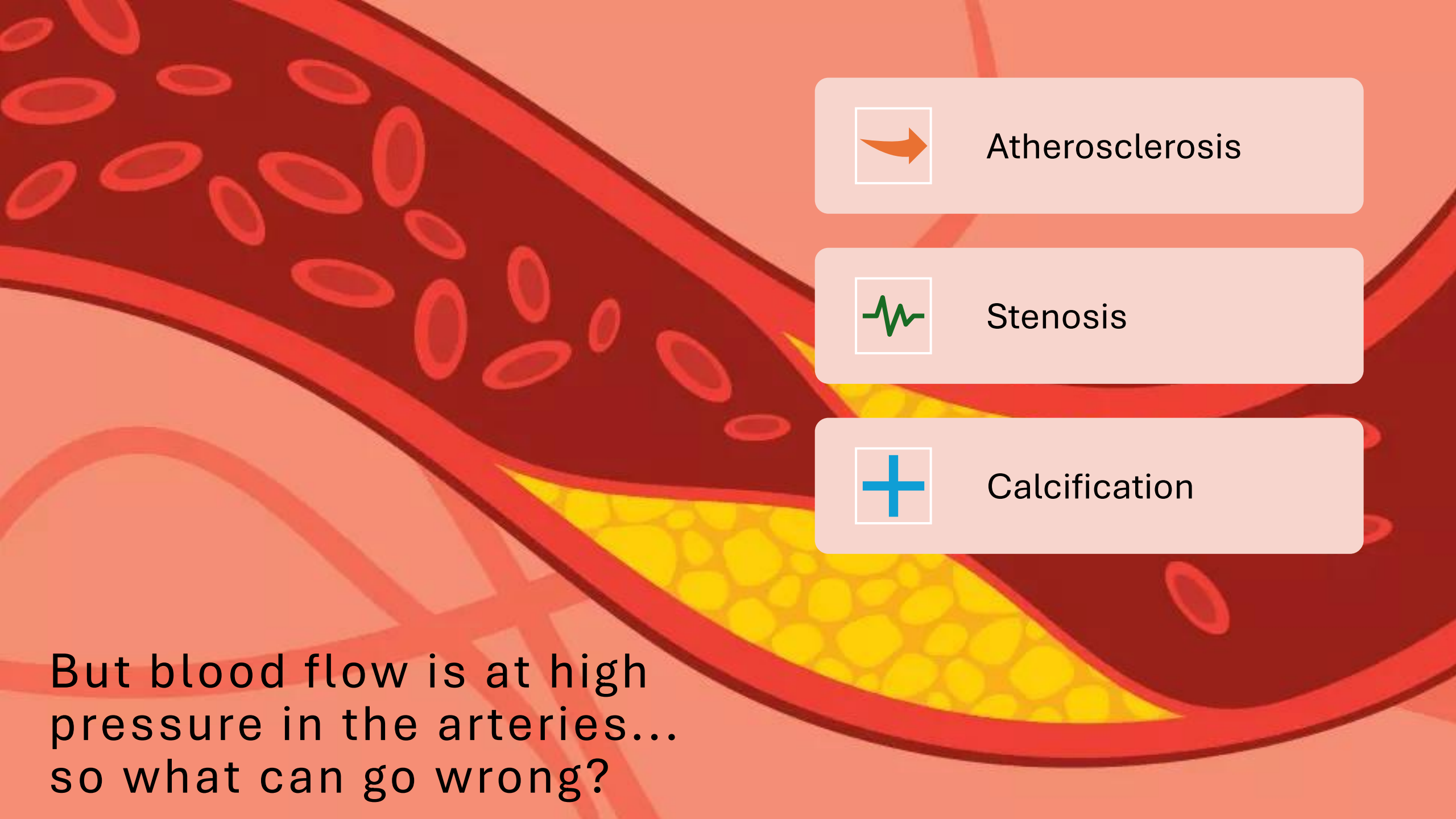


Referral to Vascular

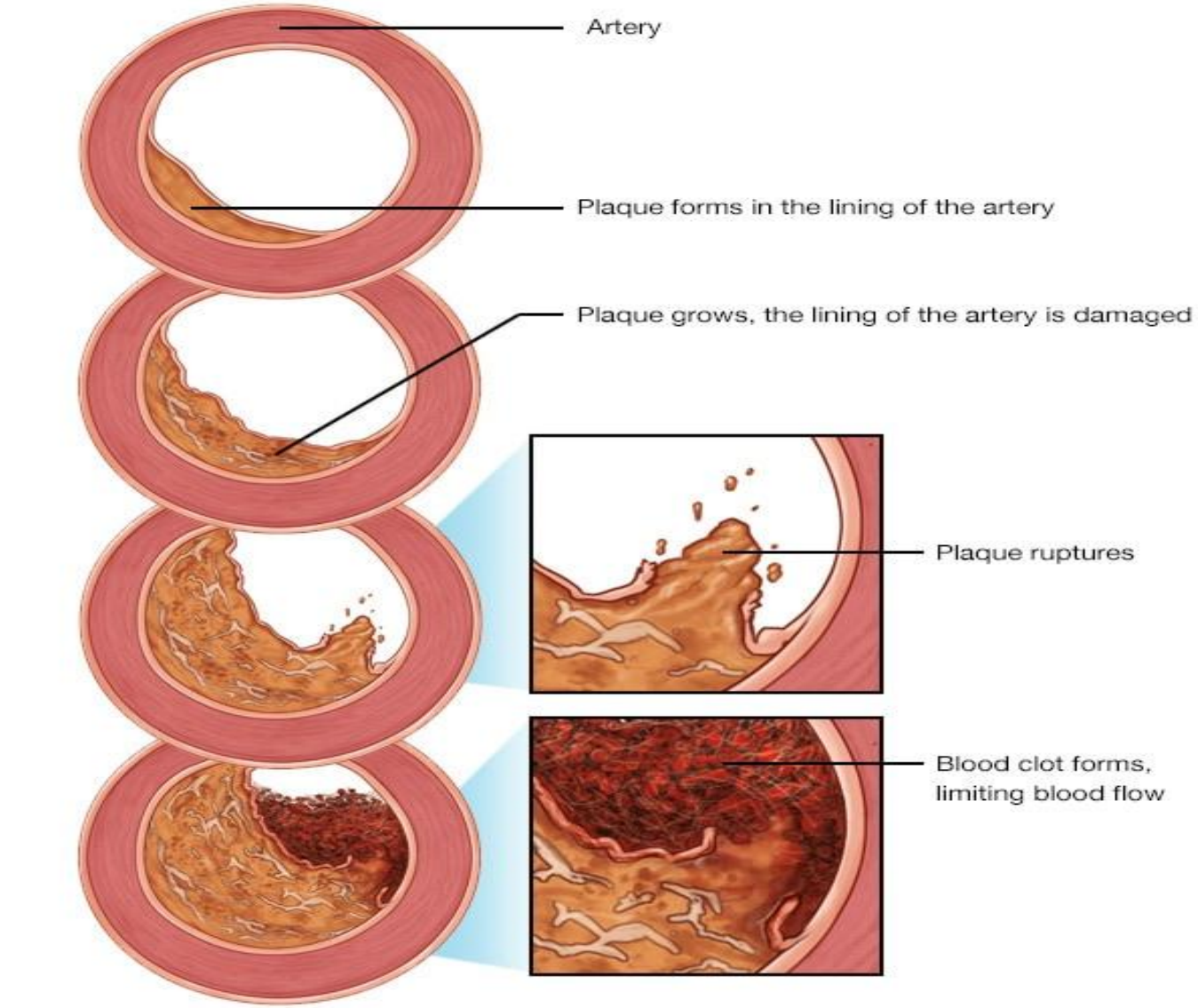
- **Sclerotherapy** - involves injecting a solution into abnormal veins to make them collapse and fade away, primarily used to treat spider veins and varicose veins.
- **Venous ablation** - treats varicose veins and venous insufficiency by closing off damaged veins, typically using heat (from radiofrequency or laser) or other methods like chemical agents

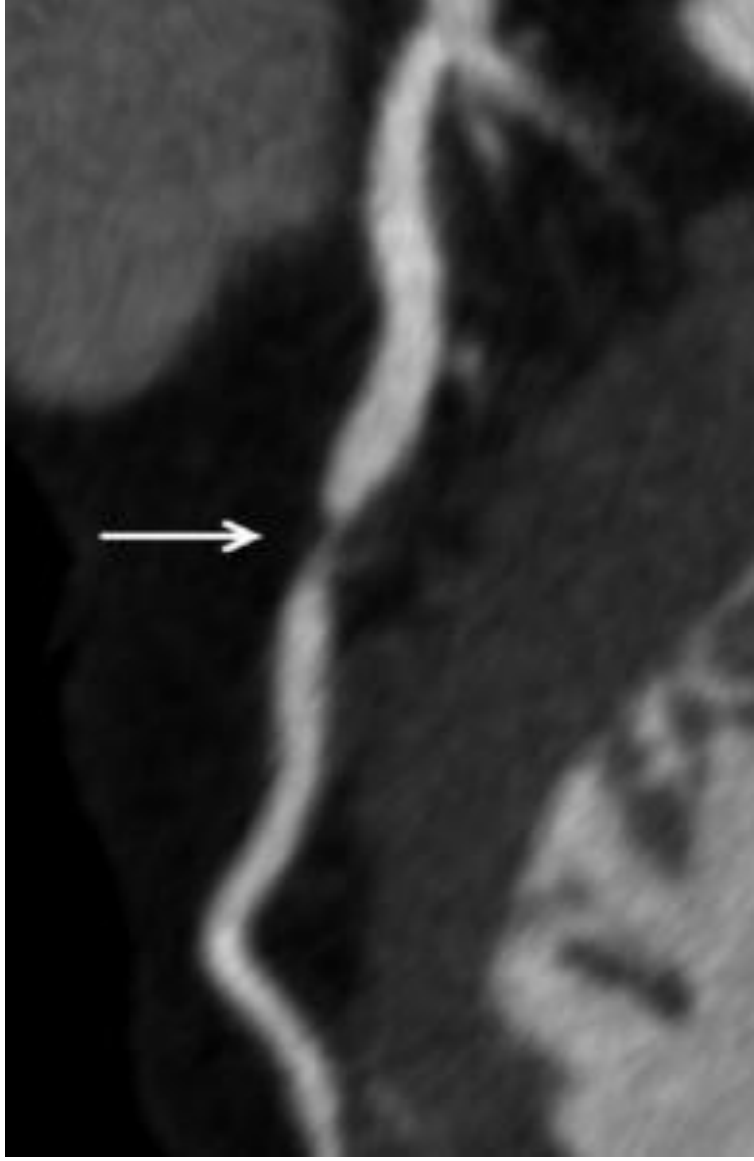






But blood flow is at high pressure in the arteries... so what can go wrong?





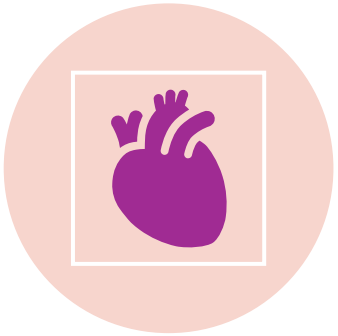
ATHEROSCLEROSIS

BUILD-UP OF FATS, CHOLESTEROL, FIBRIN, CELLULAR WASTE PRODUCTS AND OTHER SUBSTANCES WITHIN THE WALLS OF THE ARTERY

Blood vessel infection/inflammation – such as vasculitis, rheumatic fever (complication of strep throat) or infective endocarditis

Increased age – general wear and tear (degeneration) causes thickening of the arterial wall

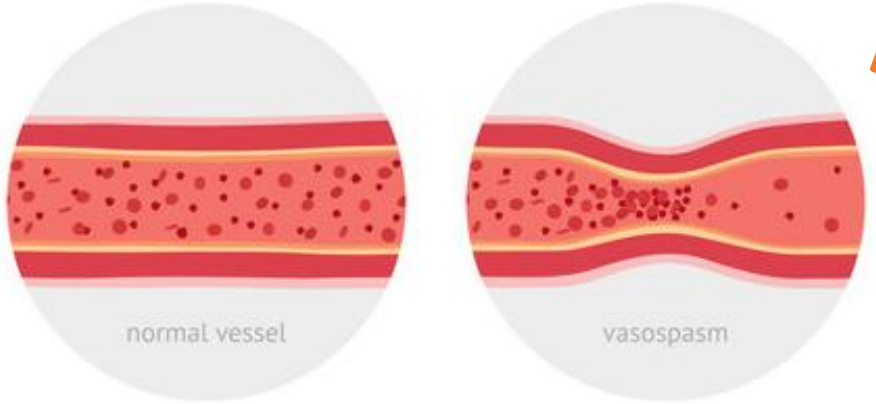
Congenital anomalies – such as fibromuscular dysphagia, abnormal cell development/thickening of the arterial wall



