

APPROACH TO PEDAL EDEMA

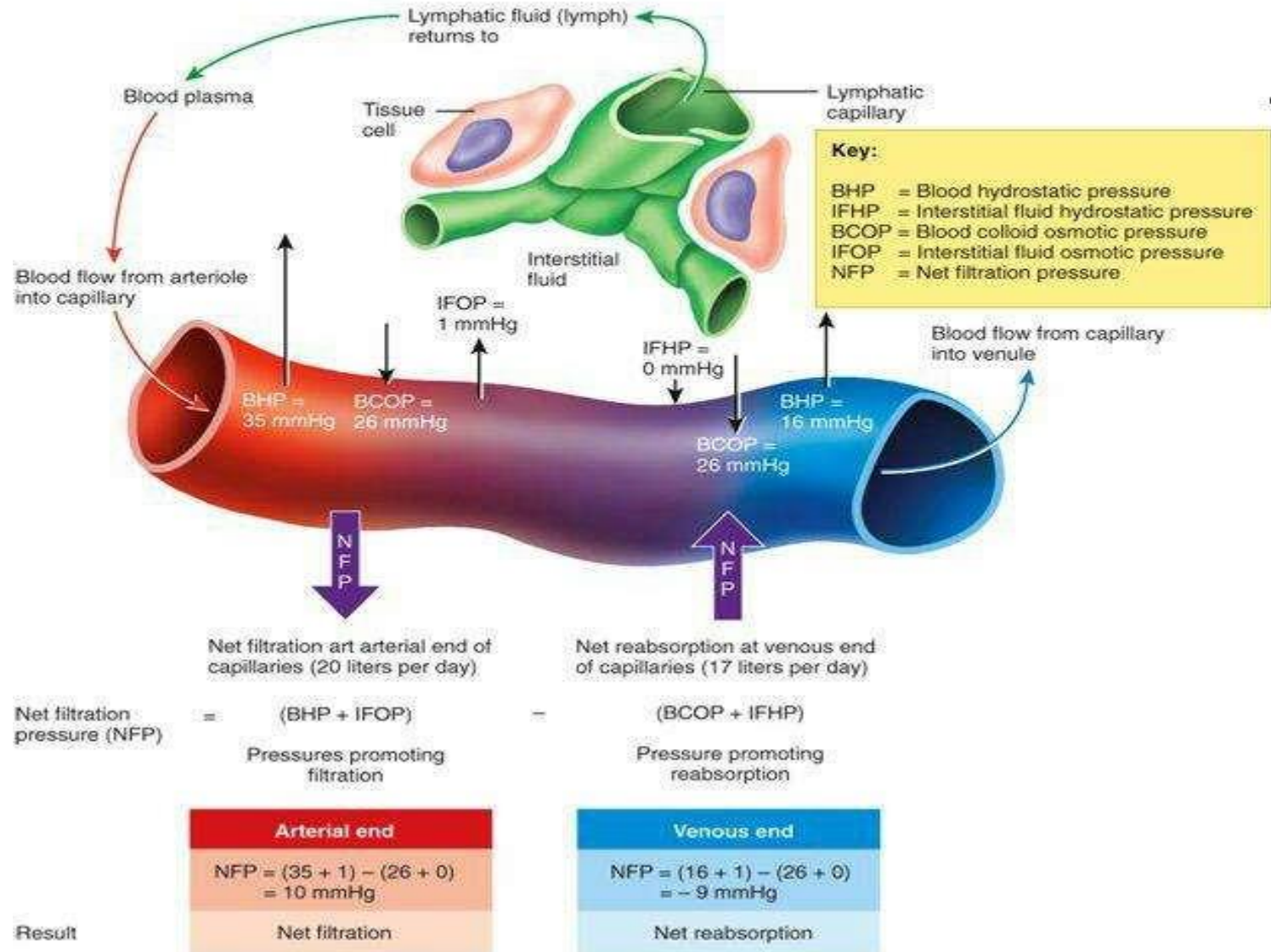
Definition of Edema

The abnormal fluid accumulation in the interstitial space that exceeds the capacity of physiological lymphatic drainage

