

The Cardio-

VASCULAR

System

- ☐ Anatomy
- ☐ Histology
- ☒ Pathology
- ☐ Pharmacology
- ☐ Physiology
- ☐ Microbiology

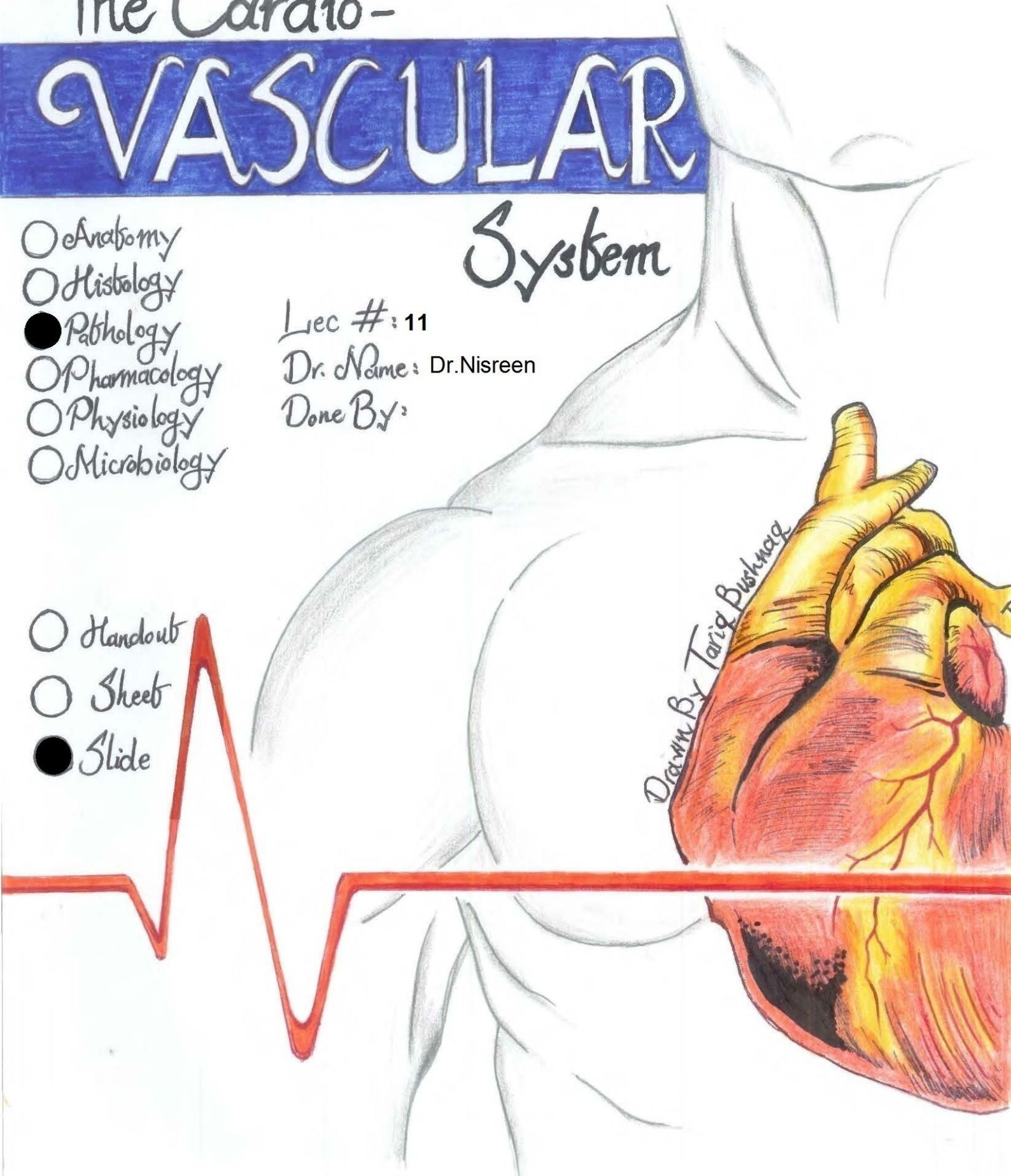
Lec #: 11

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Done By:

- ☐ Handout
- ☐ Sheet
- ☒ Slide

Drawn By: Tariq Bushnaq



EDEMA

- 60% of lean body weight = water
 - (2/3) intracellular.
 - (1/3) extracellular (interstitial fluid)
 - 5% blood plasma.
- *edema* = an accumulation of interstitial fluid within tissues.
- Extravascular fluid collection in body cavities:
 - pleural cavity (*hydrothorax*)
 - the pericardial cavity (*hydropericardium*)
 - peritoneal cavity (*hydroperitoneum*, or *ascites*).
- *Anasarca* is severe, generalized edema marked by profound swelling of subcutaneous tissues and accumulation of fluid in body cavities.

Increased Hydrostatic Pressure

Impaired Venous Return

Congestive heart failure; Constrictive pericarditis; Ascites (liver cirrhosis); Venous obstruction or compression; Thrombosis; External pressure (e.g., mass); Lower extremity inactivity with prolonged dependency

Arteriolar Dilation

Heat; Neurohumoral dysregulation

Reduced Plasma Osmotic Pressure (Hypoproteinemia)

**Protein-losing glomerulopathies (nephrotic syndrome)
Liver cirrhosis (ascites); Malnutrition; Protein-losing gastroenteropathy**

Lymphatic Obstruction

Inflammatory; Neoplastic; Postsurgical; Postirradiation

Sodium Retention

**Excessive salt intake with renal insufficiency
Increased tubular reabsorption of sodium
Renal hypoperfusion
Increased renin-angiotensin-aldosterone secretion**

