

Vascular and Microvascular Surgery

Surgical Techniques and Considerations



Lesson Objectives:

1. Identify key anatomical features of the peripheral vascular system
2. Discuss diagnostic procedures of the vascular system
3. Discuss specific elements of case planning in vascular surgery
4. Describe surgical techniques used in vascular and microvascular surgery
5. Discuss vascular pathology
6. List and describe common vascular procedures

Introduction to Peripheral Vascular Surgery

- **Introduction to Peripheral Vascular Surgery:**
 - Focuses on arteries, veins, and lymphatic vessels outside the heart.
 - Treats diseases, injuries, and congenital malformations.
- **Evolution of Vascular Procedures:**
 - Transition from open surgeries to endoscopic and endovascular techniques.
 - Endovascular procedures involve instruments inserted into blood vessels.

Setting, Technology and Techniques

- **Setting and Technology:**

- Procedures performed in interventional radiology clinics or hybrid operating rooms.
- Access to advanced imaging technology for precision and emergencies.

- **Common Techniques:**

- Overview of technology and procedural techniques in vascular surgery.
- Emphasis on minimally invasive approaches and endovascular interventions.

Pathology of Venous System

- Venous blood returns to the heart aided by skeletal muscle contractions.
- Intraluminal valves prevent blood from returning by gravity, but incompetency or inactivity can cause stasis.
- Primary varicose veins affect superficial saphenous veins, while secondary ones originate from deep saphenous veins.
- **Surgical Anatomy**
 - The peripheral vascular system consists of arteries, veins, and capillaries.
 - Arteries carry oxygenated blood away from the heart, while veins carry deoxygenated blood back to the heart.
 - Capillaries facilitate the exchange of oxygen and nutrients between blood and tissues.

The Peripheral Vascular System

Arteries

- Carry oxygenated blood from the heart to the body.
- Elastic arteries stretch during systole and recoil during diastole.
- Muscular arteries distribute blood to specific organs.
- Arterioles regulate blood flow into organs and tissues.