Mechanism

- Interstitial fluid space is dependent on the hydrostatic and oncotic pressure gradient across the capillaries and also the lymphatic drainage
- So they are dependent on four main factors, namely-
 1. Capillary permeability
 2. Capillary hydrostatic pressure
 3. Capillary oncotic pressure
 4. Lymphatic drainage
- Any derangement increases the interstitial fluid resulting in edema

Starling's Law Of The Capillaries



- **Nearly as much fluid is reabsorbed as was filtered**

- 85% of the fluid that was filtered is then reabsorbed

- Not 100% fluid returns because a few plasma proteins leave vessels into interstitial space

- Remainder of fluid & proteins enter lymphatic capillaries (3L/ day) & is eventually returned to blood

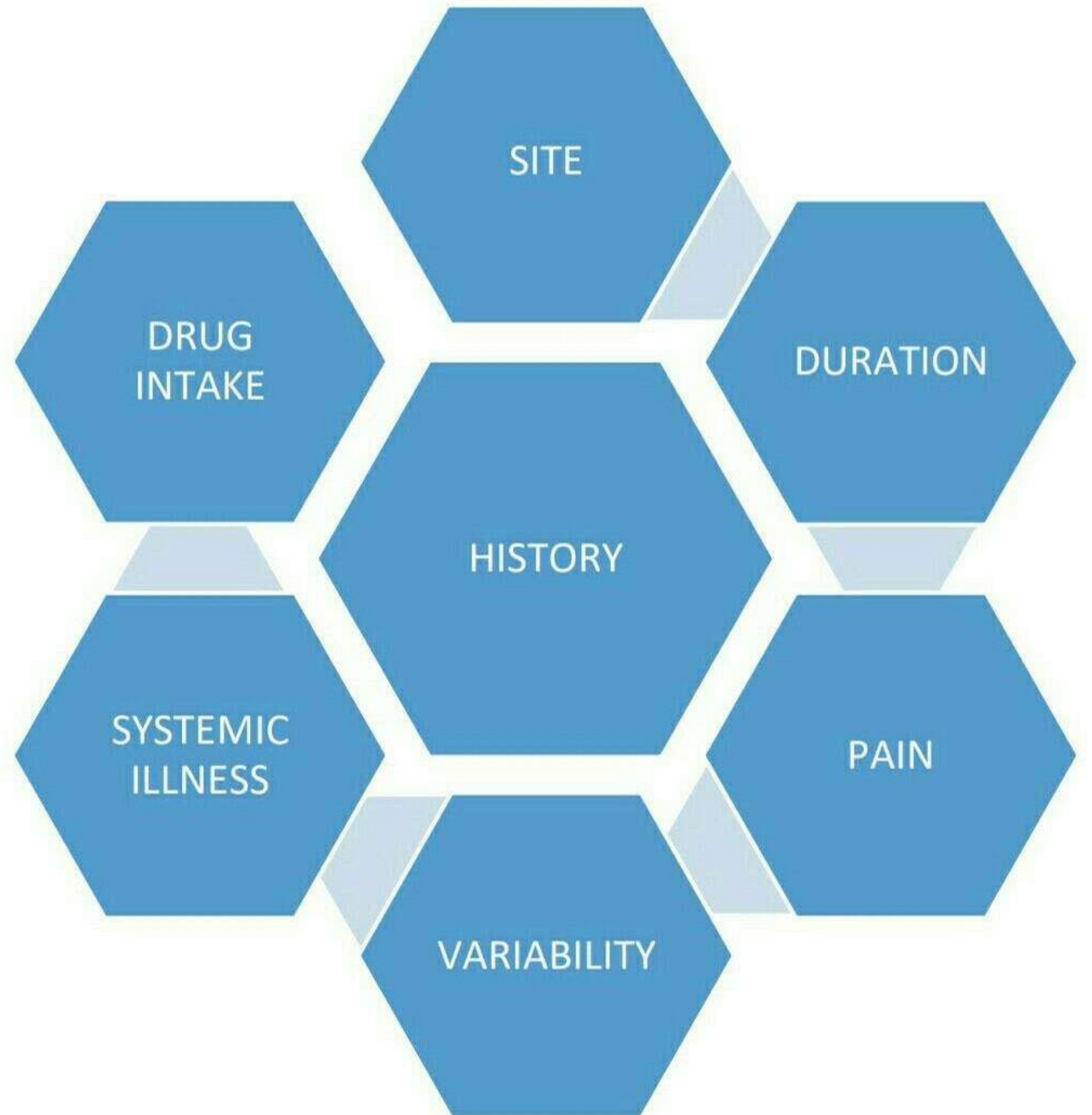
Causes

- **Increased capillary permeability**
 - Local Causes – cellulitis
 - Systemic Causes – hypersensitivity reactions, sepsis
- **Increased capillary hydrostatic pressure**
 - Local Causes – compartment syndrome, chronic venous insufficiency
 - Systemic Causes – congestive cardiac failure, cor pulmonale, renal failure, anemia, pregnancy
- **Decreased capillary oncotic pressure**
 - Systemic Causes – Protein deficient states like chronic liver diseases, nephrotic syndrome, protein losing enteropathy, malabsorption syndrome
- **Lymphatic obstruction (lymphedema)**
 - Tumour, trauma, radiation and infections like filariasis

Anasarca

- There are two principal causes of generalised oedema
 1. Fluid overload
 2. Hypoproteinemia
- The **effective arterial blood volume is reduced**, and renal blood flow decreases
- The **renin-angiotensin-aldosterone system (RAAS)** is activated, and causes sodium and water retention

History



History

1. Site and distribution

- ***Unilateral pedal edema:*** local causes like deep vein thrombosis, cellulitis, compartment syndrome and filariasis
- ***Bilateral pedal edema:*** systemic causes like congestive cardiac failure, anemia, chronic kidney disease and chronic liver disease