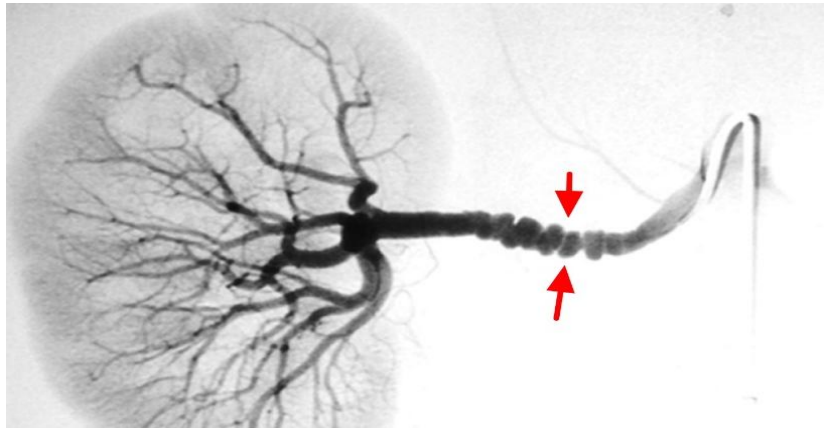
Spasms – such as angina (coronary artery spasm)

STENOSIS

NARROWING/OCCLUSION OF ARTERIES

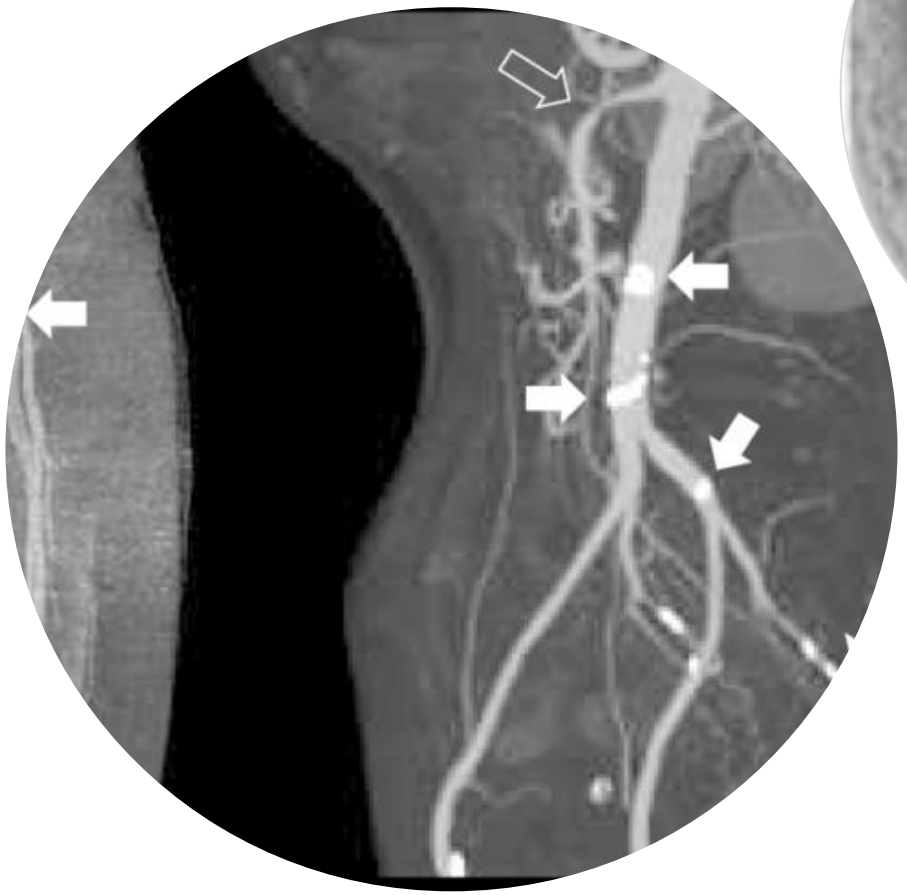


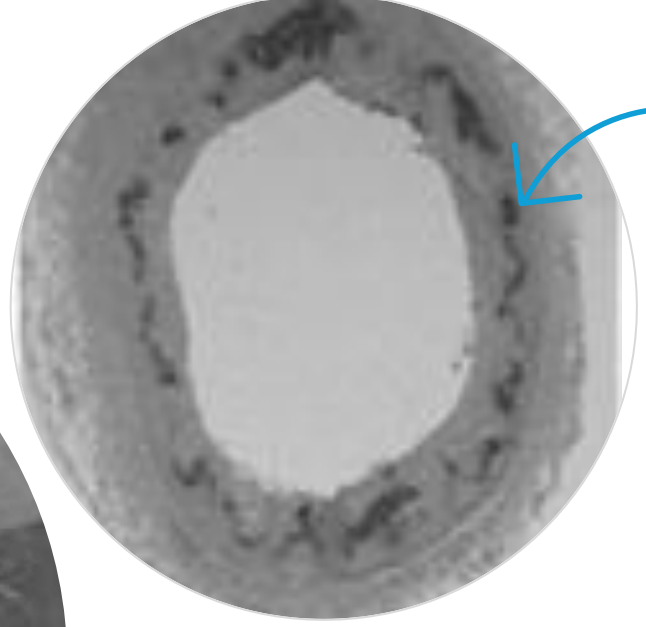
Angina *(coronary artery spasm)* – contraction of the muscular layer of the artery



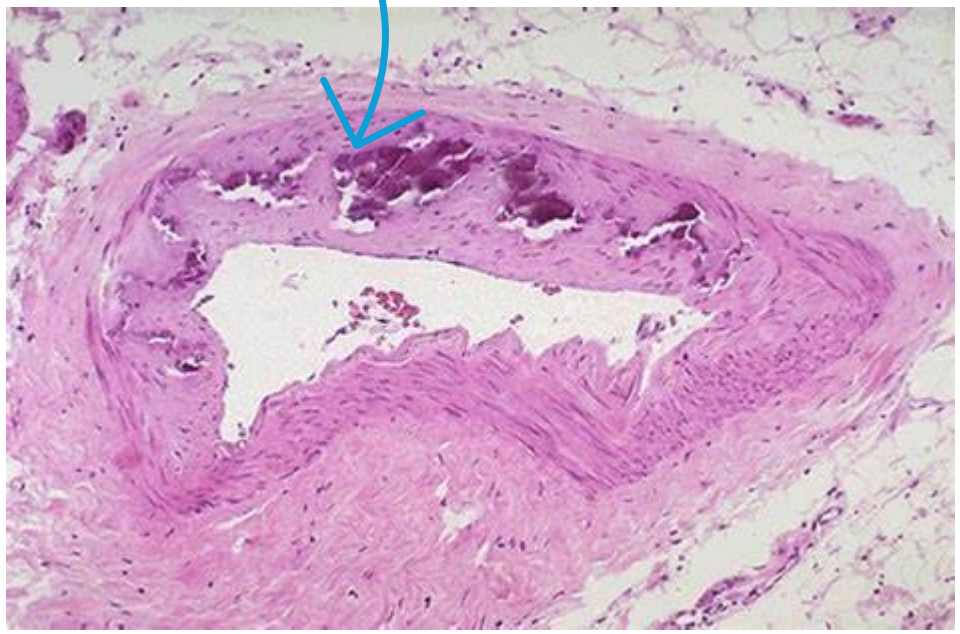
Fibromuscular dysphagia *(congenital anomaly)* – abnormal cell development and irregular thickening of muscle wall of renal artery

EXAMPLES OF STENOSIS





Calcium deposits

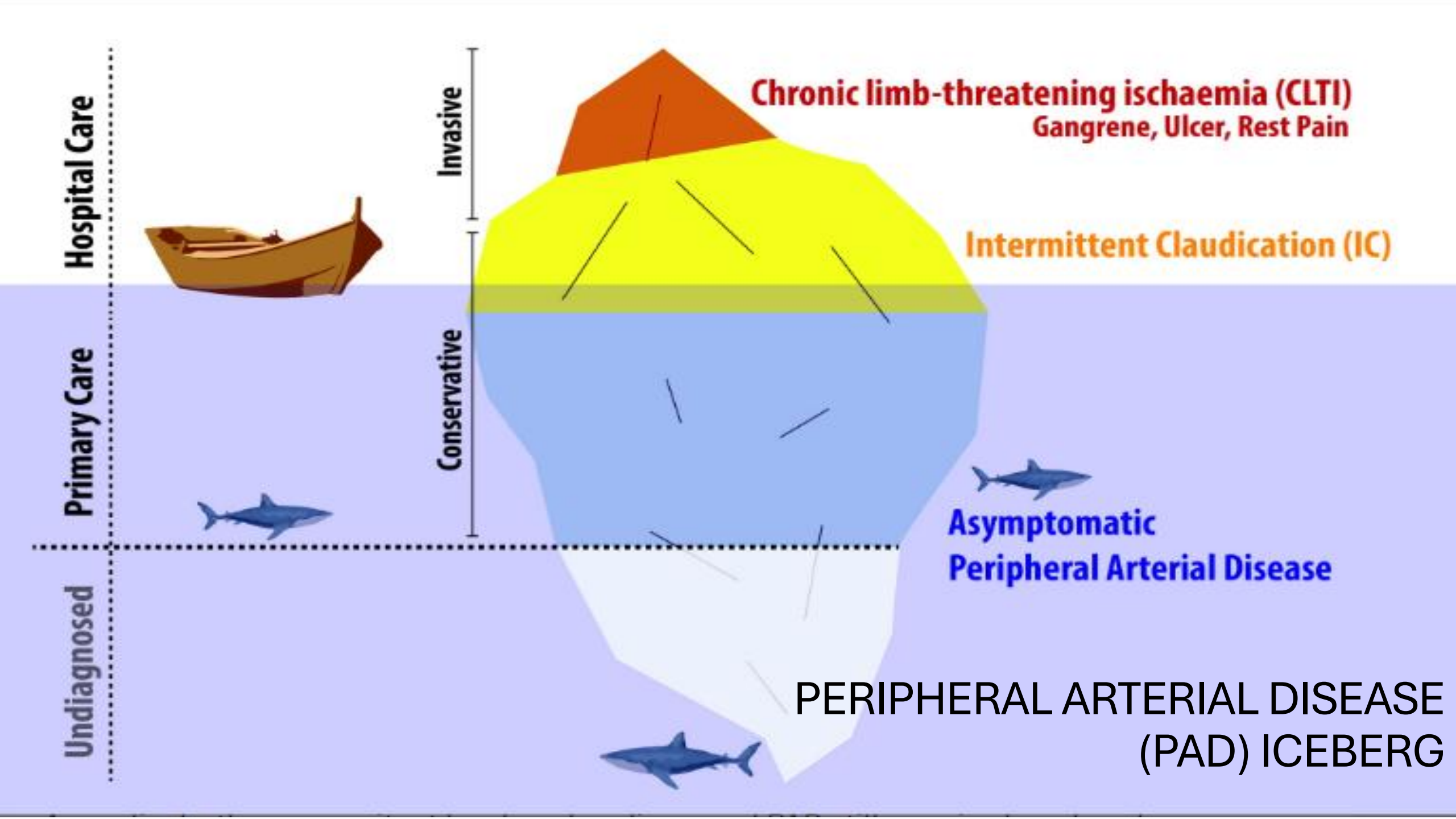


MEDIAL WALL CALCIFICATION

STIFFENING OF THE ARTERY WALLS & BUILD UP OF CALCIUM DEPOSITS WITHIN THE MEDIAL WALLS

What does this mean?

- Narrowed arteries reduce blood flow to the legs and feet.
- This is known as peripheral arterial disease (PAD).
- The arteries then compensate by dilating to preserve blood flow (arterial hypertension).
- Blood flow shifts to smaller arteries (collateral flow).
- But smaller arteries carry less blood than bigger arteries.
- Reduced blood flow to tissues = tissue damage and death (ischaemia)



PERIPHERAL ARTERIAL DISEASE (PAD) ICEBERG

What can we recommend for patients who have peripheral arterial disease (PAD)?