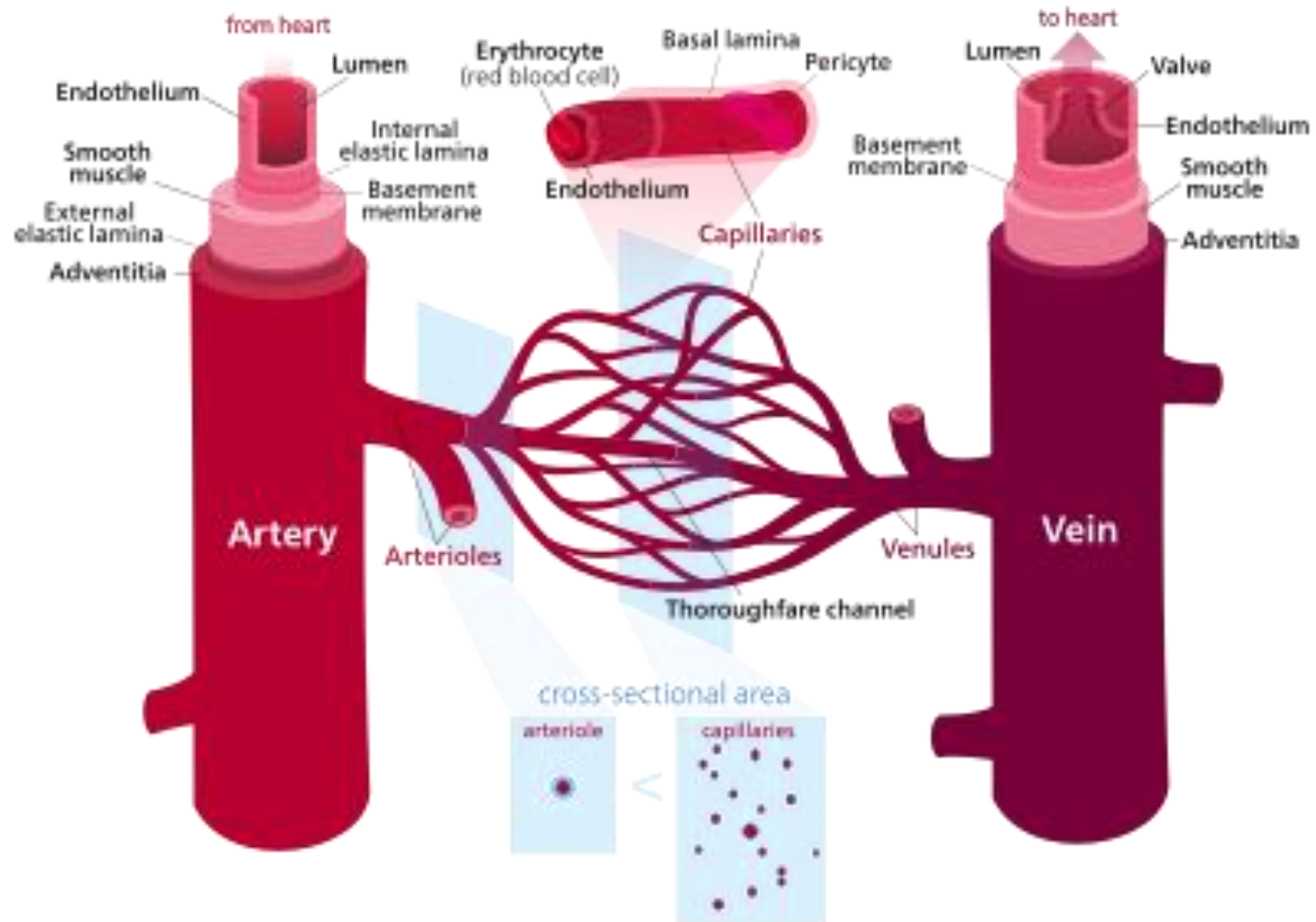
Arterioles and Capillaries

- Arterioles provide vascular resistance and regulate blood flow.
- Capillaries facilitate exchange between blood and tissues.
- Precapillary sphincters control blood flow into capillaries.

Veins