2. Duration of illness

- ***Acute:*** Cellulitis, DVT, Compartment syndrome
- ***Chronic:*** Systemic diseases, hypoproteinemic states, chronic venous insufficiency, lymphedema

History cont...

3. Association with pain

- ***Painful:*** Deep vein thrombosis and cellulitis
- ***Painless:*** Systemic diseases, hypoproteinemic states, venous insufficiency, lymphedema

4. Variability of edema

- ***Congestive cardiac failure:*** Dependent edema aggravated by standing and improves with overnight limb elevation
- ***Nephrotic syndrome:*** Edema is characteristically generalized, but especially evident in the very soft tissues of the eyelids and face in the morning
- ***Chronic liver disease:*** Ascites is predominant

History cont...

5. History of systemic illness

- **Cardiac:** Exertional dyspnea, orthopnea, paroxysmal nocturnal dyspnea, chest pain and palpitations
- **Renal:** Oliguria and puffiness of face
- **Liver:** Long term alcohol consumption, blood transfusion, tattooing, yellowish discoloration of eyes and urine and abdominal distension

History cont...

6. History of other illness

- **Hypothyroidism:** Fatigue, weight gain, decreased appetite, sleepiness, cold intolerance, constipation, decreased menses
- **Obstructive sleep apnea:** Snoring at night interrupted by episodes of apneas, excessive daytime sleepiness, daytime fatigue/tiredness

7. History of drug intake

- Common drugs like calcium channel blockers, NSAIDs and steroids
- 50% of patients taking CCBs and 5% taking NSAIDs complain of pedal edema

Drugs associated with Edema

Direct arterial vasodilators (antihypertensive)

Hydralazine

Clonidine

Methyldopa

α -blockers

Calcium channel blockers (antihypertensive)

Amlodipine

Nonsteroidal anti-inflammatory drugs
(NSAIDs)

Ibuprofen

Diclofenac

Hormones

Glucocorticoids

Anabolic steroids

Estrogens

Progestins

Growth hormone

Thiazolidinediones (oral hypoglycemics)

Rosiglitazone

Pioglitazone

Anti-depressants

MAO inhibitors

History cont...

