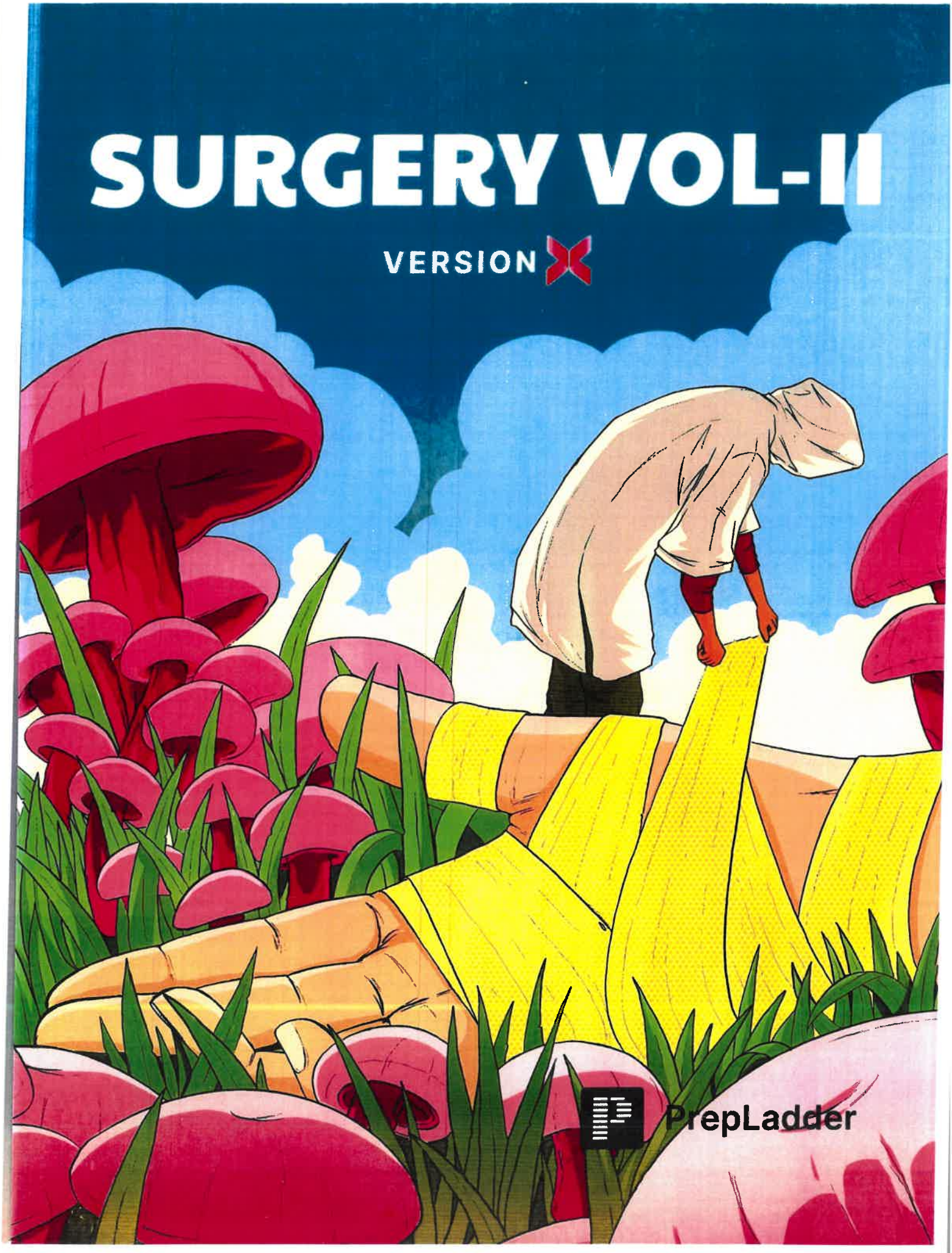
SURGERY VOL-II

VERSION X



PrepLadder

Created by team PrepLadder based on SURGERY lectures on the Prepladder app

Revision friendly **Fully Colored Book/Structured Notes**

For Best results, watch the video lectures along with reading notes

CONTENTS

Surgery Vol-2

1. ARTERIAL DISORDERS PART-1

ARTERIAL DISORDERS

PERIPHERAL ARTERIAL OCCLUSION

00:00:19

- Characterized by 5Ps -
  - Pain (M/c)
  - Pallor
  - Paresthesia
  - Paralysis (associated with worst prognosis)
  - Pulselessness (late sign in compartment syndrome)
  - Sometimes - Poikilothermia