Lifestyle changes

- Smoking cessation
- Regular exercise
- Weight loss for elevated BMI
- Heart-healthy diet
- Control blood sugar if diabetic
- Keep blood pressure well-managed

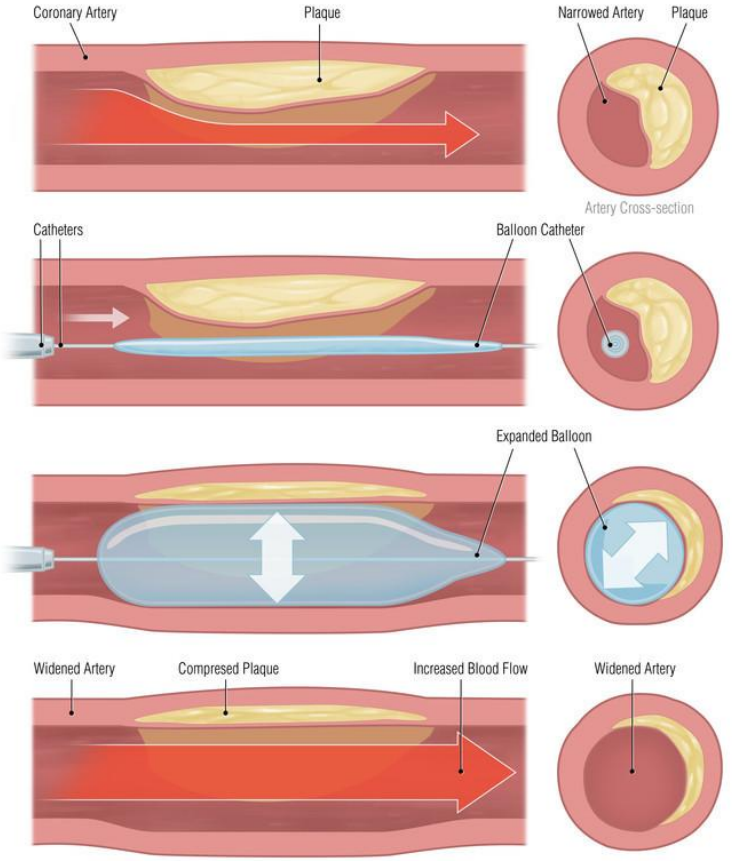
Exercise for intermittent claudication (NICE, 2020)

Medications

- **Antiplatelets** – medications like Aspirin and Clopidogrel prevent blood clots.
- **Statins** – lower cholesterol, which helps slow atherosclerosis.
- **Vasodilators** – medications like Cilostazol can help reduce claudication (leg pain) by improving blood flow.
- **Medications to manage blood pressure and diabetes**.

Referral to Vascular

- **Angioplasty and stent placement** – a balloon is used to open narrowed arteries, and a stent may be inserted to keep the artery open.
- **Bypass surgery** - a new pathway is created to re-route blood around a blocked artery, improving flow to the legs.
- **Thrombolytic therapy** – in some cases, medication can be directly administered into a blocked artery to dissolve a blood clot.



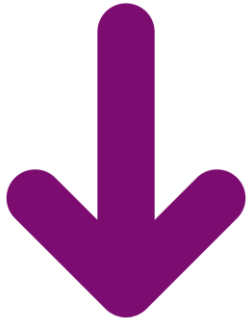
Patient information leaflets

Activity - What are the risk factors for venous and arterial disease?