8. History of trauma and radiation

- Trauma and radiation can cause cellulitis and compartment syndrome
- Long term radiation can also cause lymphedema

Local examination

1. **Distribution** - Identify whether it is unilateral (usually local causes) or bilateral (predominantly systemic causes)
2. **Site** – Bony prominences like medial malleolus and anterior aspect of tibia, sacrum in bedridden patients
3. **Tenderness** – Deep vein thrombosis, cellulitis and compartment syndrome are generally tender. Lymphedema and edema due to systemic diseases and hypoproteinemic states are painless
4. **Pitting edema** – Except lymphedema and myxedema, most other diseases cause pitting pedal edema. Lymphedema is initially pitting
 - ✓ Hyaluronic acid deposition in hypothyroidism

Pitting edema



Local exam cont...

5. Skin changes

- a. ***Cellulitis*** – Most common site is leg, red, hot & swollen
- b. ***Myxedema*** – Dry , coarse & thick skin
- c. ***Chronic venous insufficiency*** – Hemosiderin deposition causes brawny skin. Often varicose veins & venous ulcers visible
- d. ***Chronic lymphedema*** – Hyperkeratotic and papillomatous skin with induration, known as lymphostatic verrucosis (***elephantiasis***)
Kaposi-stemmer sign is the inability to pinch the skin on the dorsum of the foot near the second toe