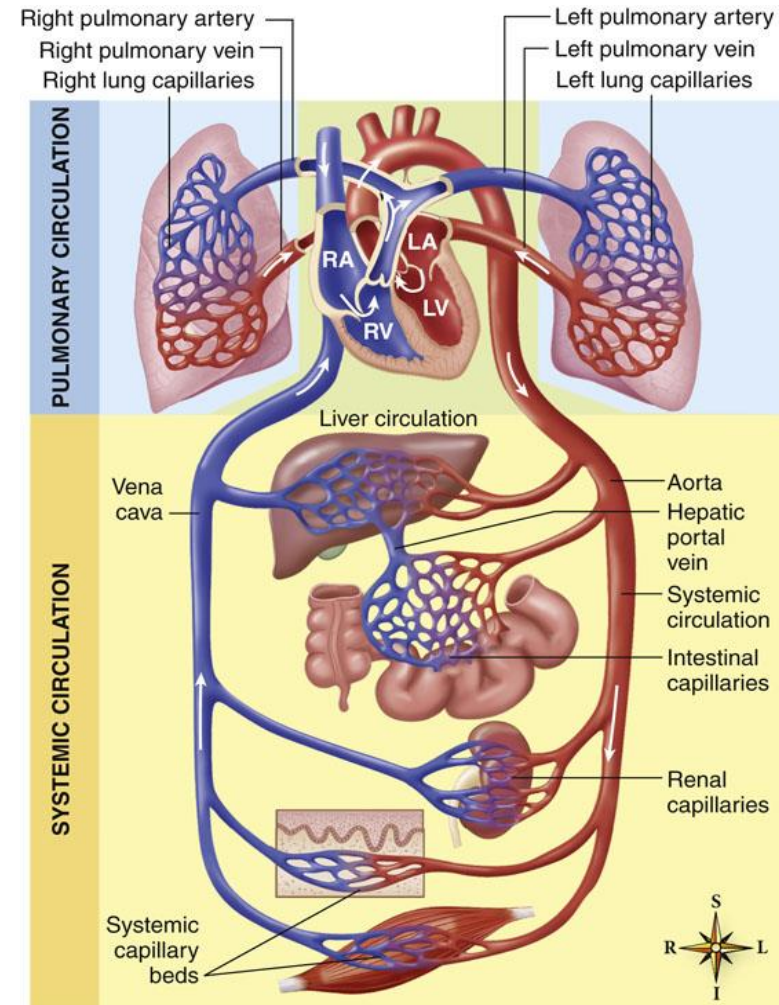
- Carry deoxygenated blood back to the heart.
- Thin-walled and expandable, functioning as blood transport and storage.
- Veins have one-way valves to prevent backflow.
- Blood is propelled towards the heart by skeletal muscle contractions and pressure changes.