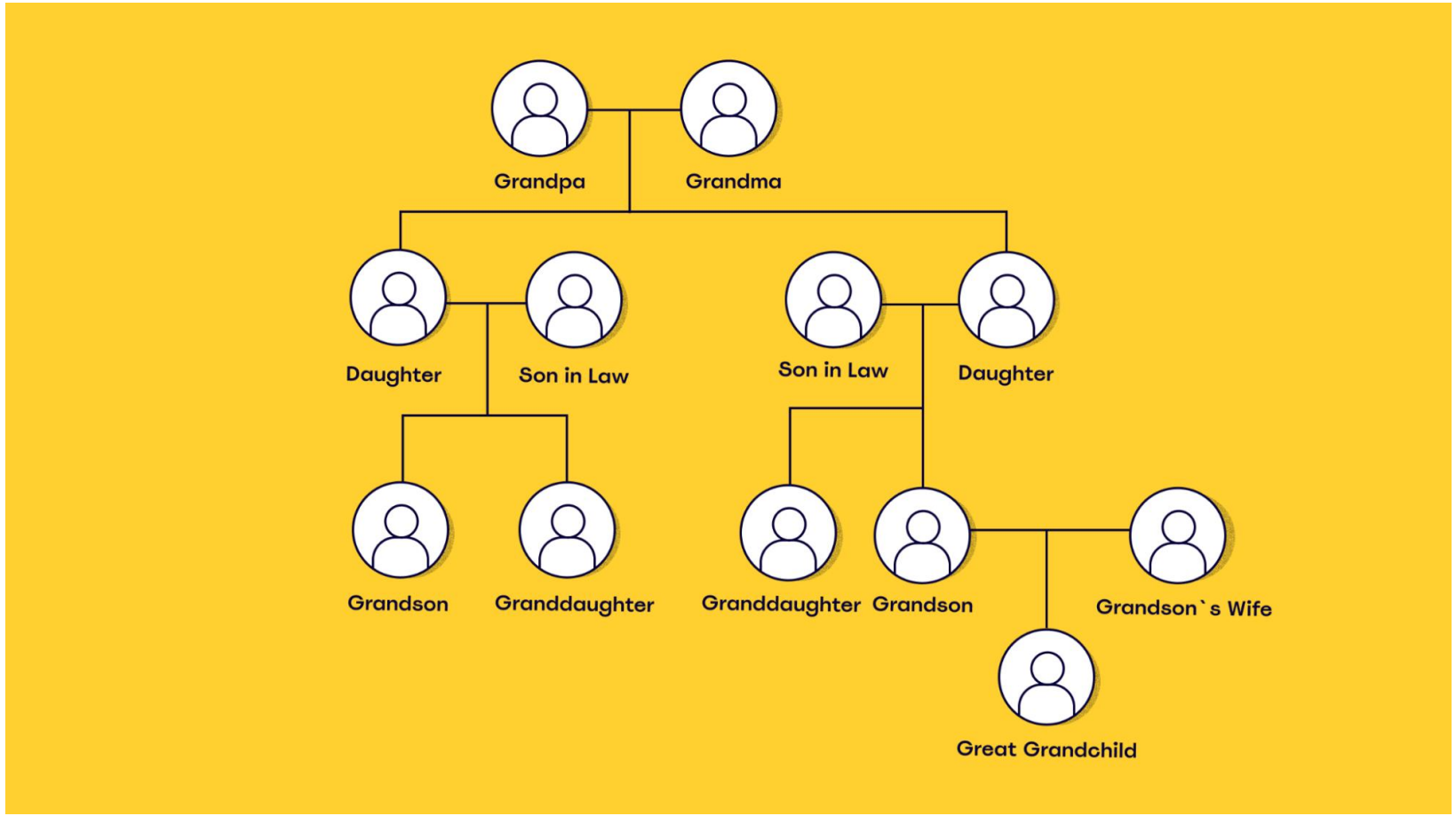
Venous risk factors

Venous and arterial risk factors

Arterial risk factors

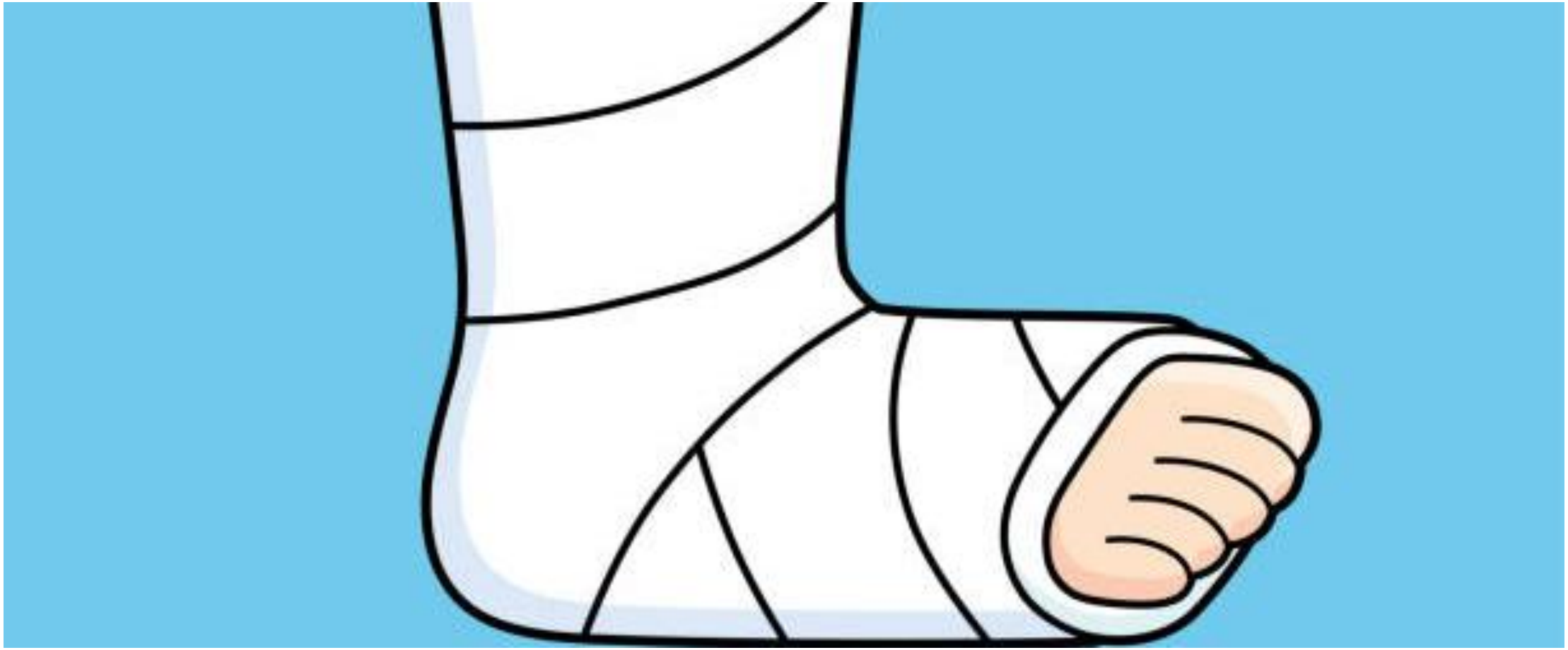


Family history/genetic predisposition

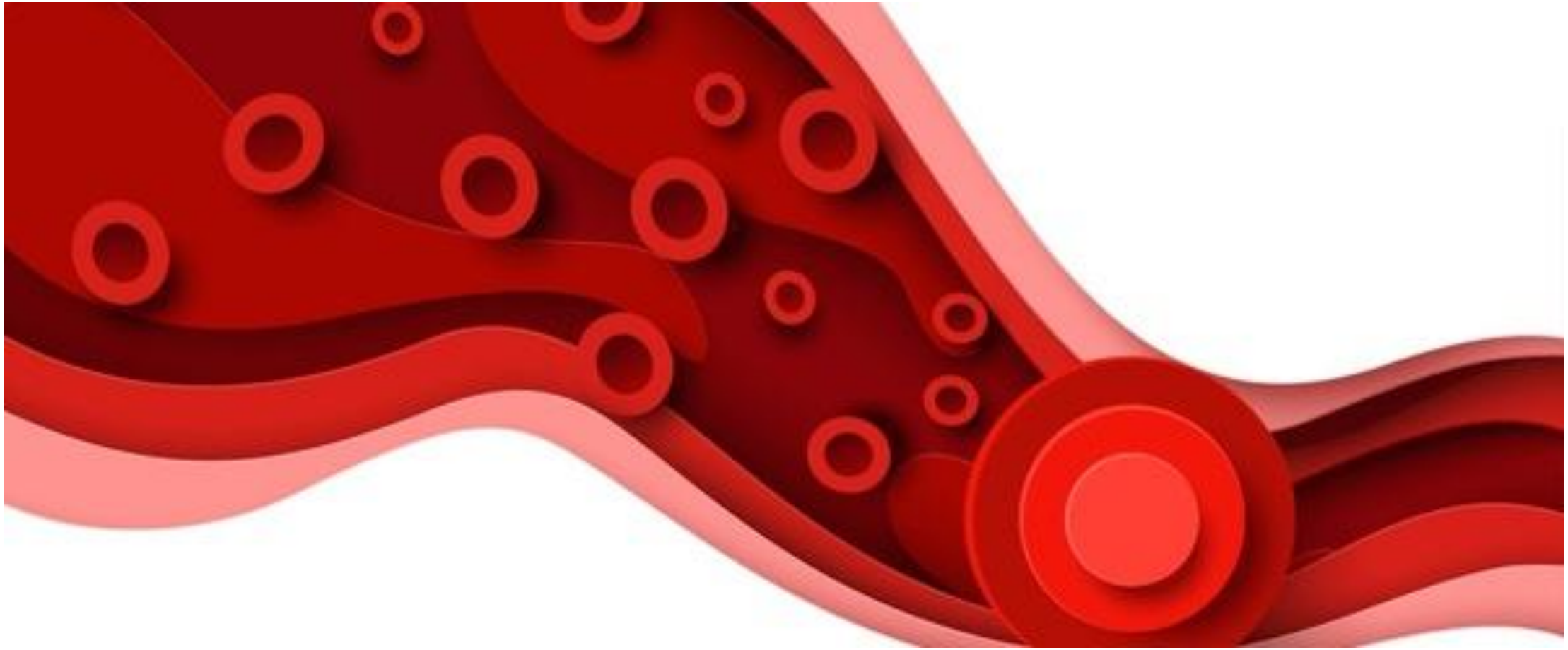


Advanced age

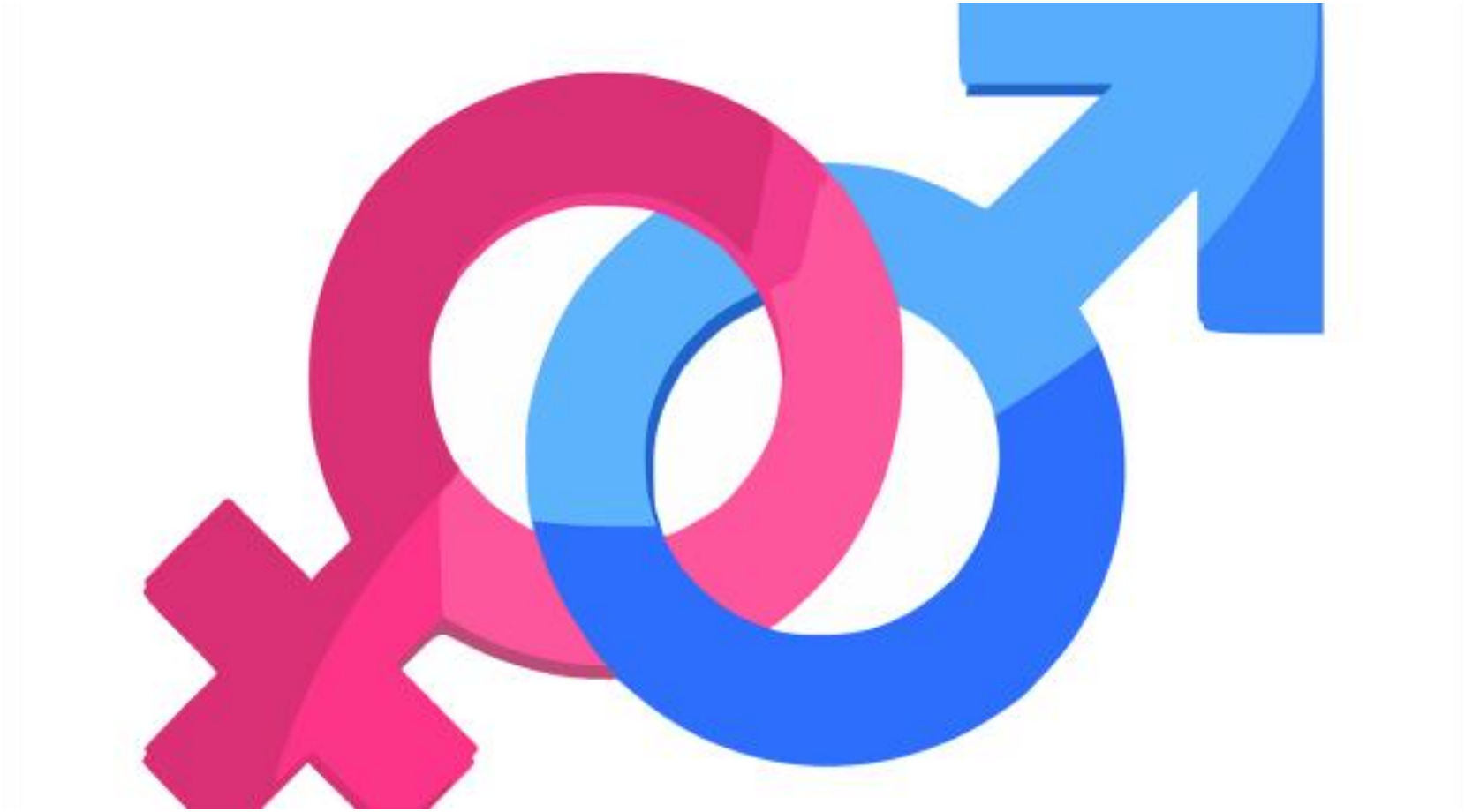
Trauma or injury



History of deep vein thrombosis (DVT)

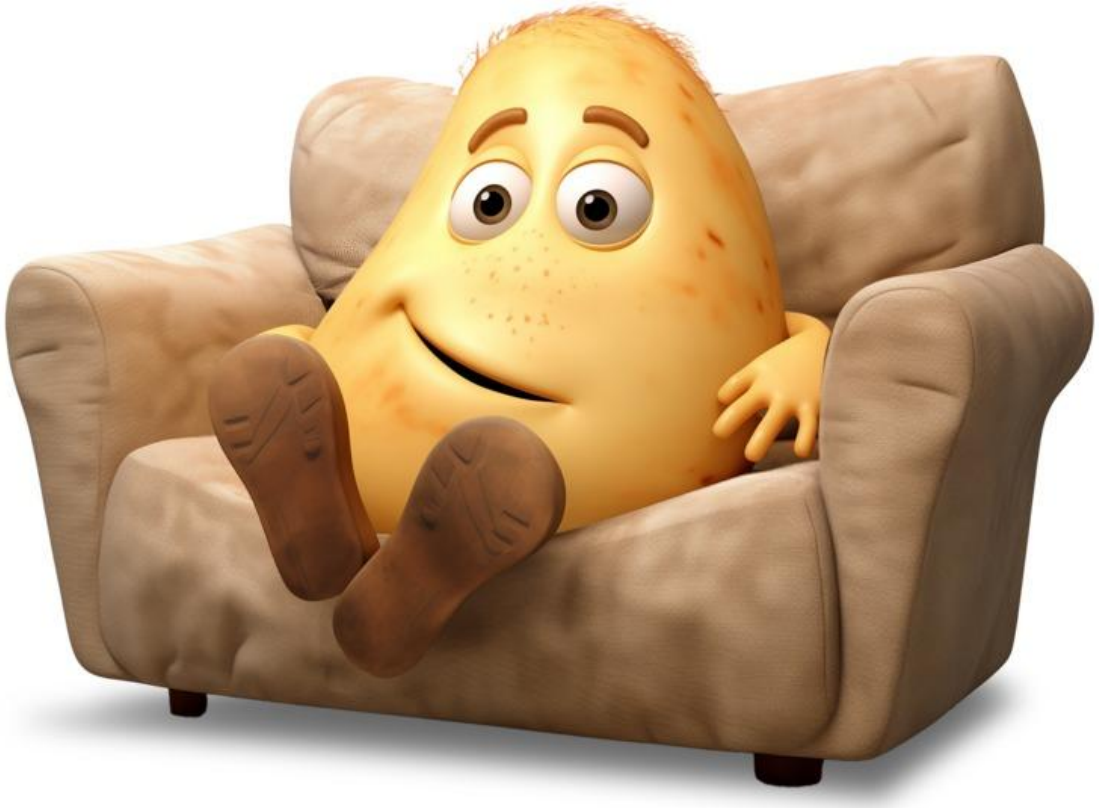


Biological sex



Obesity and poor diet

Physical inactivity



Prolonged standing

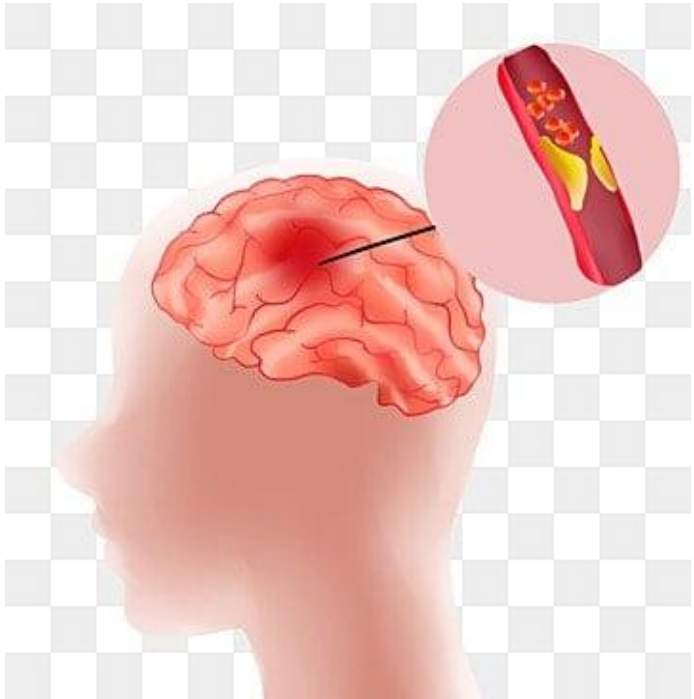
Smoking

Diabetes

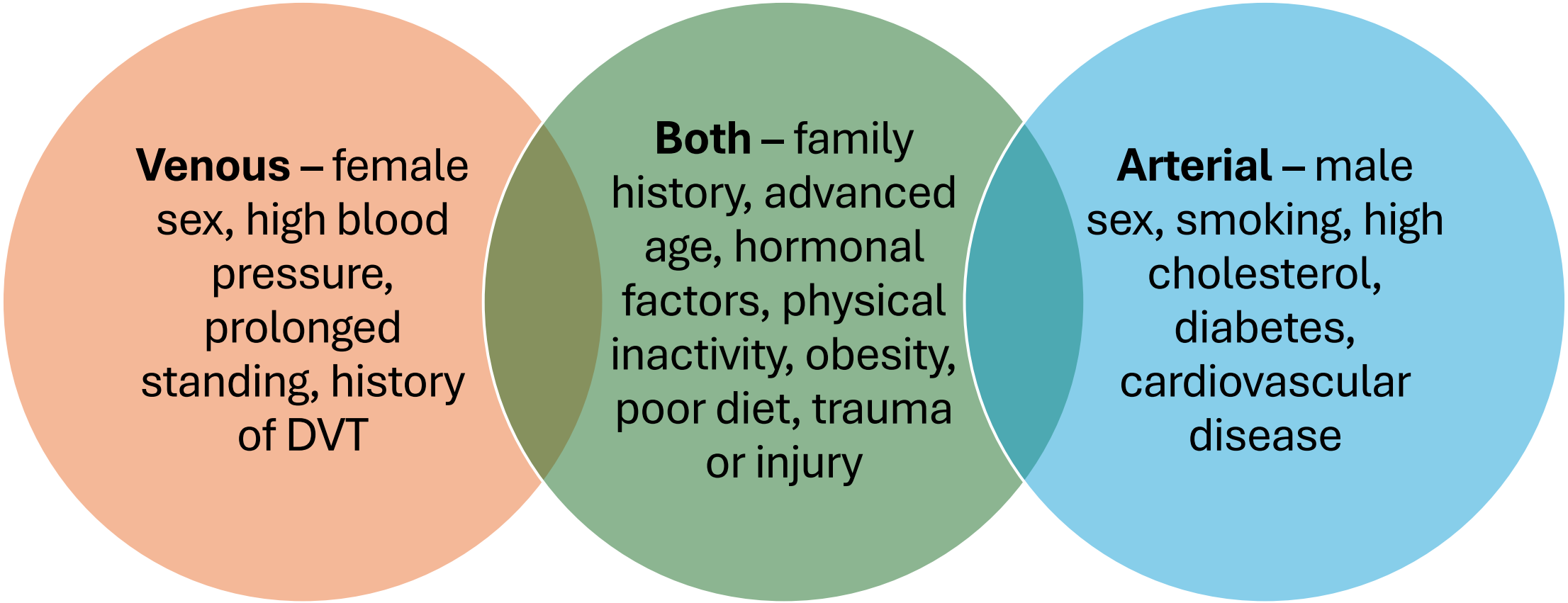
High blood pressure

High cholesterol

Cardiovascular disease



Summary of risk factors for venous and arterial disease



What can we do to help modify these risk factors?