CAUSES

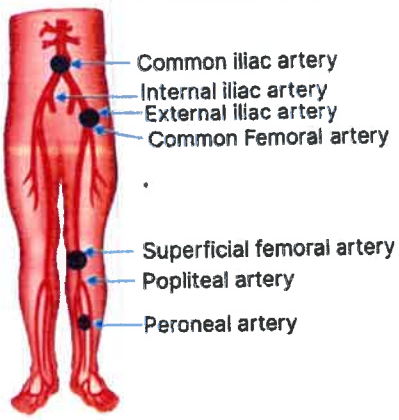
- Atherosclerosis -m/c cause of [redacted]
- Buerger's disease
- Takayasu arteritis
- Systemic Lupus Erythematosus
- Post-traumatic
- Radiation injury→ obliterative endarteritis → [redacted]

ATHEROSCLEROSIS

- More common
- 6th to 7th decade
- Involves large & medium-sized vessels -
  - Aorta, Iliac artery
  - Femoral artery
  - Popliteal artery
- Lower limb [redacted]

BURGER'S DISEASES (THROMBANGIITIS OBLITERANS)

- Exclusively seen in -
  - Young (age <40 years)
  - Males
  - Smokers
- Involve small & medium-sized vessels -
  - Tibial artery
  - Plantar artery
  - Radial artery
- Seen in Lower limb > [redacted]



SITE OF DISEASE	MANIFESTATIONS
AORTO-ILIAC OBSTRUCTION	• Claudication (ischemia of muscles) - buttocks, thigh and calves (B/L) • Femoral and distal pulses - absent in both limbs • Bruit at aorto-iliac region • Leriche syndrome - triad of claudication, erectile dysfunction, absent pulses
ILIAC OBSTRUCTION	• Claudication - thigh and calf (U/L) • Femoral and distal pulses absent in affected limb • Bruit: heard over iliac region
FEMORO-POPLITEAL OBSTRUCTION	• Claudication - Calf (U/L) • Femoral pulses - Palpable • Distal pulses - Absent (U/L)
DISTAL OBSTRUCTION	• Claudication - Calf and foot (U/L) • Femoral and popliteal pulses - Palpable • Ankle pulses - Absent (U/L)

EMBOLIC OCCLUSION

00:11:06

- Embolus - detached thrombus from heart or more proximal vessels
- M/c source of embolus - Left atrium
- 2nd M/c source of embolus - Mural thrombus
- Manifestation - dependent on organs involved

ORGANS INVOLVED	SYMPTOMS
Brain	• Transient ischemic attack/Stroke
Retina	• Amaurosis Fugax - temporary loss of vision due to lack of blood flow to retina
Mesenteric vessels	• Acute mesenteric ischemia → if T/t not provided early → ischemia and gangrene of small intestine
Spleen	• Local pain
Kidney	• Loin pain and haematuria

DIAGNOSIS

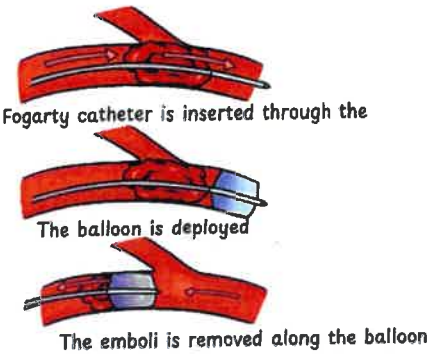
00:14:09

- Clinical diagnosis
  - Look for source of embolus → atrial fibrillation, myocardial infarction
  - No h/o claudication
  - Severe pain and numbness in limb
  - Movement becomes difficult and painful
  - Distal pulses not palpable
  - Emergency situation - make diagnosis on basis of clinical manifestation