Surgical Anatomy



Circulatory Pathways

- Divided into two main pathways:
- **Systemic system**
 - Carries blood to all organs and tissues of the body except the lungs and then returns it to the heart
- **Pulmonary system**
 - Moves blood to the lungs and back to the heart.



Blood Pressure

Systolic & Diastolic Pressure:

- Systolic: Higher pressure during ventricle contraction.
- Diastolic: Lower pressure during relaxation phase

Regulation:

- Influenced by autonomic nervous system chemicals.
- Hormonal regulation via renin-angiotensin-aldosterone system.

Causes of Hypotension:

- Hypovolemia, fluid shifts, shock, infection.

Causes of Hypertension:

- Cardiovascular diseases, chronic renal failure, hypermetabolic conditions.

Factors Affecting Normal BP:

- Gender, age, weight, exercise, diurnal fluctuation.

Arteries

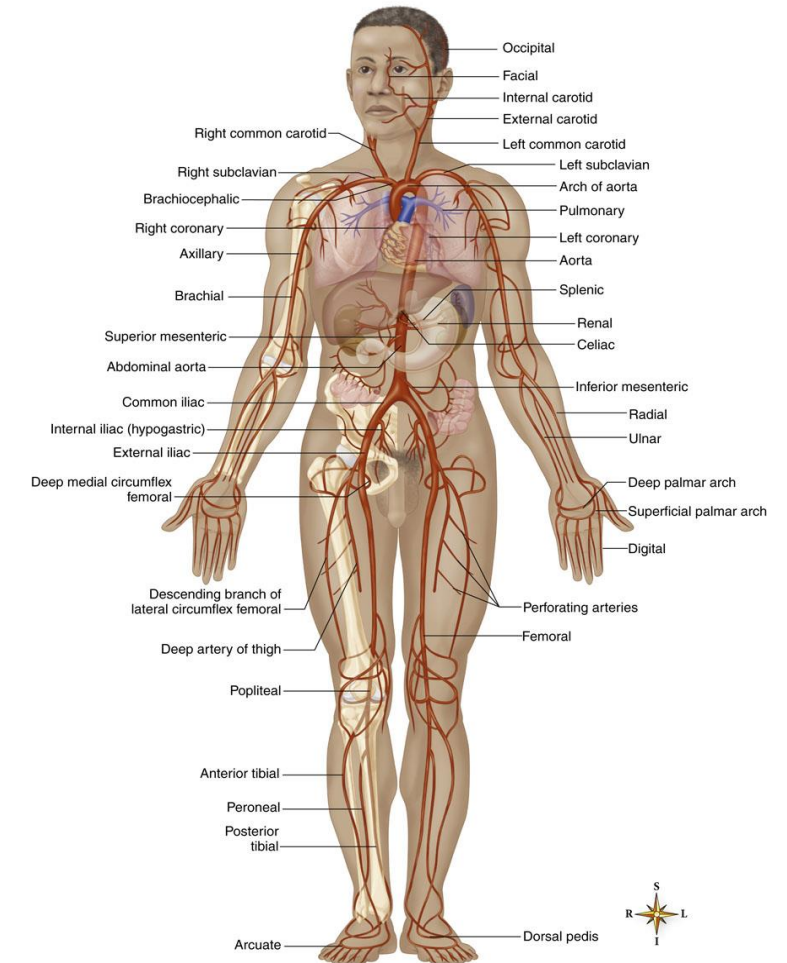
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- **Major Arteries**

- The aorta: largest artery, emerges from heart's left ventricle, terminates at pelvic bifurcation.
- Thoracic descending aorta: arises from left ventricle forming aortic arch, gives rise to major branches.

- **Head**

- Brachiocephalic artery: gives rise to right common carotid artery and vertebral artery.
- Right common carotid: branches to form external carotid artery and arteries of the brain.



Arteries

(Slide 2 of 2)

- **Upper Extremities**

- Arteries from aortic arch: brachiocephalic, left common carotid, left subclavian arteries.
- Right side: right common carotid and right subclavian arteries.

- **Abdomen**

- Descending aorta branches to celiac trunk: gastric, splenic, hepatic arteries.
- Renal arteries: branch from aorta, supply kidneys.

- **Lower Limbs**

- Iliac arteries divide into internal and external iliac arteries.
- Femoral artery communicates with popliteal artery in knee area.