Modifiable risk factors

- Obesity and poor diet
- Physical inactivity
- Current smoker
- Hormonal factors
- Long period of standing
- Diabetes
- High blood pressure
- High cholesterol
- Cardiovascular disease

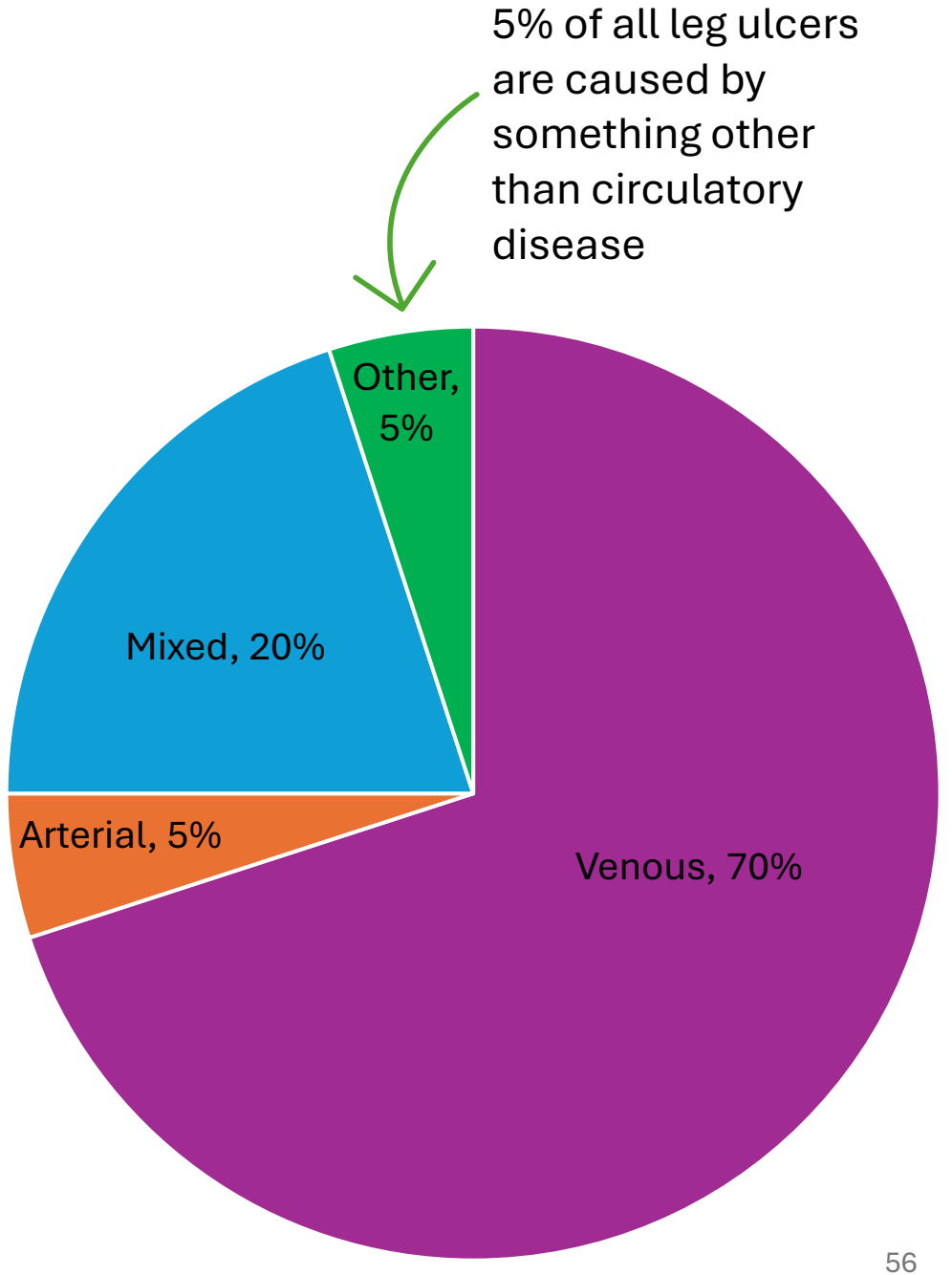
Non-modifiable risk factors

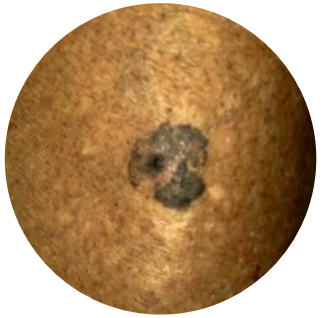
- Ageing
- Family history
- Biological sex
- Previous trauma secondary to injury or surgery
- Ex-smoker
- Previous DVT

Other things to consider…

- Studies show an association between chronic kidney disease and pad
- African Americans and Hispanic people have a higher risk of developing PAD
- High levels of stress are also a contributing factor to PAD
- Intravenous (IV) drug use damages the veins and leading to increased risk of CVI.

Other types of leg ulcers and skin conditions





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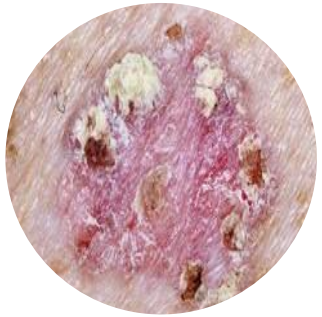
B

C

D



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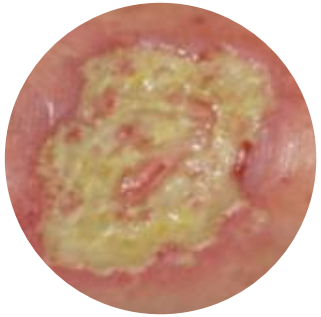

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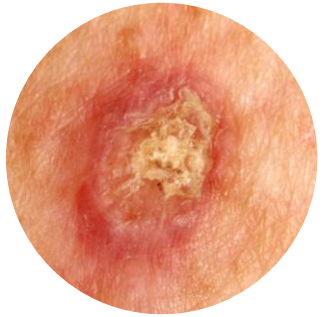

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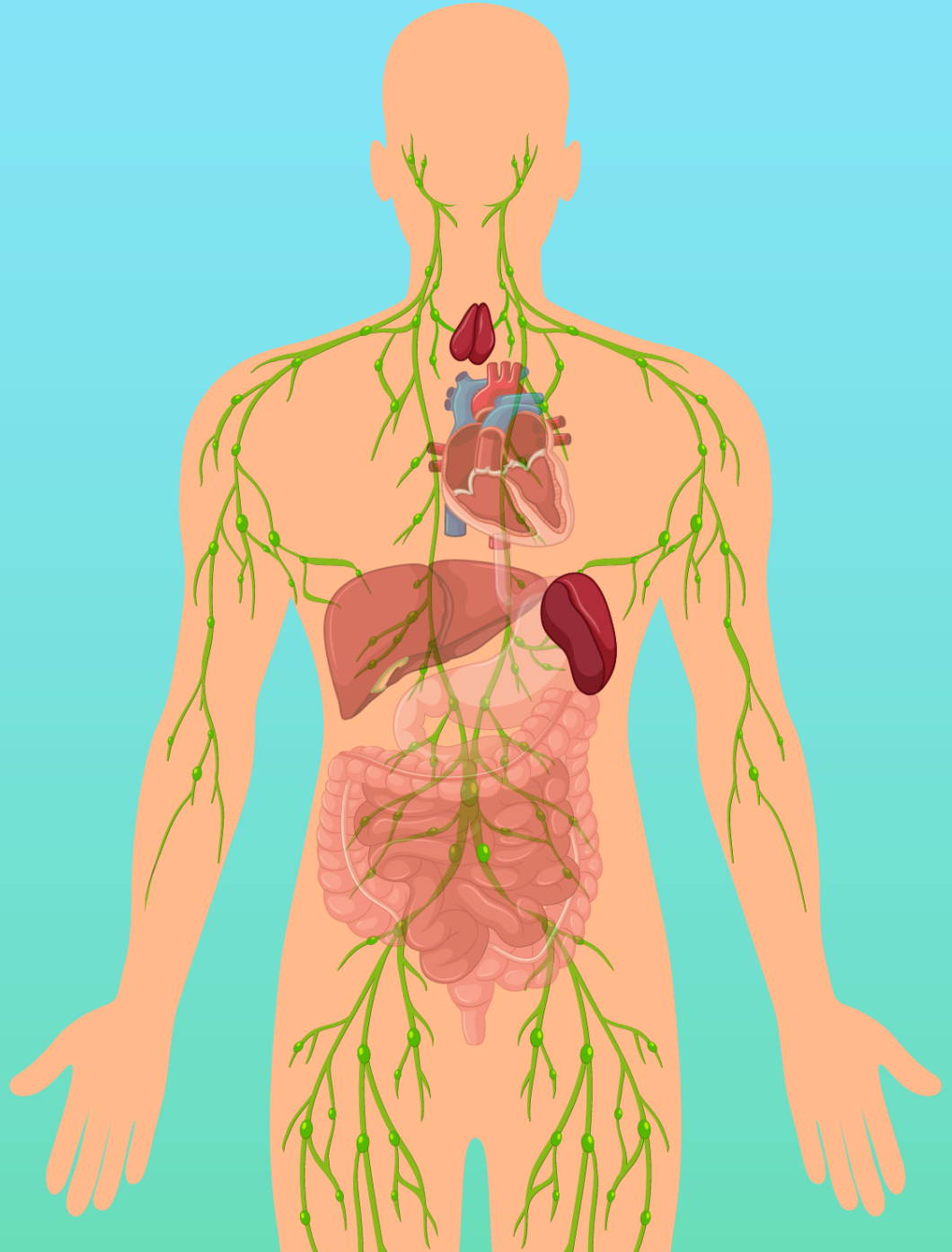
Which of these looks abnormal and why?

Don’t panic!

- You do not need to know all these different type of abnormal ulcers!
- You just need to be able to identify when something isn’t following a normal healing trajectory and know how to escalate it!

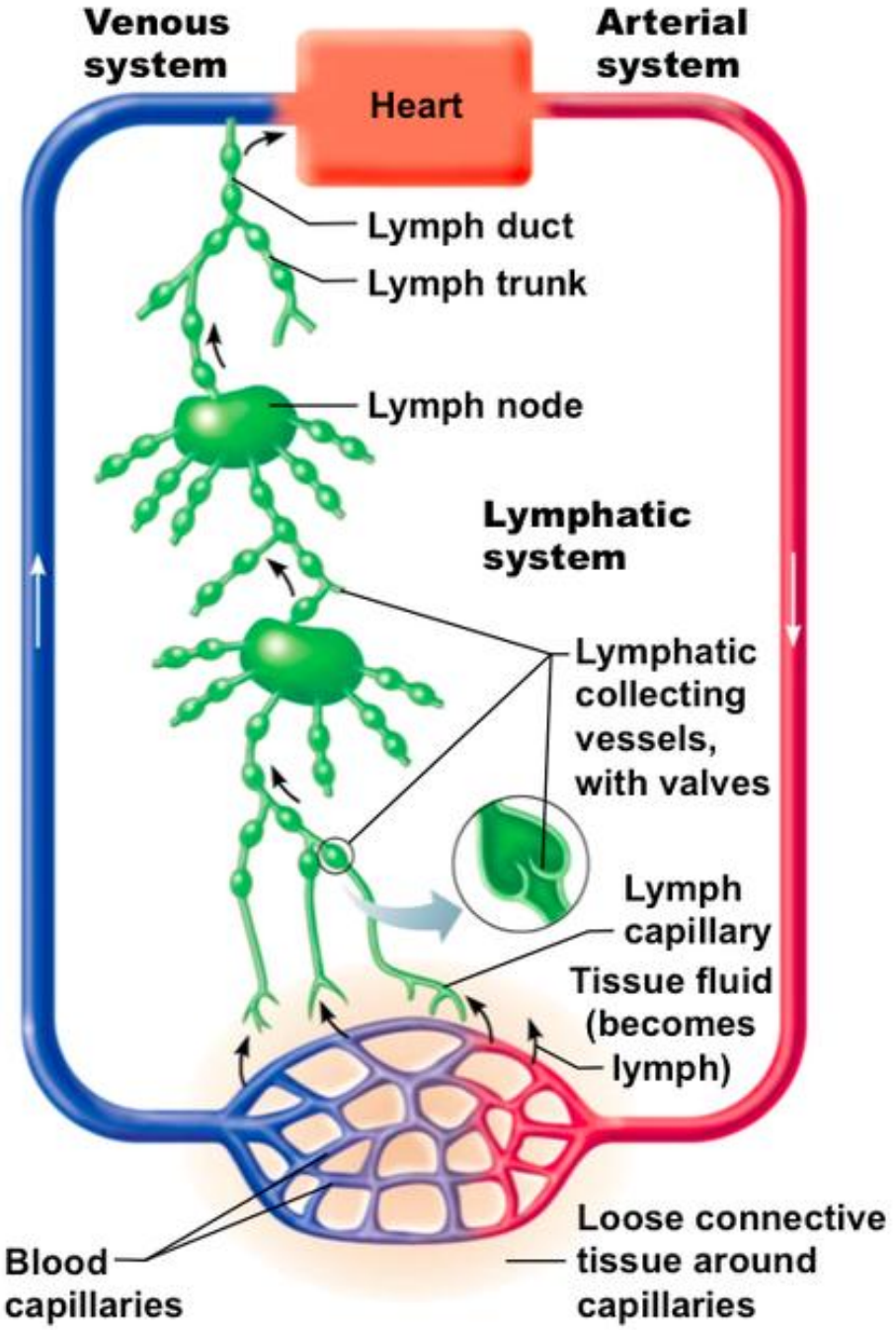
What about the...

LYMPHATIC SYSTEM



What is the lymphatic system?