T/t

- I/V Heparin (5000 U)
  - Reduces extension of thrombus
  - Maintains patency of vessels
- Embolectomy in case of embolus/thrombectomy in case of thrombus → Fogarty balloon catheter used

Fogarty balloon catheter



BUERGER'S DISEASES (TAO-THROMBOANGIITIS OBLITERANS)

00:16:33

- Segmental inflammatory disease
- Progresses from distal to proximal, skip lesions present
- Inflammatory process involves initially arteries and ultimately involves all 3 structures arteries, veins and nerves

CLINICAL FEATURES

- Triad
  - Raynaud's phenomenon
  - Intermittent claudication due to ischemia of muscles during walk/exercise (symptoms more common in daytime)
    → Fairly claudication distance remains constant
    → Walking for certain distance leads to intermittent claudication
    → As disease progresses, claudication distance ↓ (claudication distance progresses)
  - Migratory superficial thrombophlebitis

BOYD'S CLASSIFICATION (For Intermittent Claudication)

GRADE I	Pain initially occurs, but fades with continued walking as ↑ blood flow → washes away substance P
GRADE II	Patient can walk with pain
GRADE III	Pain compels patient to take rest
GRADE IV	Rest pain

- Rest pain - due to cutaneous ischemia
  - Sympathetic stimulation → vasoconstriction → cutaneous ischemia
  - Can perform lumbar sympathectomy if patient having rest pain
  - Pain at night and patient sitting on bed hanging legs by side of bed, by gravity some amount of blood reaches ischemic areas and there is improvement in pain

- Gangrene -
  - Involves small and medium sized vessels
  - Progression - distal to proximal region
  - Initially gangrene of toe → foot → can reach upto below knee

VASCULAR CLAUDICATION	NEUROGENIC PSEUDOCLAUDICATION

• Due to occlusion of artery → ischemia of muscles
• Cramping pain after walking for certain distance
  ○ In majority of patients walking distance is fairly constant → claudication distance
• Provoking factors for intermittent claudication
  ○ Walking and exercise
  ○ Up an incline
• Distal pulses reduced due to vascular occlusion
	• Due to lumbar canal stenosis
	• Provoking factors
	  ○ Walking and exercise
	  ○ Standing still
	  ○ Down an incline
	• Walking distance variable
	• Pulses - normal

DIAGNOSIS

- IOC for diagnosis - Duplex
  - Tells about site of occlusion, ↓ flow
- Collaterals in
  - Buerger's disease - Corkscrew collaterals
  - Budd Chiari syndrome - Venography → Spider web collaterals

00:28:32

ANKLE BRACHIAL PRESSURE INDEX

- ABPI= Systolic BP at Ankle/Arm (Brachial artery)

ABPI	INTERPRETATION
>1.4	• Suggestive of calcified vessels due to Diabetes mellitus, End stage renal disease
1.0-1.4	• Normal
0.91-0.99	• Borderline → further diagnostic testing is suggested
0.5-0.8	• Intermittent claudication (hemodynamically significant arterial occlusion)
0.1-0.4	• Critical limb ischemia (CLTI- Chronic Limb Threatening Ischemia)

TOE BRACHIAL PRESSURE INDEX (TBI)

- Toe (digital) arteries - rarely affected by sclerosis
- TBI+ABI - More reliable diagnostic tool for detection of large vessel steno-occlusive diseases in patients of Diabetes mellitus
- TBI <0.6 - Suggestive of significant arterial lesions

DIGITAL SUBTRACTION ANGIOGRAPHY (DSA)

- Injection of dye in Common femoral artery using seldinger technique
- Called as DSA
  - Digital- images are digitalized by computer

- Subtraction- background like bone and soft tissue removed providing clearer images
- Benefits - provides dynamic arterial flow information
- Indication - done whenever intervention is planned

COMPLICATIONS

- Bleeding, hematoma, thrombosis
- False aneurysm formation, arterial dissection
- Digital embolization
- Renal dysfunction, allergic reaction