Inflammation

Acute inflammation; Chronic inflammation; Angiogenesis

LYMPHATICS

To thoracic duct and eventually
to left subclavian vein

Hydrostatic pressure

Increased interstitial
fluid pressure

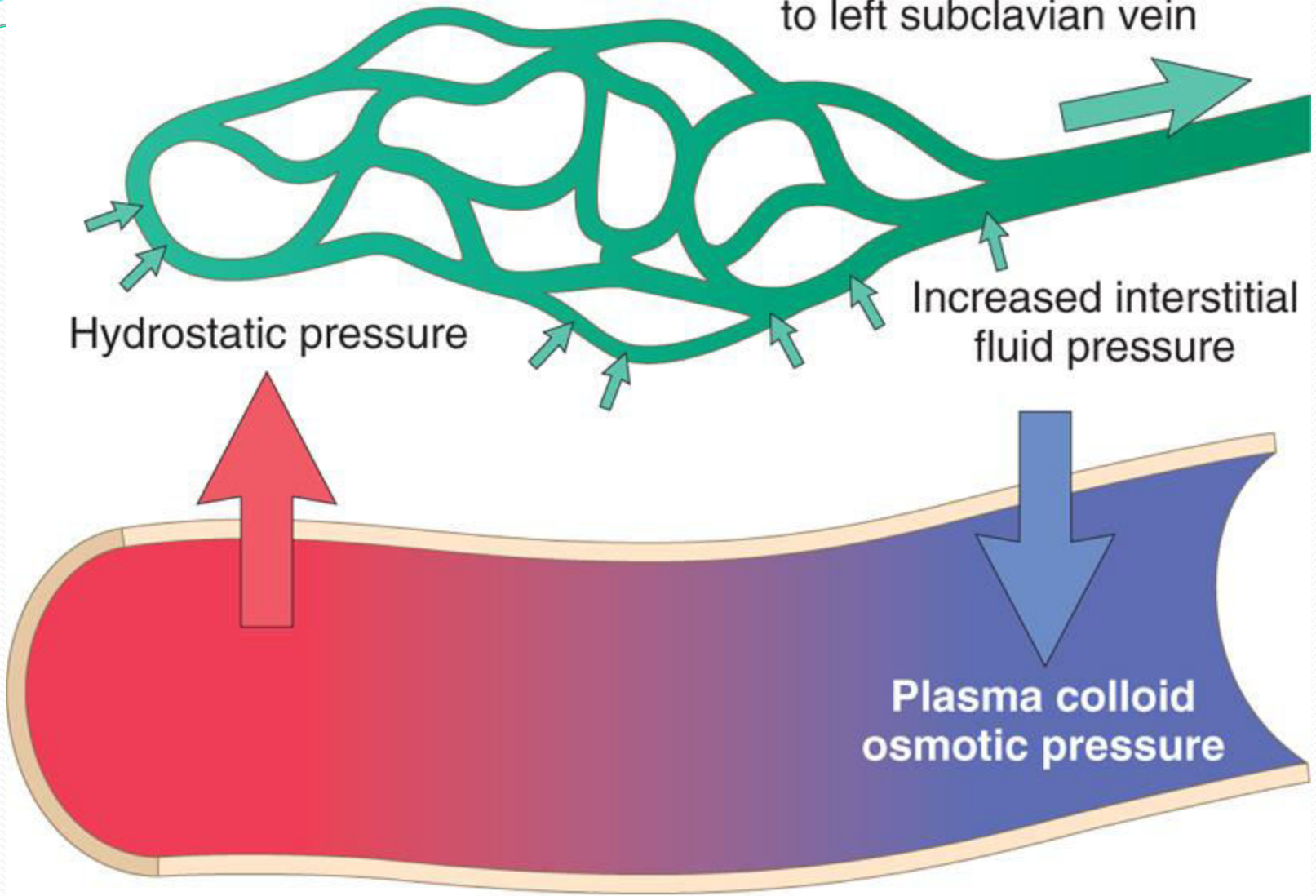
Plasma colloid
osmotic pressure

Arterial end

CAPILLARY BED

Venous end

Kumar et al: Robbins Basic Pathology, 9e.
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Increased Hydrostatic Pressure

- *Local* : -impaired venous return- e.g. DVT
- *Generalized*: -congestive heart failure (most common):
 - reduced cardiac output leads → hypoperfusion of the kidneys → renin-angiotensin-aldosterone axis → sodium and water retention (*secondary hyperaldosteronism*).
 - (vicious circle): fluid retention → increased venous hydrostatic pressures → worsening edema.
 - Treatment of generalized edema:
 - salt restriction
 - diuretics
 - aldosterone antagonists

Reduced Plasma Osmotic Pressure

- common causes:

1- albumin is lost from the circulation

e.g. *nephrotic syndrome* → loss of albumin (and other plasma proteins) in the urine .

2- albumin synthesized in inadequate amounts

e.g. severe liver disease (e.g., *cirrhosis*)

e.g. protein malnutrition

- Unfortunately, increased salt and water retention by the kidney not only fails to correct the plasma volume deficit but also exacerbates the edema, since the primary defect (low serum protein) persists

Lymphatic Obstruction = lymphedema

- *Causes:*

- 1- localized obstruction caused by an inflammation.e.g. *filariasis* (so-called *elephantiasis*)
- 2- neoplastic conditions. E.g. breast cancer: Infiltration and obstruction of superficial lymphatics cause edema of the breast's overlying skin → *peau d'orange* (orange peel).
- 3- post surgical. e.g. breast cancer who undergo axillary lymph node resection and/or irradiation → upper limb lymphedema
- 4- irradiation

Sodium and Water Retention

- leads to edema by increasing hydrostatic pressure (due to expansion of the intravascular volume) and reducing plasma osmotic pressure.
- causes: diseases that compromise **renal** function, including *poststreptococcal glomerulonephritis* and *acute renal failure*

Clinical Correlation

- **Subcutaneous edema:** the most common, is important to recognize primarily because it signals potential underlying cardiac or renal disease
- Can impair wound healing or the clearance of infections.
- **Pulmonary edema**
 - Common causes:
 - left ventricular failure - renal failure - ARDS
 - inflammatory and infectious disorders of the lung.
 - can cause death by interfering with normal ventilatory function & impeding oxygen diffusion
 - creates a favorable environment for infections.
- **Brain edema**
 - is life-threatening → → brain *herniation* (extrude) through the foramen magnum.