- The lymphatic system is a network of vessels and glands throughout the body that helps fight infection and remove excess fluid.
- It is responsible for collecting all fluid in the tissues and returning it to the circulatory system.

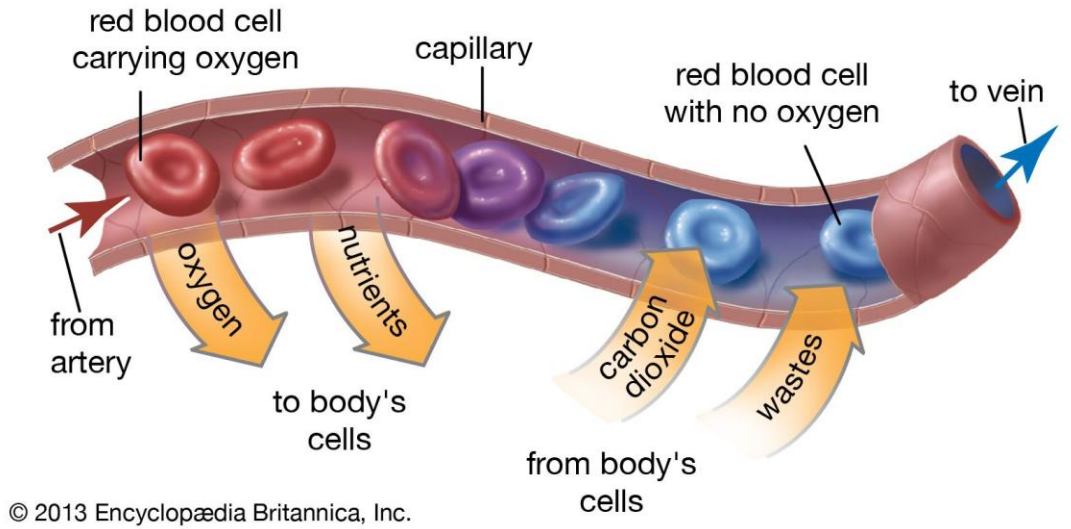


How does the lymphatic system work?

- 20 litres of plasma (liquid part of the blood) flow out of tiny pores in the thin walls of the capillaries.
- Imagine water seeping out of a sponge… where does this liquid go?

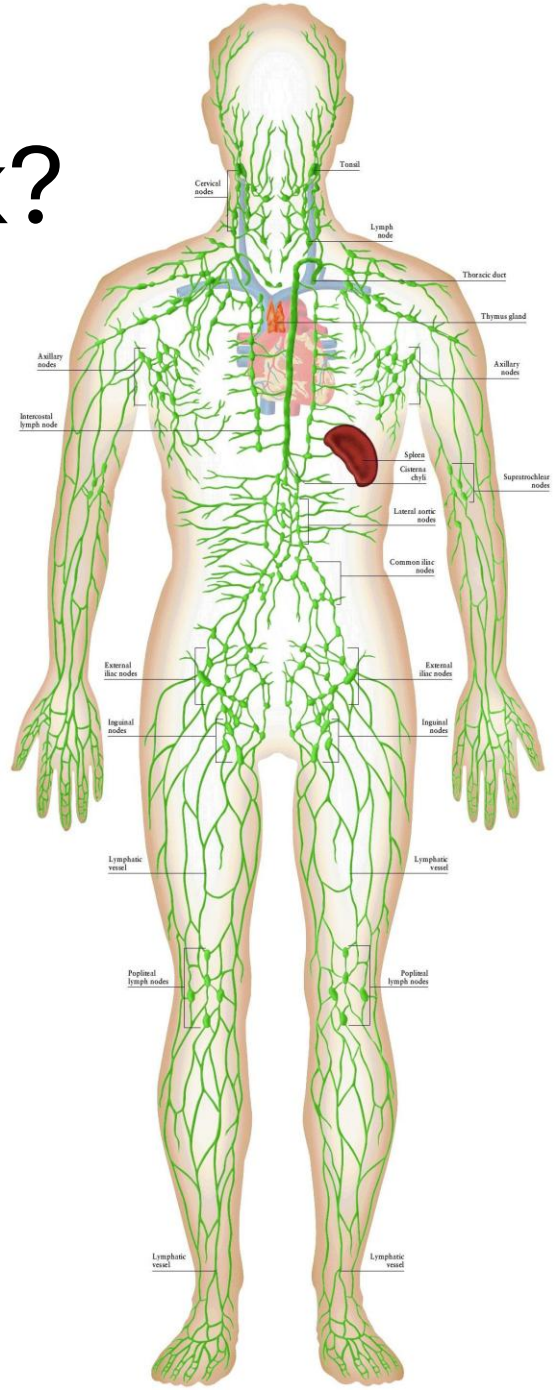
How does the lymphatic system work?

- It delivers oxygen and nutrients to the tissues surrounding each capillary.
- The tissues hungrily soak up all the nutrients while leaving behind waste.
- The plasma doesn't mind cleaning up the mess — it picks up the waste and then returns to the bloodstream the same way it came, by flowing back through the pores in the capillary walls.



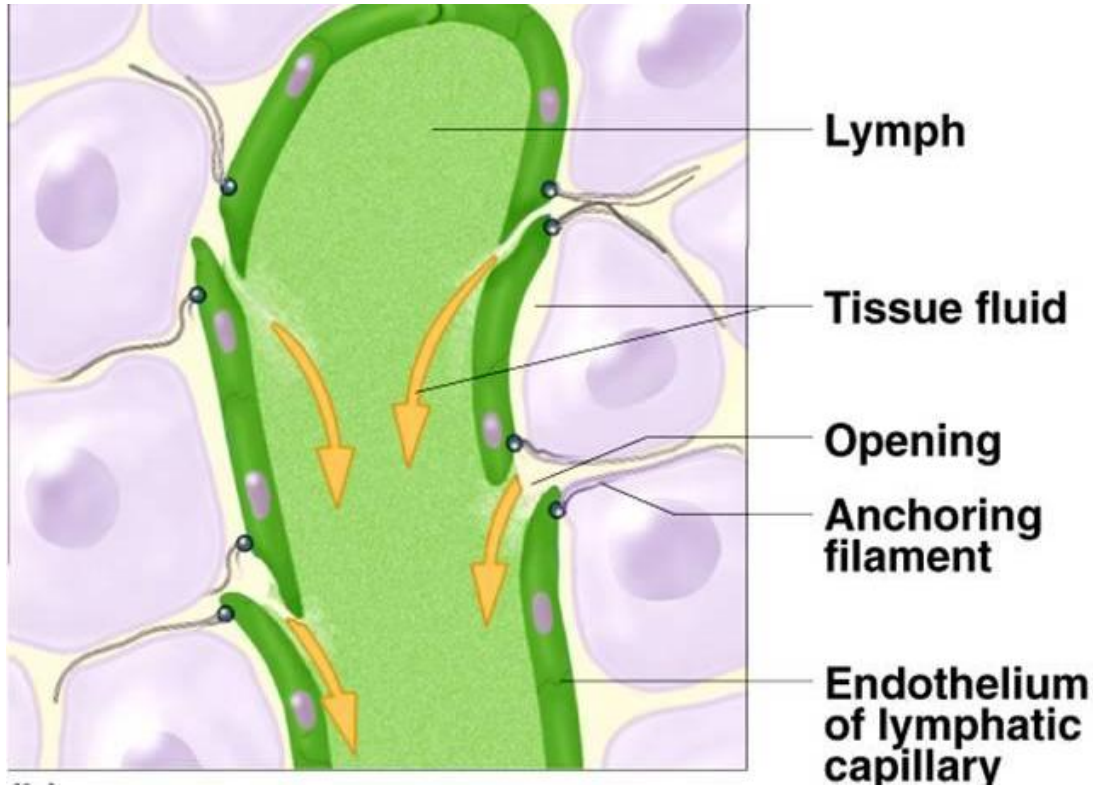
How does the lymphatic system work?

- Each day, about 17 litres of plasma return to your bloodstream in this way.
- Since 20 litres initially flowed out of the capillary walls, 3 litres are still roaming around in the body's tissues.
- This is where the lymphatic system steps in…



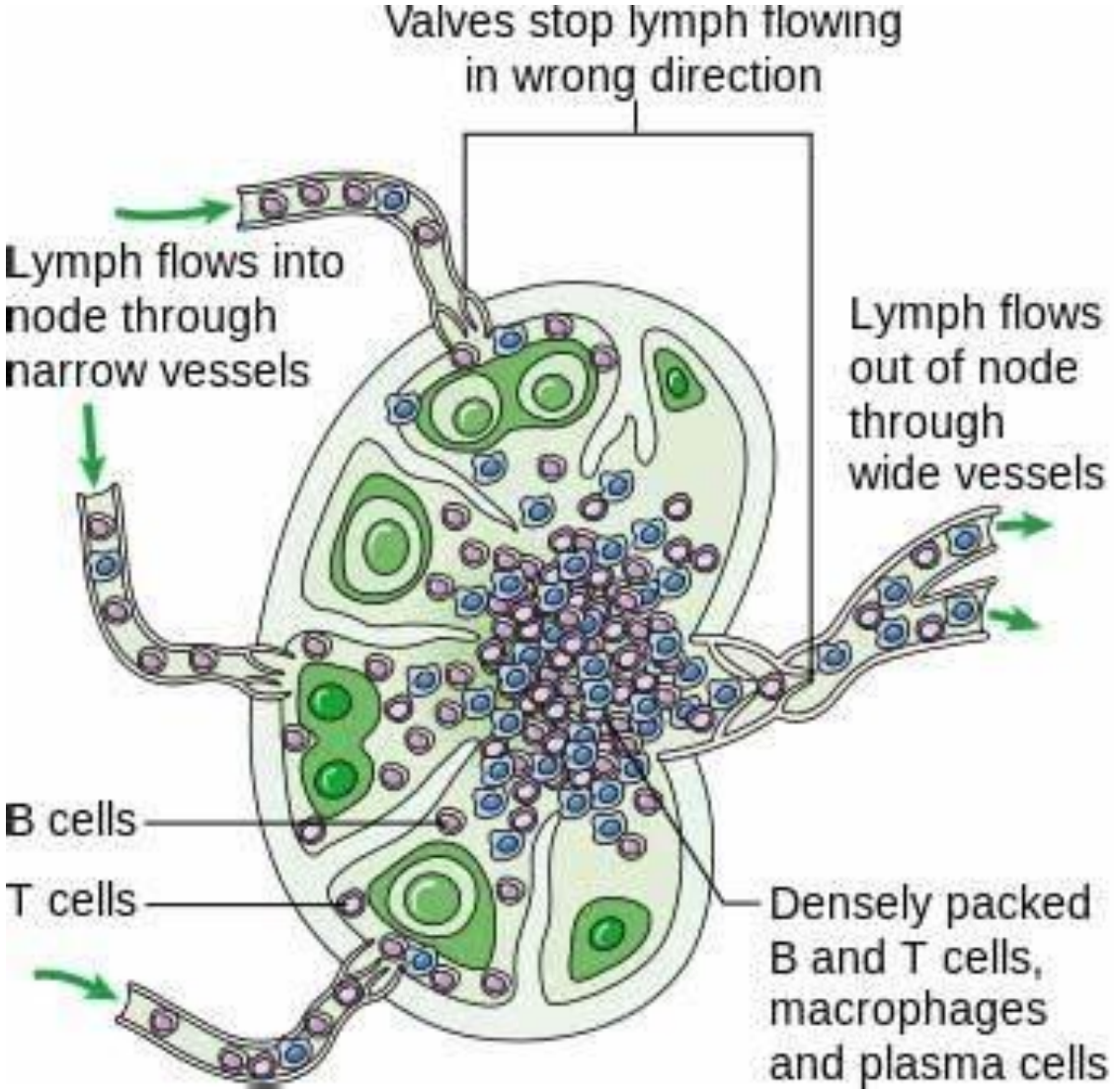
What are lymphatic vessels and what do they do?

- Thin-walled tubes throughout the body collect excess fluid (lymph) from tissues and return it to the bloodstream.
- Anchoring filaments connect the lymphatic vessel to surrounding tissues.
- Movement of these tissues pull on the anchoring filaments, helping fluid move into the lymphatic vessels through openings.
- These vessels contain one-way valves that keep lymph moving the right way.
- Lymphatic vessels then pass lymph through lymph nodes of filtration.