FONTAINE'S STAGING OF LIMB ISCHEMIA

STAGE I	Asymptomatic
STAGE IIA	Mild intermittent claudication
STAGE IIB	Moderate - severe intermittent claudication
STAGE III	Rest pain
STAGE IV	Critical limb ischemia → ulceration → gangrene

T/t

- Abstinence from smoking
- Vasodilators -
- Lumbar sympathectomy done for rest pain
  - Muscle blood supply is not under sympathetic control so lumbar sympathectomy not done for intermittent claudication
  - Skin blood supply is under sympathetic control → sympathetic stimulation → cutaneous ischemia → rest pain → lumbar sympathectomy performed
- Omental transposition around arteries
- Amputation for gangrene

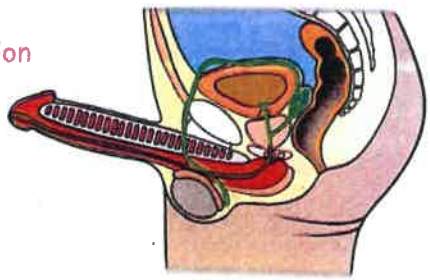
SMOKER WITH GANGRENE

- 6^{th}-7^{th} decade - atherosclerosis (M/c cause)
- 4^{th} decade - cause - Buerger's diseases

LUMBAR SYMPATHECTOMY

00:38:50

- Indication - Rest pain
- Ganglia removed - L_1-L_4 ganglia on affected side
- B/L lumbar sympathectomy -
  - At least L_1 ganglia preserved on one side to prevent retrograde ejaculation
    → Erection - due to parasympathetic system
    → Ejaculation – due to sympathetic system
    → At time of ejaculation - internal urinary sphincter at bladder neck is under sympathetic control (L_1 sympathetic ganglia) → sympathetic stimulation → ejaculation → sphincter closed so most of semen goes out via urethra



Retrograde ejaculation

→ In case L1 removed → internal urinary sphincter not closed → semen goes into bladder → retrograde ejaculation

→ Other conditions with retrograde ejaculation- TURP (No proximal landmark, ↑ risk of injury of internal urinary sphincter)

→ α blockers → smooth muscle relaxation → retrograde ejaculation

CAUSES OF RETROGRADE EJACULATION

- B/L lumbar sympathectomy with B/L L1 ganglia removal
- TURP, α -blockers

- Structures mistaken for lumbar sympathetic ganglia and accidentally removed
  - Genitofemoral nerve
  - Psoas sheath, Psoas minor
  - Lymphatics

INDICATIONS FOR LUMBAR SYMPATHECTOMY

- Buerger's disease (Rest Pain), Atherosclerosis, Raynaud's Disease, Acrocyanosis
- Causalgia, Hyperhidrosis, Erythrocyanosis, Frost Bite

GANGRENE

00:43:17

- Death of macroscopic portions of tissue
- Tissue turns black as there is breakdown of haemoglobin and formation of iron sulphide
- Affects most distal part of limb

Dry gangrene Wet gangrene

	DRY GANGRENE	WET GANGRENE
SITE	Lower limb	M/c in bowel
MECHANISM	Arterial occlusion→ Gradual slowing of blood → tissue desiccation	Venous occlusion → superadded infection
MICROSCOPY	Organ - dry, shrunken and black	Moist, swollen and dark
LINE OF DEMARCATION	Present between gangrenous tissue and healthy part	Poor line of demarcation/ usually no line of demarcation
PRESENCE OF BACTERIA	Bacteria fail to survive	Numerous bacteria
PROGNOSIS	Better	Poor

AMPUTATION

00:48:06

INDICATIONS OF AMPUTATION

Dead limb	Deadly limb	'Dead loss' limb
• Gangrene → arterial occlusion → severe enough to cause infarction of major parts of tissues	• Wet gangrene • Spreading cellulitis ○ If amputation not done in these cases → putrefaction and infection can spread to surrounding tissues • AV fistula • Malignancy → metastasis	• No proper functioning of limb, so to improve quality of life amputation of limb needs to be done • Severe rest pain with unreconstructable CLI • Paralysis • Contracture • Trauma