Cellulitis



Myxedema



Chronic venous insufficiency

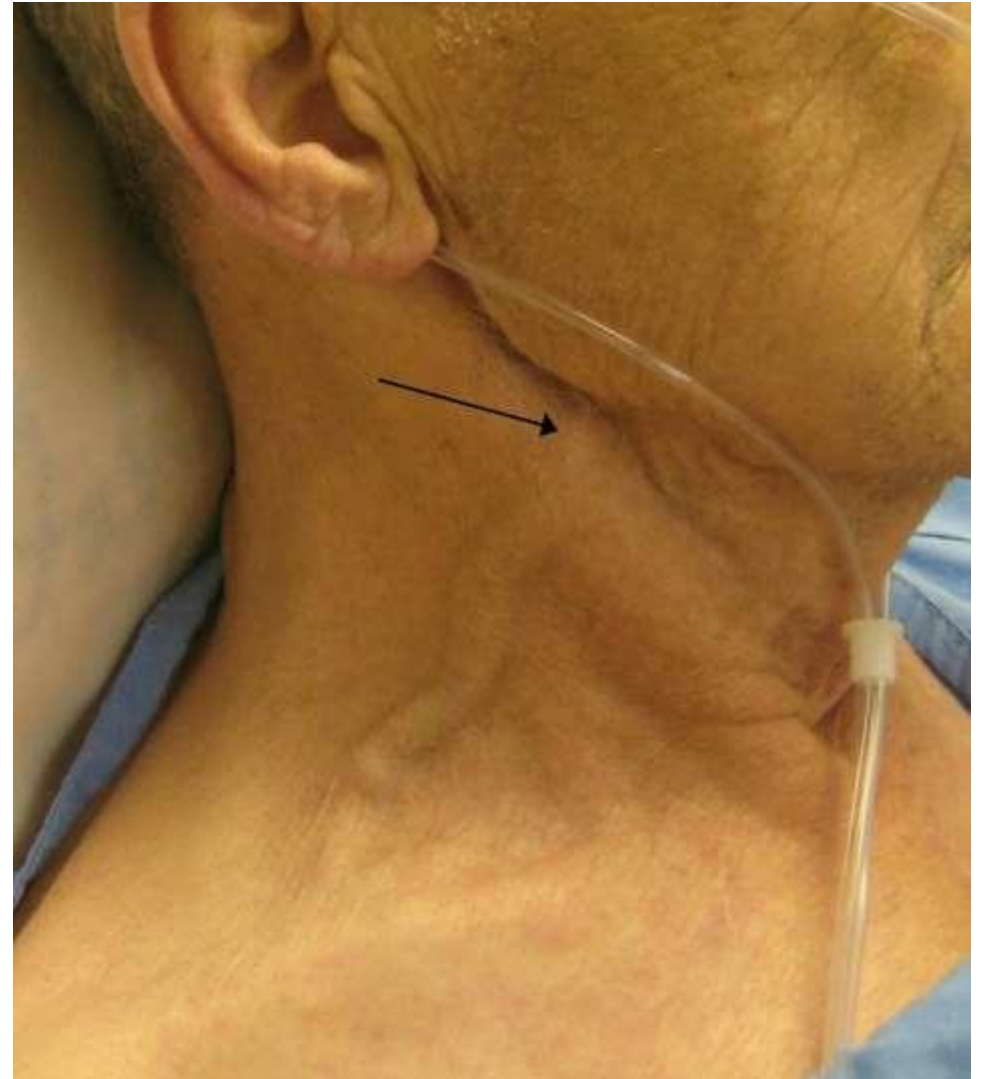


Filariasis



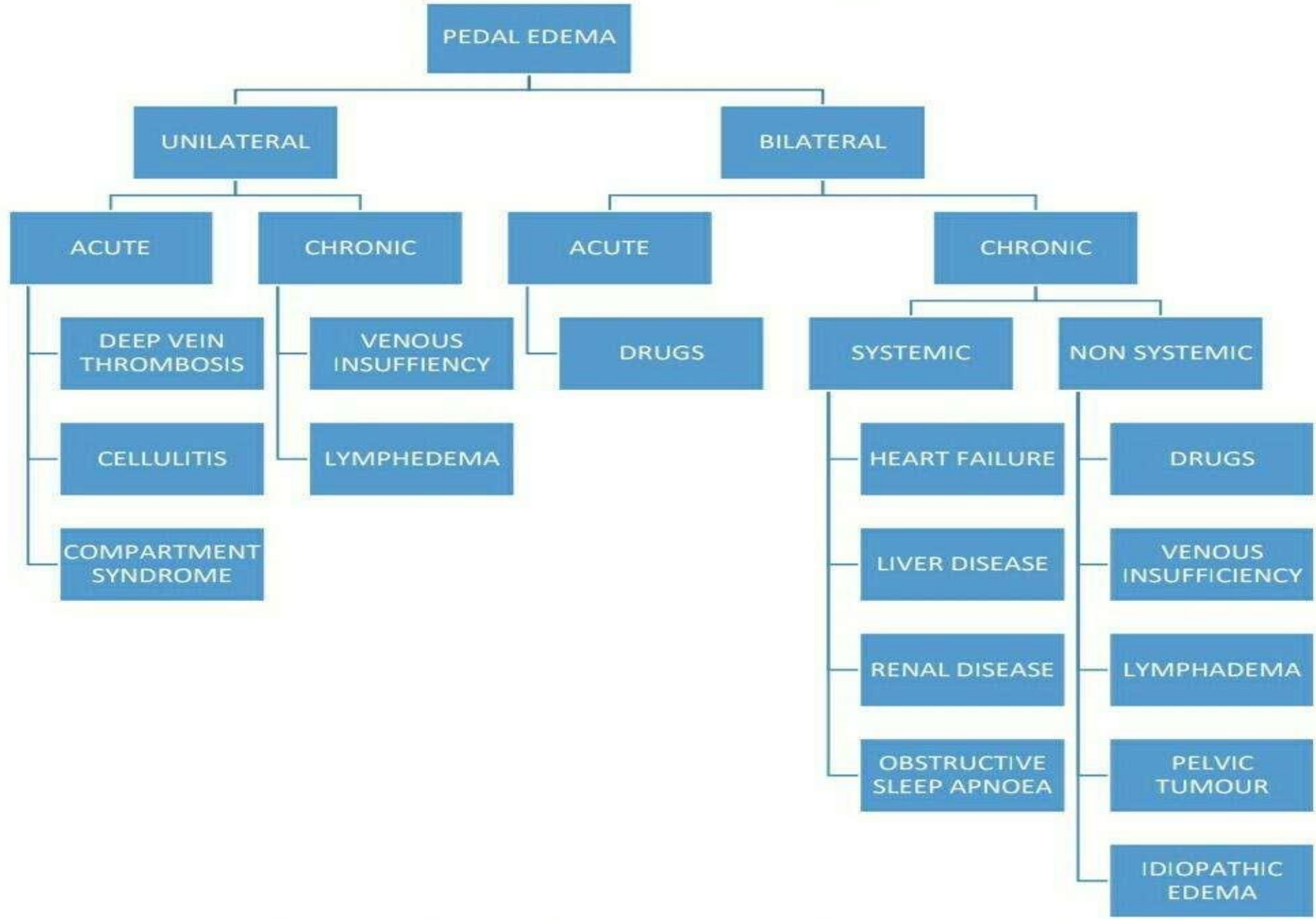
Jugular venous pressure

- JVP distinguish the causes of *anasarca*
- JVP is elevated in fluid overload states
 1. Congestive cardiac failure
 2. Cor pulmonale
 3. Renal failure
- JVP is not elevated in protein deficient states
 1. Cirrhosis
 2. Nephrotic syndrome
 3. Malabsorption syndrome



Systemic examination

- **Congestive cardiac failure** – Elevated jugular venous pressure, third heart sound and crepitations over the lung bases
- **Chronic liver disease** – Icterus, ascites, splenomegaly, gynaecomastia, spider naevi
- **Chronic kidney disease** – Anemia, dry skin, uremic breath
- **Hypothyroidism** – Bradycardia, skin changes like dry skin and sparse hair, hoarseness of voice



Lab Investigations

1. **Complete blood count** – Anemia and clue to the cause of anemia
2. **Urine routine/microscopy and renal function test**– Chronic kidney disease & nephrotic syndrome
3. **Liver function test** – Chronic liver disease
4. **Serum total protein and albumin** – Chronic liver disease, nephrotic syndrome, protein losing enteropathy and malnutrition
5. **Serum lipid profile** –Nephrotic syndrome, coronary heart disease
6. **Chest X ray, ECG and Brain natriuretic peptide** – Heart failure
7. **Serum TSH** – Hypothyroidism
8. **D-dimer** – elevated D-dimer is suggestive of DVT

Imaging

1. **USG Abdomen and KUB** – altered liver echo-texture and shrunken liver in CLD, and bilateral shrunken kidneys in CKD
2. **Doppler study** – Deep vein thrombosis and chronic venous insufficiency