Diagnostic Procedures

- **Arterial plethysmography**
 - Measures arterial pulse waveform during systole.
 - Uses pulse volume recorder with three leg cuffs inflated to 65 mm Hg.
- **Doppler scanning**
 - Amplifies blood flow sounds in vessels.
 - Generates high-frequency sound waves reflected back for analysis.
- **Arteriography/angiography**
 - Imaging of arteries or veins for diagnosis or intervention.
 - Contrast medium injected into artery under fluoroscopy.
- **Intravascular ultrasonography**
 - Maps vessel lumen using rotating flexible catheter with transducer.
 - Generates 360-degree visual image of vessel, including plaque and wall thickness.



Instrumentation, Supplies, and Equipment

☐ Supplies

☐ General supplies used for most vascular procedures

- ☐ Laparotomy packs, extremity drapes, various knife blades,
 - closed wound drainage system, 4x4's, ect....

☐ Biologic and synthetic grafts

☐ Used to bypass an occlusion or reconstruct a vessel

☐ Refer to Figures 23-3 and 23-4

Vascular Diseases

- **Atherosclerosis:**
 - Common arterial disease causing stiffening and loss of elasticity.
- **Peripheral Atherosclerosis:**
 - Deposits on artery walls lead to poor circulation, pain, and potential embolism.
- **Thrombophlebitis:**
 - Clot formation in leg veins due to venous stasis.
- **Deep Vein Thrombosis:**
 - Clots in deep leg veins.

Vascular Diseases (contd.)

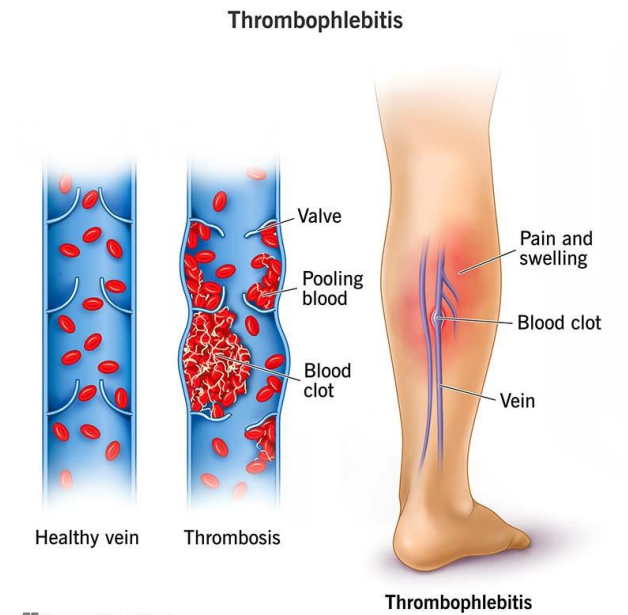
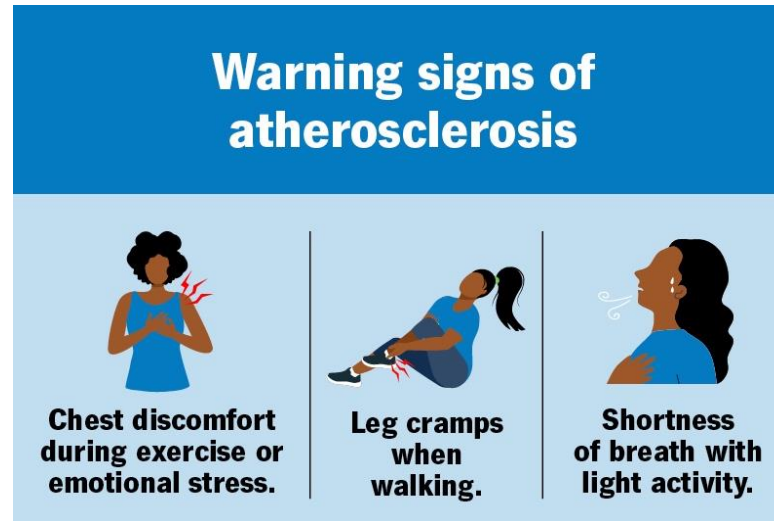
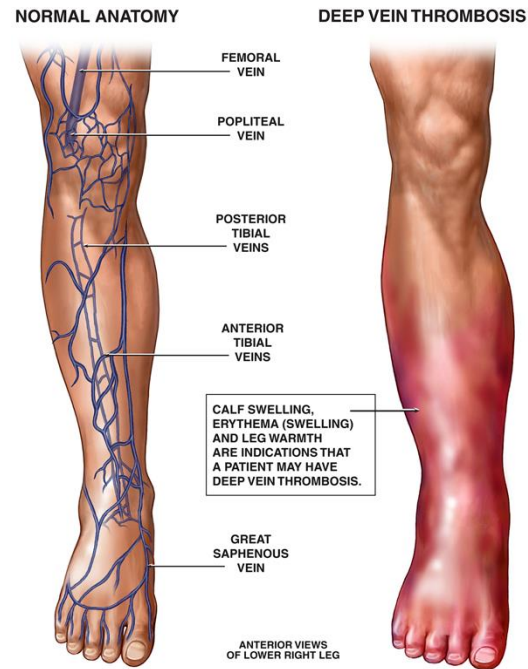
- **Aneurysms**