DISTAL AND TRANSMETATARSAL AMPUTATION

- Local amputation of digits done in patients with Diabetes mellitus (cause small vessel diseases with relatively good blood supply to surrounding tissues)
- Ray excision- done for involvement of metatarsophalangeal joint
- Transmetatarsal amputation- done for involvement of several toes with adequate proximal circulation

MAJOR AMPUTATION

BELOW KNEE AMPUTATION	ABOVE KNEE AMPUTATION
• Preserves knee joint • Gives best chance of walking again with prosthesis • Stump length should not be <8cm (generally should be 10-12 cm)	• More likely to heal • Appropriate if patient has no prospect of walking again • Done if femoral pulses absent • Stump length should not be <20 cm

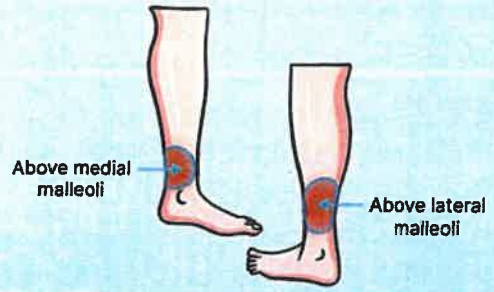
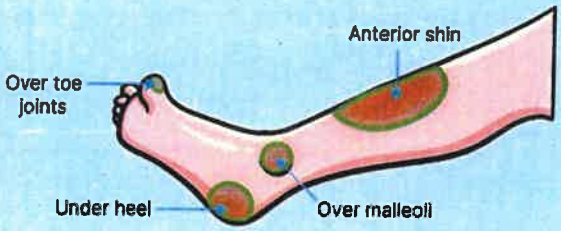
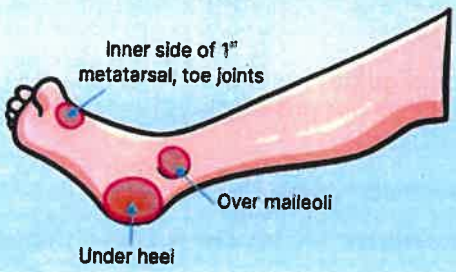
COMPLICATIONS OF AMPUTATION

EARLY COMPLICATIONS	LATE COMPLICATIONS

• Hemorrhage
• Hematoma
• Infections → if not drained on time → abscess, contamination due to fecal matter → gas gangrene
• Wound dehiscence
• Flap necrosis
• DVT → Pulmonary embolism
	• Pain
	  ○ Due to unresolved hematoma
	  ○ Bone spur
	  ○ Amputation neuroma
	• Phantom limb - patient can feel amputated limb
	• Phantom pain - pain in amputated limb
	• Stump ulceration due to ischemia

LEG ULCERS

00:54:41

LEG ULCERS	CHARACTERISTIC FEATURES
VENOUS ULCERS (VARICOSE ULCER) 	• Located typically around medial malleolus (Gaiter's area/region) • Can be present around lateral malleolus
ARTERIAL ULCER 	• Caused by arterial occlusion • Seen in distal ends of limbs
NEUROPATHIC ULCERS 	• Mainly seen over bony prominences

ARTERIAL ULCERS

00:56:25

ETIOLOGY

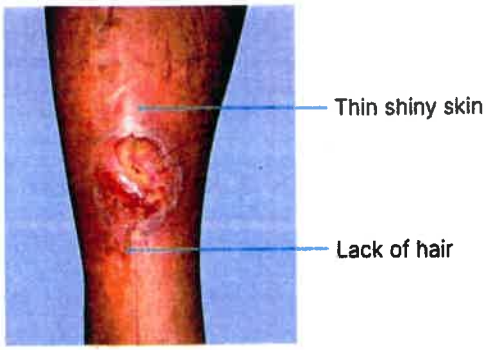
- Impaired blood flow → ischemia → tissue death → ulcer having punched out edges
- Diabetes mellitus
  - Microangiopathy
  - Macroangiopathy
    → Endothelial dysfunction → impaired blood flow → ischemia → tissue death → ulcer with punched out edges
- Arterial occlusion → ischemia → intensely painful ulcer