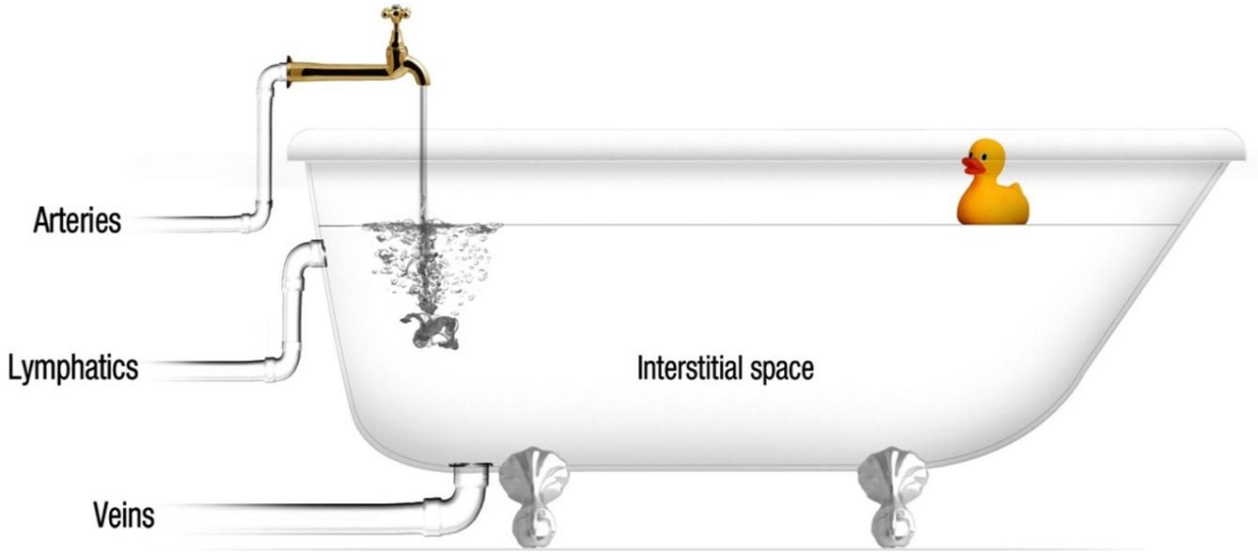
What are lymph nodes and how do they work?

- Bean-shape glands that monitors and filters/cleanse lymph as it filters through them.
- Clear out damaged cells and cancerous cells.
- Store lymphocytes and other immune system cells that attach and destroy harmful substances like bacteria.
- There are about 600 lymph nodes scattered throughout the body.
- You may be able to feel some lymph nodes through the skin in areas like the armpits, groin or neck.



What can go wrong?

- Oedema is an umbrella term used to describe swelling of all causes and occurs when fluid accumulates in the tissues.
- When the lymphatic system cannot absorb the production of fluid and waste products in the tissues fast enough; more is being produced than can be dealt with via the lymphatic system. The result is an abnormal collection of fluid in the tissue spaces.

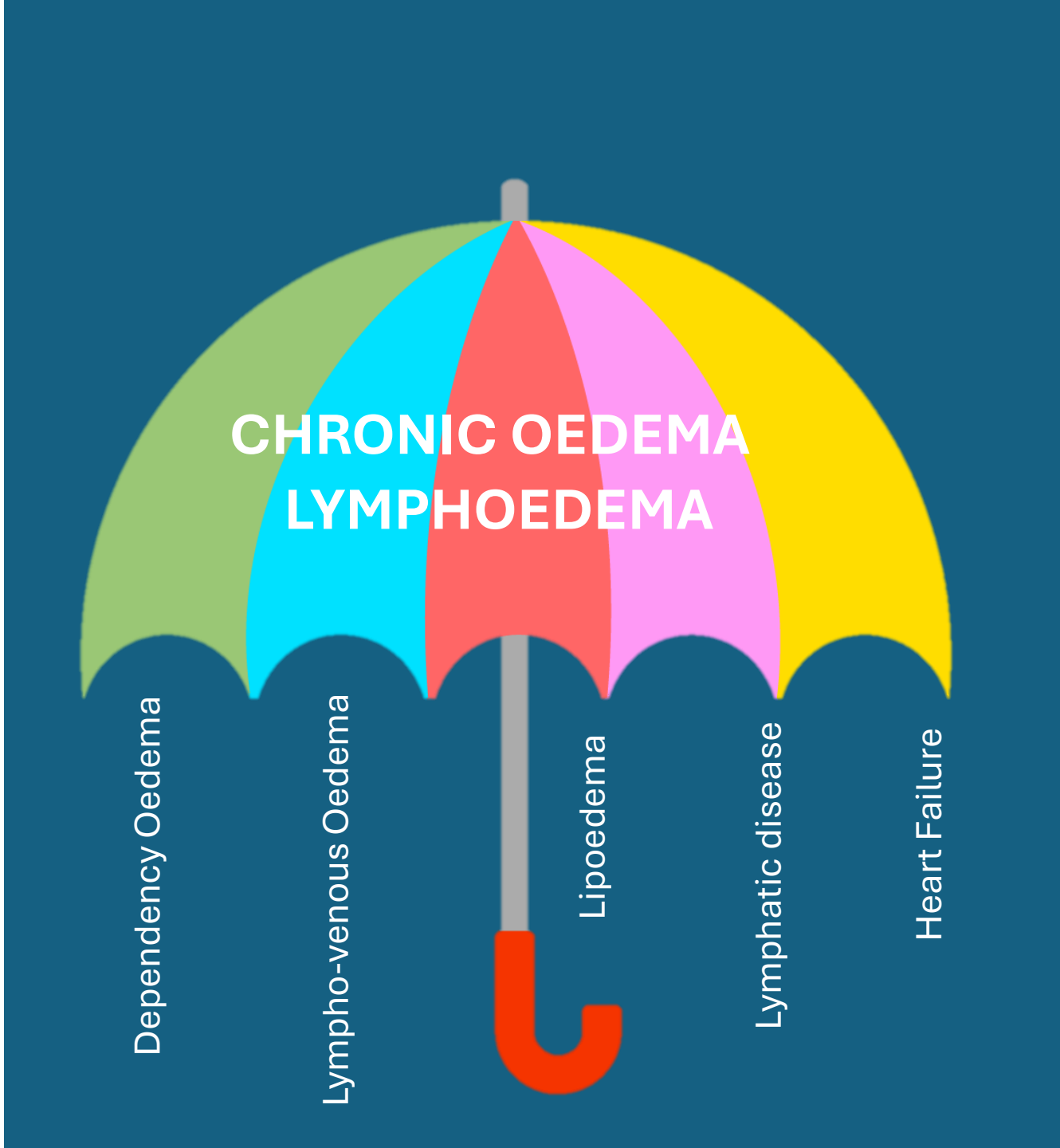


This results in… acute oedema

- Present for < 3 months
- Soft, pliable, pitting
- Temporary swelling
- Reduces with elevation and exercise
- Associated with sprains (inflammatory response leads to increase vessel permeability)
- Can be caused by venous reflux, physical inactivity and long periods of standing
- May become chronic without treatment…

Chronic oedema / Lymphoedema

- Used to describe a group of conditions
- Present for more than 3 months
- Not resolved by elevation or diuretics
- Used interchangeably with the term ‘Lymphoedema’ - in every case of chronic oedema there will be some impairment of lymphatic drainage.



1. Lymphovenous oedema

- Occurs when there is a combination of lymphatic and venous dysfunction.
- Veins cannot effectively return blood to the heart, leading to increased pressure (venous hypertension) and fluid leakage into surrounding tissues
- Causes include: DVT, severe varicose veins, phlebitis, trauma, CVI, obesity, immobility.

2. Dependency oedema

- Swelling that occurs in the lower parts of the body.
- Arises when gravity causes fluid to pool in these area.
- Fluid naturally accumulates in the lower extremities due to gravitational pull, particularly when standing or sitting for long periods.
- Normally seen in individuals who are immobile or have limited mobility.
- Extended periods of immobility, such as sitting in a wheelchair, can exacerbate fluid accumulation.

3. Lymphatic disease/Lymphoedema

- Chronic swelling of the limbs due to a failure of the lymph drainage system to remove interstitial fluid.
- Primary Lymphoedema – congenital deficiencies (born with a defect to lymphatics)
- Secondary Lymphoedema (as a result of damage to the lymphatics). For example:
  - Radiotherapy
  - Surgery – orthopedic, removal of lymph nodes
  - Extensive burns
  - Tumor blockage
  - Infection – Filariasis, cellulitis, insect bites
  - Inflammatory conditions E.g. rheumatoid arthritis, dermatitis, eczema
  - Skin grafts

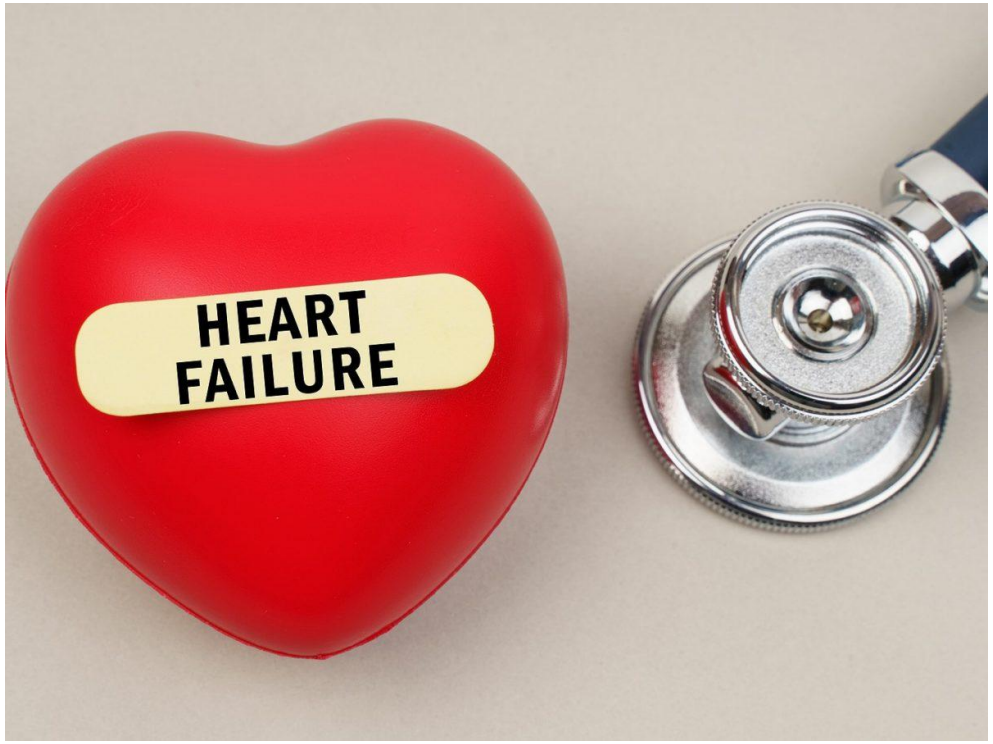
4. Lipoedema

Lipoedema UK
Charity No 1181312

- Chronic condition characterised by an abormal buildup of fat primarily in the lower body, particularly in both legs.
- Predominantly affects women, develops around hormonal changes
- Can cause pain, tenderness and bruising to skin.
- Unlike regular fat, lipoedema gat is resistant to diet and exercise.
- Typical ‘bracelet effect’ with no/minimal oedema in feet and hands
- Lipo-lymphoedema may develop due to long term impact on lymphatics
- Often lead to further compilations if left untreated.

5. Heart Failure

- The location and severity of the swelling can be an indicator of how severe the heart failure is.
- Some types of oedema, such as pulmonary oedema, are a medical emergency. This causes fluid to accumulate around the lungs.
- However, the most typical type of oedema people with heart failure experience affects the lower legs and feet.
- The heart muscles cannot pump blood as effectively as they should with heart failure.
- The heart lacks the necessary force to propel the blood through the arteries and back through the veins, leading to increased pressure in the blood vessels.
- This increase pressure forces fluid out of the blood vessels and into the surrounding tissues, resulting in oedema.



All types of chronic oedema can result in…

- Protein-rich oedema causing non-pitting tissue which becomes firm and fibrotic
- Skin changes – some of these are reversible but some are no!
- Increased risk of associated infection.
- Can be managed or maintained but not cured!

What are the statistics?

- A study by Moffat et al (2019) reported a prevalence of 3.93 per 1000.
- However, data from referrals to the National Lymphoedema service in Wales reveals a prevalence of 6 per 1000.
- This data suggests that lymphoedema affects between 200,000 and 420,000 people of all ages in the UK.
- However, Lymphoedema is not recognised and diagnosed by many, therefore these figures may not be an accurate representation of the problem…
- A study by Gaskin (2017) found that the Leicester GP database showed 10% of patients requiring leg care also had oedema.
- But a local DN audit revealed that 59% of patients have oedema!