- Definition: Artery portion increasing by >50% of normal diameter.
- Causes: Infection, disease, or trauma; common in arterial bifurcations.
- Risks: Potential rupture leading to catastrophic outcomes.

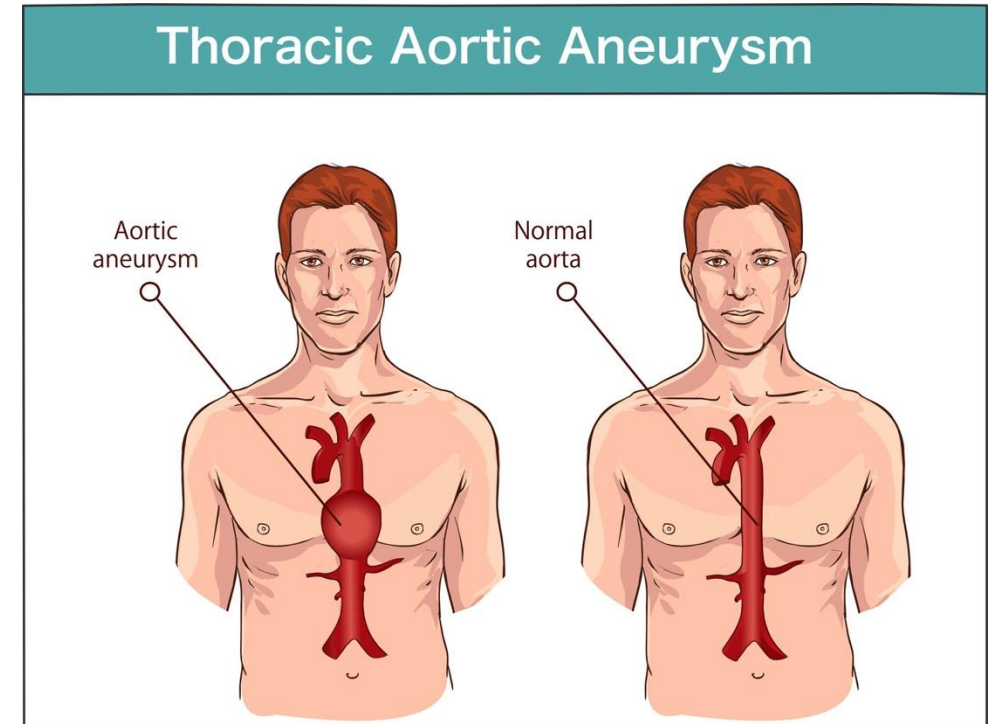
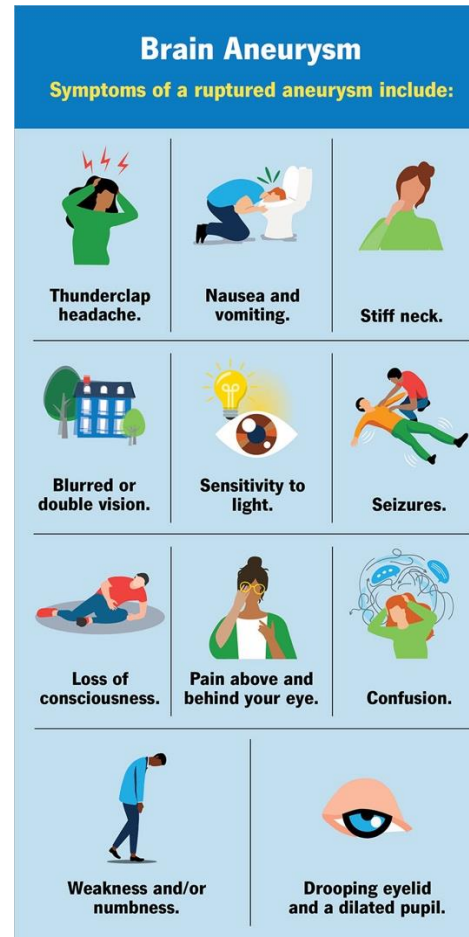
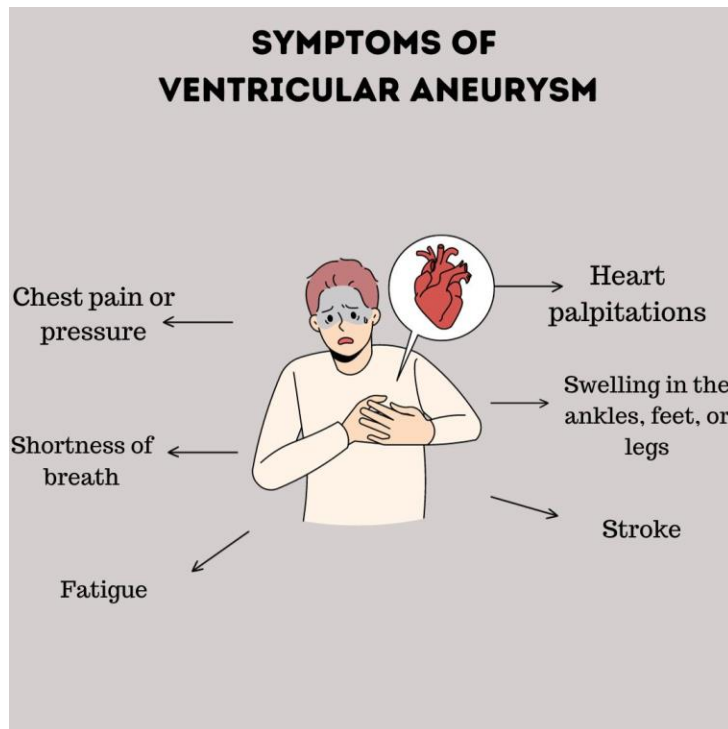
- **Intimal Hyperplasia**