Arterial ulcer

CLINICAL FEATURES

- Punched out ulcer,
- Distal pulses -
- Associated with -

- Thin shiny skin, loss of subcutaneous fat
- Loss of hair, Brittle nails



Arterial ulcer

DIAGNOSIS
- Clinical diagnosis
- Doppler - to assess vascular flow

T/t
- Revascularization procedure
- Infected ulcers - debridement + antibiotics

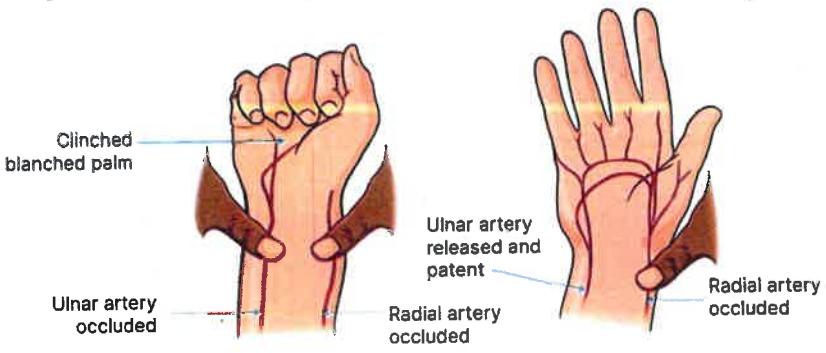
ARTERIOVENOUS FISTULA (AVF)

01:00:00

- Congenital- M/c
- Acquired- Penetrating trauma > Iatrogenic (creating fistula for hemodialysis)

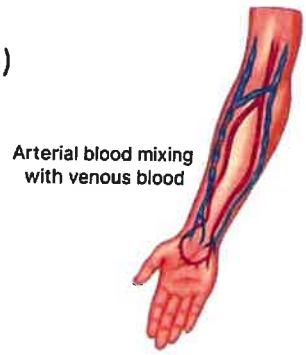
SURGICALLY CREATED FISTULAS
- Brescia-Cimino fistula - between Radial artery and Cephalic vein
- Snuff box fistula - between Posterior branch of radial artery and Cephalic vein
- Feinberg fistula - between Radial artery and Basilic vein

MODIFIED ALLEN'S TEST
- Tests adequacy of blood supply to hand from Radial and Ulnar arteries and arcade between them
- Done prior to creation of AVF
- Procedure -
  - Patient with clinched blanched palm → Ulnar and Radial artery occluded → on opening palm → Ulnar artery released
    → Hand having normal color → patent Ulnar artery
    → When Ulnar artery released → hand still pale → Ulnar artery occluded (not patent)



PATHOPHYSIOLOGY

- ↑ VR → ↑ CO → ↑ HR → ↑ SBP
- Wide pulse pressure (In comparison to systolic BP, diastolic BP does not ↑ that much)
- Pulsatile
- Palpable
- Chronic cases - Arterialization of vein
  - Dilated, tortuous and thickened veins
- Nicoladoni's / Branham sign
  - Occlusion of artery proximal to fistula leads to
    → Pulsatile mass- size ↓
    → Thrill disappears
    → HR- ↓/normalized



DIAGNOSIS

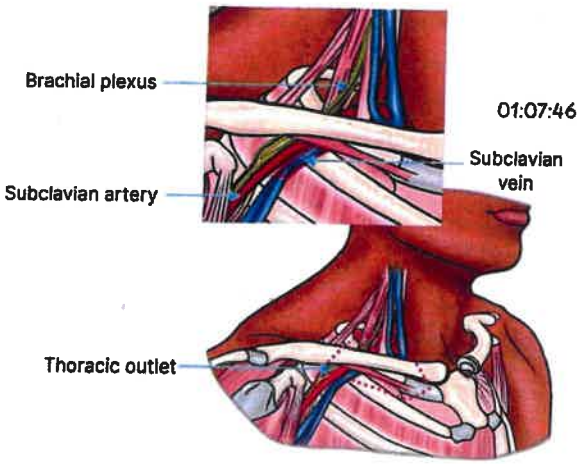
- Angiography
  - Diagnostic
  - Therapeutic – for small fistula embolization
- Duplex scan