3. **Lympho-scintigraphy** – a radio-nucleotide tracer is injected into the first web space and flow of lymph is monitored using a gamma camera
4. **Echocardiography** – assesses the left ventricular function in CHF, measures pulmonary artery pressure and diagnoses pulmonary hypertension in cor pulmonale and OSA

Management

- **Chronic kidney disease** – Fluid & salt restriction and loop diuretics like furosemide or torsemide can be given
- **Congestive heart failure** – Salt restrictions, diuretics like furosemide & spironolactone, and ventricular remodeling drugs like beta blockers & ACE inhibitors
- **Chronic liver disease** – Fluid & salt restriction, and diuretics like furosemide and spironolactone. Albumin infusion in refractory cases

Management cont...

- **Obstructive sleep apnea** – Weight reduction and CPAP (continuous positive airway pressure)
- **Hypothyroidism** – Replace thyroxine 1.6 mcg/kg body weight
- **Cellulitis** – Limb elevation and empirical antibiotics against Staph aureus

Management cont...

- **Deep vein thrombosis** – Anticoagulant therapy using LMWH followed by oral anticoagulants like warfarin. In chronic bedridden patients, bandages, stockings, compression devices & prophylactic heparin to prevent DVT
- **Venous insufficiency** – Limb elevation, high knee compression stockings & pneumatic compression devices. Skin care with topical steroids & emollients to avoid excoriation & ulceration
- **Lymphedema** – Manual massaging, compressive stockings & intermittent pneumatic compression. In refractory cases, surgical procedures like bypass & debulking

Thank you