- Thickening of tunica intima layer due to central line or graft placement.
- Symptoms: Similar to atherosclerosis in arteries; poor venous return, swelling, tissue breakdown in veins.

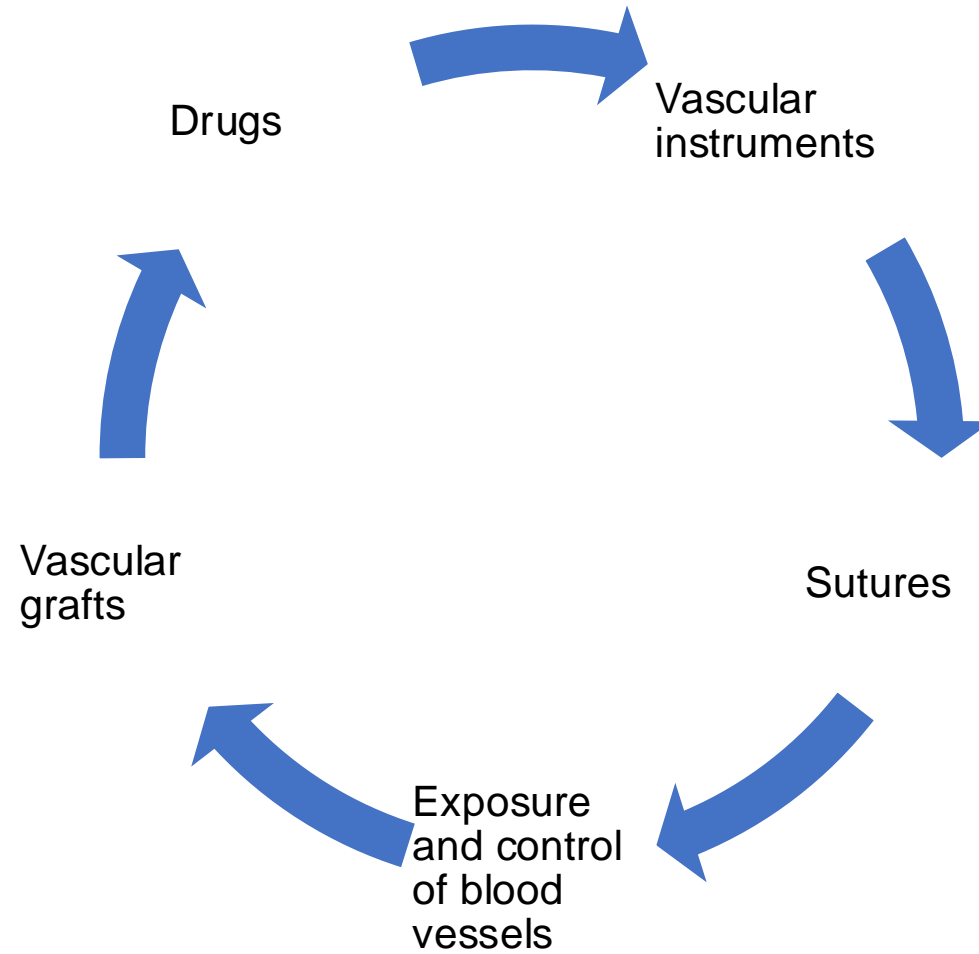
Symptoms of Vascular Diseases



Symptoms of Aneurysm



Case Planning



Surgical Techniques

- Endarterectomy
 - Vessel anastomosis
 - Graft tunnelling
 - Endovascular techniques
 - Access
 - Anesthesia
- Imaging
 - Guidewires
 - Access sheath
 - Catheters
 - Endovascular stent
 - Microvascular surgery suturing techniques

Principles of Vascular Surgery

Figure 23.1 Vessel 'looping' (a) a silastic loop (sling) is double-wrapped around the vessel above and below where surgery is to be performed. (b) the loops may be tightened by elevating them tightly. This occludes the blood flow (and hence bleeding) as well as elevating the vessel into the surgical field.

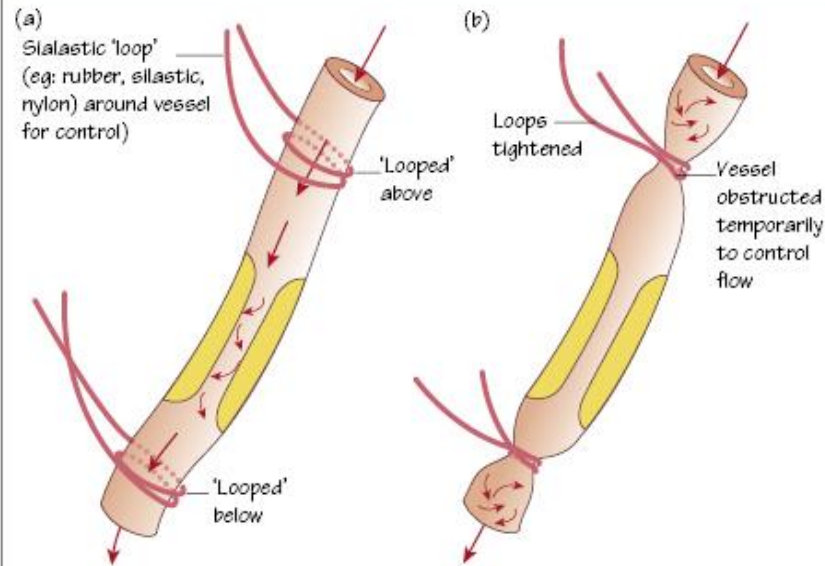


Figure 23.2 Endarterectomy. Plaque is carefully teased from vessel wall leaving smooth surface for re-endothelialisation. Typically the arteriotomy is closed with a patch graft anastomosis to reduce incidence of re-stenosis.