T/t

- Small fistula - Embolization
- Large fistula - Surgical ligation

THORACIC OUTLET COMPRESSION SYNDROME (TOS)

- Compression of subclavian vessels and nerves of brachial plexus at thoracic inlet
- More common in middle aged females
- Compression at TOS
  - Dynamic compression - compression prominently in one particular posture
  - Best diagnosed by Provocative test



TYPES

Neurogenic form (M/c)
- Compression of C_8T_1
- M/c affected nerve - Ulnar

Vascular form
- Compression of Subclavian artery and Subclavian vein

PREDISPOSING FACTORS

- Cervical rib/Abnormal 1st rib/Fibrous band
- Long transverse process of C_7
- Osteoarthritis, Pancoast tumor, Cervical hematoma

CLINICAL FEATURES

- Neurogenic form

- M/c involved nerve root value - [redacted]
- Pain and paresthesia over inner aspect of forearm and hand
- On examination - Atrophy of Hypothenar muscles, Interossei

- Arterial compression - pain, pallor, paresthesia
- Venous form - occlusion of vein/veinous thrombosis → collection of deoxygenated blood → cyanosis, edema and pain

DIAGNOSIS

PROVOCATIVE TEST

- Adson's test (Scalene test)
- Costoclavicular test (Military position/Halsted test)
- Hyperabduction test (Wright test)
- Roos test (Arm Claudication test)

ADSON'S TEST

- 1st Radial pulses checked → Ask patient to take deep breath and hold it→ Extend neck fully and turn face towards the side
- If after this test there is obliteration of radial pulses → suggests diagnosis of thoracic outlet syndrome

COSTOCLAVICULAR TEST

- 1st radial pulses are checked → patient instructed to draw shoulders downwards and backwards
- If obliteration of pulses/reproduction of symptoms again → suggestive of compression

HYPERABDUCTION TEST

- 1st radial pulses are checked → ask patient to hyper abduct arm till 180°
- If obliteration of radial pulses → suggest diagnosis of Thoracic outlet compression syndrome

ROOS TEST

- Ask patient to draw shoulder backwards → arms in horizontal position → elbow at 90° → ask patient to perform exercise with hands
- Numbness and pain in hands with exercise → suggest diagnosis of TOS

MANAGEMENT

- Neurogenic form (>90%)
  - Conservative management
    → Improvement in sitting, sleeping and standing position
    → Physiotherapy advised - muscle stretching and strengthening exercises taught to patient
- Indications for surgical intervention
  - Failure of conservative management
  - Progression of sensory or [redacted]
  - Excessively prolonged Ulnar or [redacted]
  - Narrowing/occlusion of Subclavian artery } Vascular form
  - Thrombosis of Axillary/Subclavian vein
  - Presence of anatomical abnormality like cervical rib, fibrous band

OPERATIONS FOR TOS

- Complete removal of 1st rib, division of Scalenus anticus and Medius
- Large aneurysm/thrombosis of Subclavian artery - Graft reconstruction
- Subclavian vein thrombosis - Thrombolytic and anticoagulant therapy followed by surgical decompression

MCQ's

Q. A 40-year-old male having a long history of cigarette smoking presented with gangrene of left foot. An amputation of the left foot was done. Representative sections from the specimen revealed presence of arterial thrombus with neutrophilic infiltrate in the arterial wall. The inflammation also extended into the neighboring veins and nerves. The most probable diagnosis is

a. Takayasu arteritis
b. Giant cell arteritis
c. Hypersensitivity angiitis
d. Thromboangiitis obliterans

Ans: (d)

Q. A 25-year-old male presented to the outpatient department complaining of pain and numbness on the medial aspect of his right arm. On examination, wasting of the thenar and hypothenar eminence was noted. The adduction and abduction of fingers were restricted. The hands were cold and cyanosed. The radial pulse on the right side was diminished. The left hand appeared normal. A chest X-ray showed a cervical rib. Which of the following is the commonest feature of thoracic outlet syndrome?

a. Intermittent claudication
b. Pain in radial distribution
c. Pain in ulnar distribution
d. Gangrene

Ans: (c)