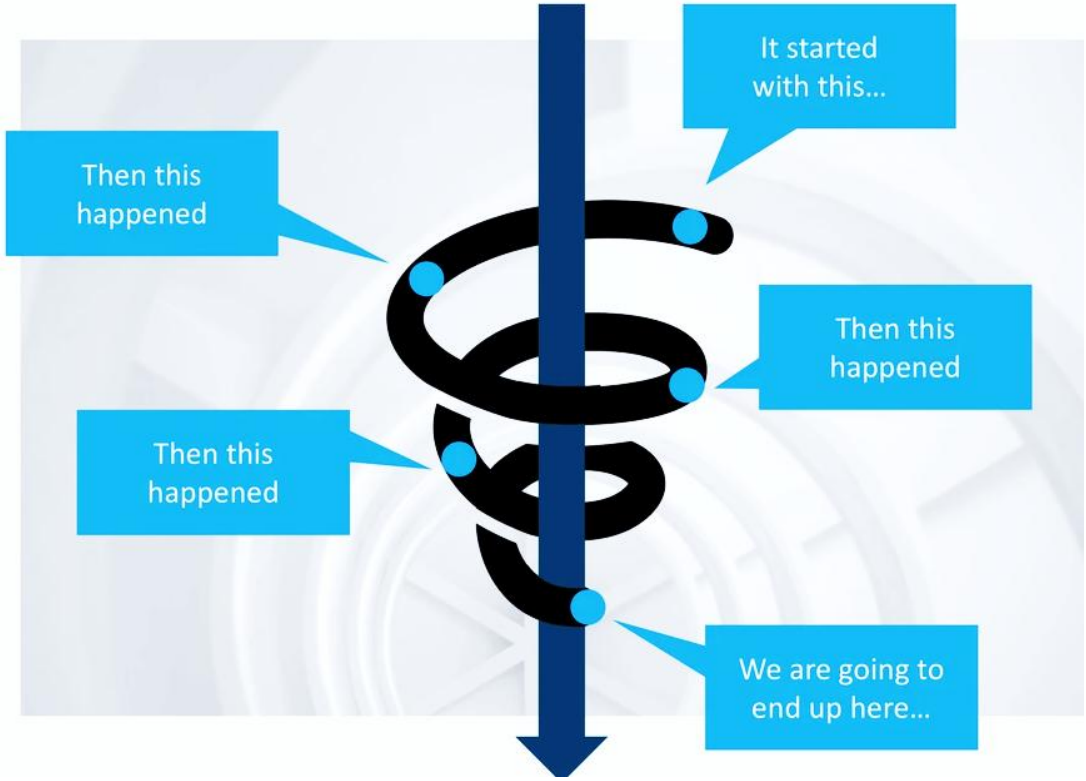
What are the oedema predictions for the future?

People with chronic oedema in Oxfordshire	2014	2030 (estimated using AI)
Under 65	2,026	~2,586
Over 65	1,186	~1,660
Over 85	457	~791
Total	3,699	~5,037

- Growing ageing population with more complex comorbidities – heart failure, reduced mobility, cancer survivors.
- Increase in obesity.
- The evidence is clear! There is going to be a significant increase in the incidence of chronic oedema in the population of Oxfordshire.

Why is this important? The downward spiral…

- If left untreated chronic venous and lymphovenous disease will progress along a continuum of increased swelling and chronic inflammatory skin changes.
- It is essential that early venous and lymphovenous disease is recognised, and appropriate treatment is initiated, to slow and control progression.



Let’s step into someone else’s shoes for a moment…

Imagine these are your legs.

- How do they feel?
- How do they look?
- How easy is it to move around with them?
- How easy is it to clean them?
- Are they painful?

Take a minute to imagine how they would impact on:

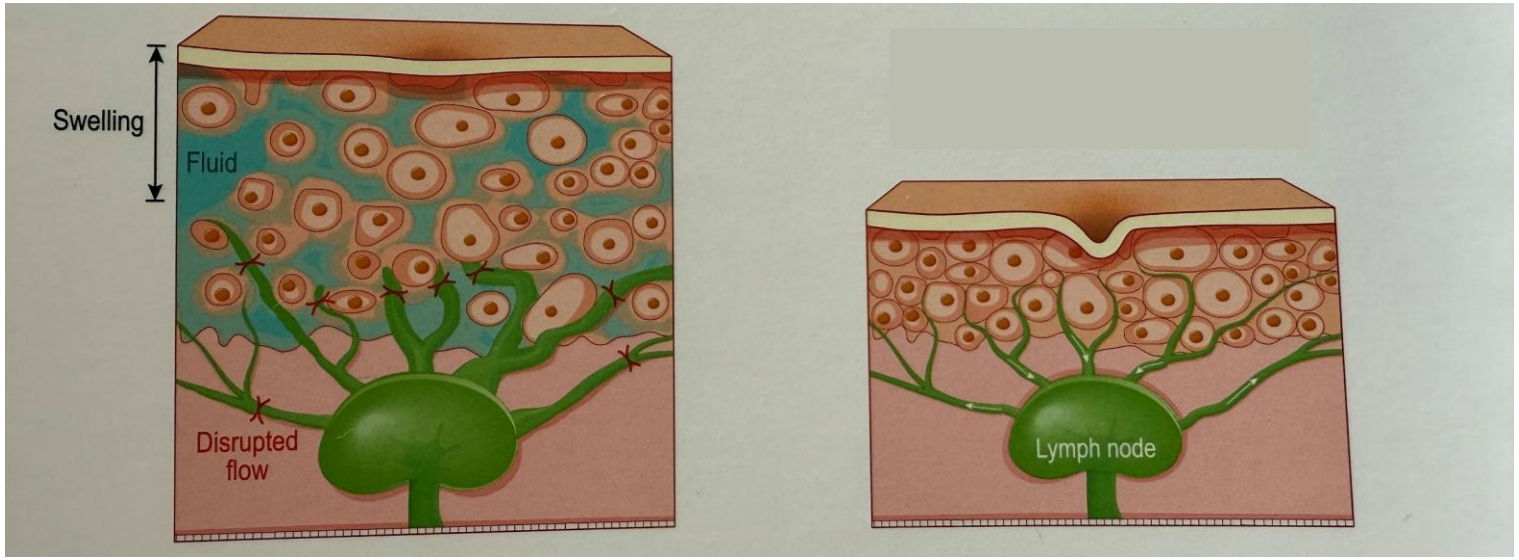
- Your life at home
- Your relationships – partner, children
- Your job
- Your recreational activities
- How you feel about yourself?

A VOLUNTEER PLEASE!

What can we recommend for patients who have oedema?

How can compression help?

- Primary treatment method to reduce oedema and improve lymphatic drainage
- When the lymphatic system is compromised, pressure within the system causes the vessels to dilate and results in backflow of lymph into the tissues.
- The external pressure created when compression is applied, moves fluid from the tissues into the initial lymphatics, increasing lymph transport.
- Where there is lymphatic failure, compression will help to push fluid through the tissues towards the lymphatic system to ensure efficient drainage.



Unhealthy lymphatics

Healthy/compressed lymphatics

Other important things to consider…

Exercise

Leg elevation

Dietary changes

Diuretics

Skin care

Patient information leaflets

LYMPHOEDEMA

What are the aims of this leaflet?

This leaflet has been written to help you understand more about Lymphoedema. It tells you what it is, what causes it, what can be done about it, and where you can find out more about it.

What is lymphoedema?

Lymphoedema is a long-term swelling that develops because of a fault within the lymphatic drainage system. This may be as a result of the lymphatic system not developing properly, or because it has been damaged.

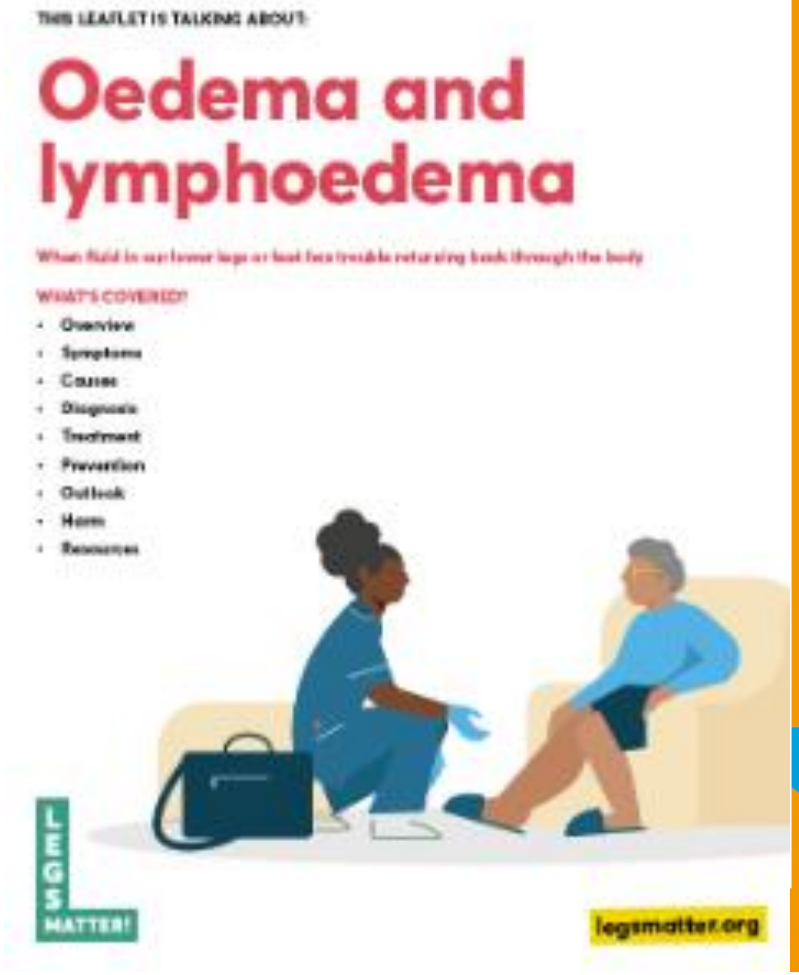
The lymphatic system is a network of narrow tubes that drain fluid from all areas of the body. It forms part of the circulatory and immune systems. It has several functions, including 1) maintenance of the correct levels of fluid by returning lymphatic fluid from the tissue spaces to the blood, 2) maintaining immune function which helps the body fight infections. The lymphatic system also helps stopping the spread of cancer and controlling diseases caused by inflammation.

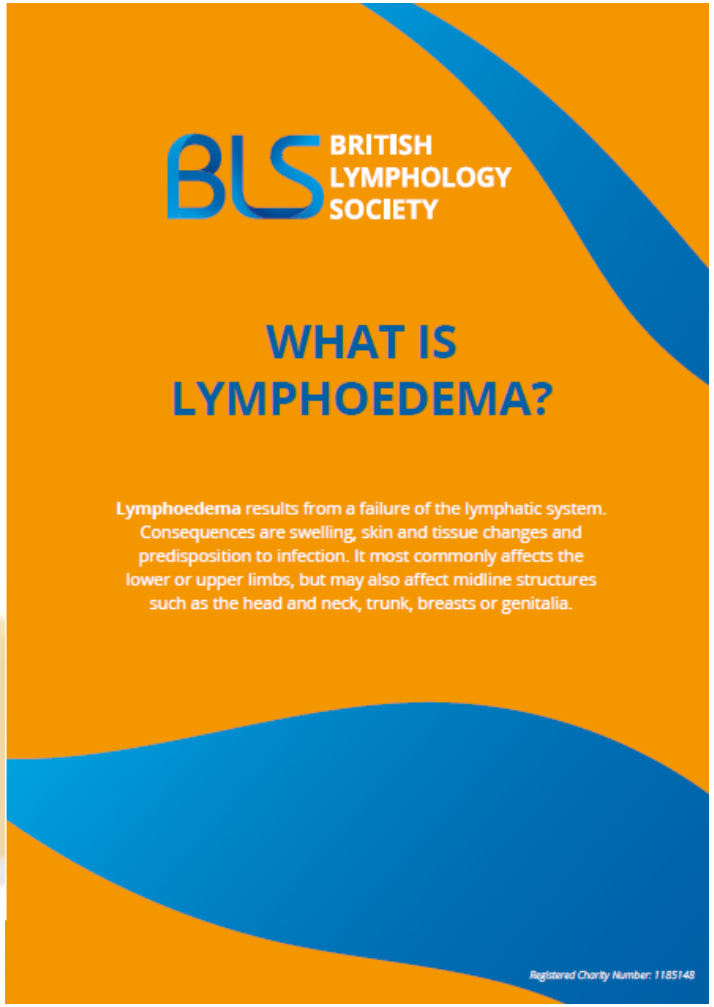
When the lymphatic system fails, for whatever reason, there will be complications with fluid balance which results in swelling, and also with increased risk of skin infections. Lymphoedema usually affects the limbs but can affect any part of the body, depending on the underlying cause. Although thought to be relatively uncommon, recent research suggests about half a million people in the UK are living with lymphoedema.

What causes lymphoedema?

Lymphoedema can be either "primary" or "secondary".

Primary lymphoedema is a rare condition that is often inherited through the genes. The lymphatic system fails to develop normally, causing swelling of





BREAK TIME!