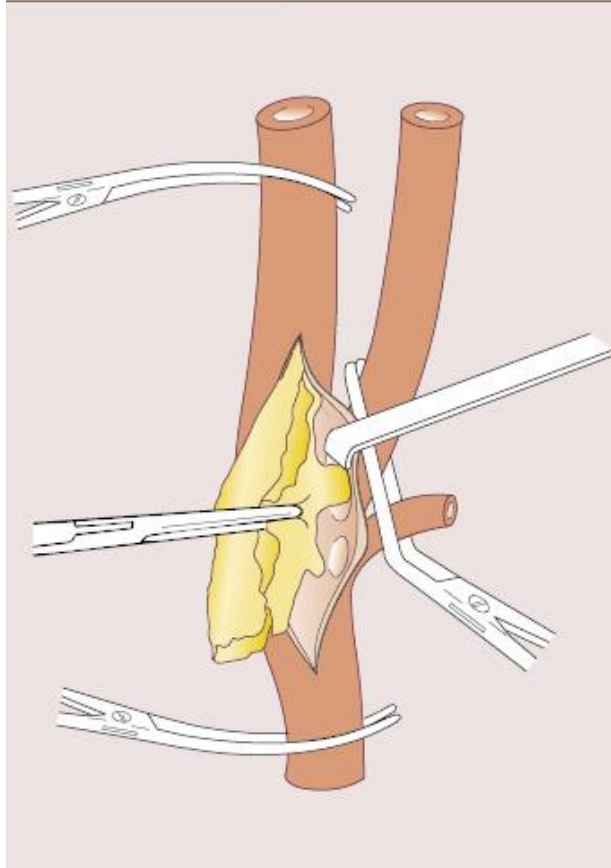
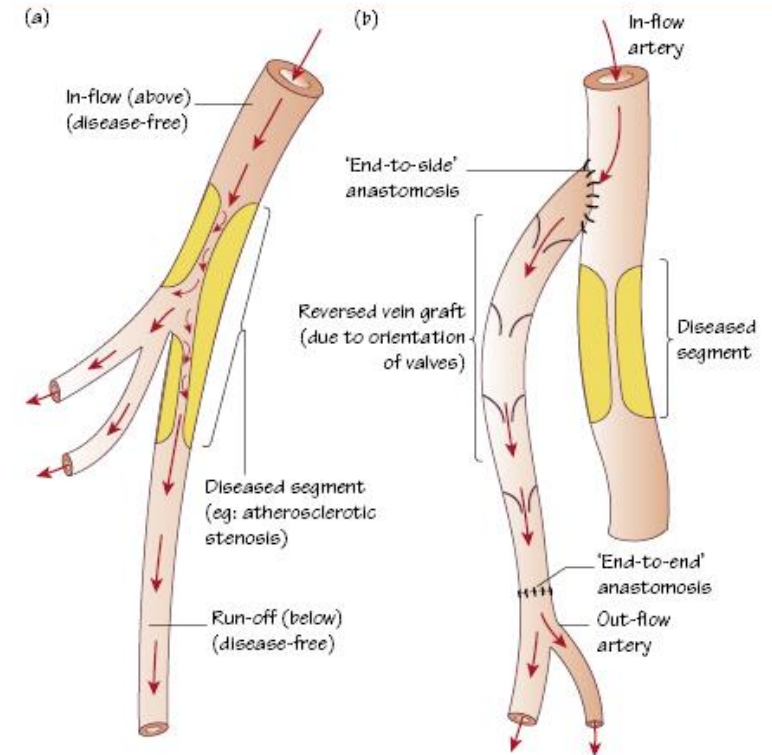


Figure 23.3 (a) Diagram of diseased segment of artery (e.g. common femoral artery) with reduced flow in the out-flow branches (i.e. 'run-off') (b) Illustration of typical bypass morphology using a reversed vein graft (note direction of venous valves). The vein graft effectively bypass the blocked segment of artery to restore blood flow distally. Note the different description for arterial anastomosis that may be used.



Procedures in Detail

- **Endovascular Procedures**

- Angioplasty
- Central venous line
- Intraoperative angiography
- Insertion of a vena cava filter
- Endovascular aneurysm repair (EVAR)

Watch "Endovascular vs. Open Procedures" Video

Endovascular vs Open Procedures Video



Endovascular vs Open Procedures Video

Summary of Video:

- Endovascular procedures are less invasive as open
- If a procedure can be done endovascular, it will be
- Hybrid procedures, with endo and open components can be done

Open Vascular Procedures

- Vascular access for renal hemodialysis
- Brachiocephalic arteriovenous fistula
- Thrombectomy
- Carotid endarterectomy
- Abdominal aortic aneurysm (open)
- Aortobifemoral bypass
- In situ saphenous femoropopliteal bypass
- Femoropopliteal bypass

Watch the "Carotid Endarterectomy" Video

Carotid Endarterectomy Video



Carotid Endarterectomy Video

- Summary of Video:
 - Dissection to Carotid Artery
 - Control of Vessel
 - Removal of Plaque
 - Application of Patch
 - Closure

Read Chapter 30 from the E-Book

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Congratulations!

Lesson 30 is complete.