2. ARTERIAL DISORDERS PART-2

RAYNAUD'S PHENOMENON

00:00:22

- Episodic Digital Ischemia
  - On exposure to cold
  - Emotional stress
  - Use of vibrating tools

SEQUENCE OF EVENTS

(Mnemonic: Boys Common Room)

Blanching (Stage of local syncope)
Exposure to cold → spasm of digital arterioles

↓

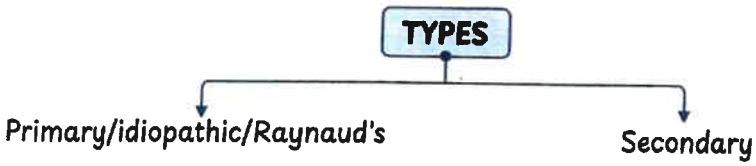
Cyanosis (stage of local asphyxia)
Capillaries and venules dilate → collection of deoxygenated blood → cyanosis

↓

Redness (stage of recovery)
Resolution of digital spasm → ↑ blood flow in dilated arteries and capillaries

CLINICAL FEATURES

- More common in fingers > toes
- Radial, ulnar, pedal pulses - normal



T/t

- >90% of patients improve after avoiding stimulus
  - Avoid cold stimulus, wear warm gloves during winters and avoid using vibrating tools → still no improvement → calcium channel blockers
- Calcium channel blockers – Diltiazem, Nifedipine

ACUTE MESENTERIC ISCHEMIA

00:04:01

- Embolic occlusion, thrombosis, vasoconstriction in artery → Impaired blood supply to organ
- Venous thrombosis → Collection of deoxygenated blood → congestion in organ → ischemia

ETIOLOGY

- Embolic occlusion in 50% cases → Involvement of Superior mesenteric artery
  - Arrhythmia - if patient has atrial fibrillation
  - Valvular heart diseases
  - MI - Formation of mural thrombus
- Arterial thrombosis - responsible for 25% cases of acute mesenteric ischemia
  - Atherosclerosis
- Non-occlusive mesenteric ischemia/NOMI
  - Hypotension/ shock → Vasoconstriction of Superior mesenteric artery → supply to bowel affected
  - Responsible for 5-15% cases of acute mesenteric ischemia
  - Causes
    → Heart failure, massive burns, sepsis
    → Acute pancreatitis, Acute MI
  - Venous thrombosis

VIRCHOW'S TRIAD

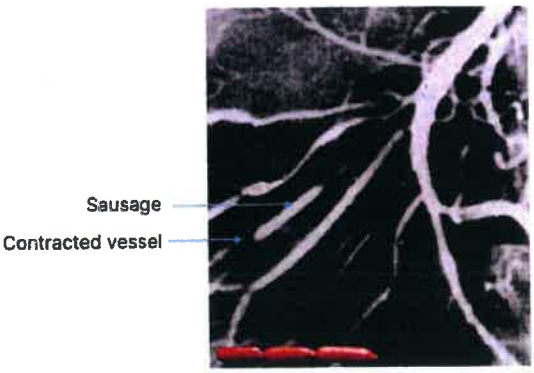
- Endothelial injuries
- Stasis of blood flow
- Hyper coagulable state-most important

CLINICAL FEATURES

- Severe abdominal pain - M/c symptom
- Persistent vomiting and diarrhea
- Melena and hematochezia in approximately 15% cases
- Late stages - ischemia → gangrene → sepsis and shock

DIAGNOSIS

- IOC for diagnosis - Mesenteric arteriography
  - On mesenteric arteriography in Non occlusive mesenteric ischemia → String of Sausages sign → contracted vessels in between appearance like sausage



MANAGEMENT

- Early diagnosis - most important, as delay in diagnosis can cause gangrene of bowel
- Aggressive resuscitation in OT - I/V fluids + I/V antibiotics
- Non-occlusive mesenteric ischemia due to spasm of mesenteric vessels - Early revascularization → catheter directed papaverine infusion into superior mesenteric artery → relieves spasm of mesenteric vessels
- Mesenteric venous thrombosis - Anticoagulants given to stop propagation of thrombus