



- 12 years old boy presented to paed's opd with hx of generalised swelling of his whole body, clinical exam shows pitting oedema of his feet while urine exam show +3 albumin.

- Nephrotic syndrome

- 35 years old lady having chronic hepatitis c non responder, now is having abdominal distention and peripheral oedema...
u/s abdomen was performed....

- 30 years old lady having chronic small bowel diarrhea, is anaemic, having proximal myopathy, malnourished and having swelling of ankles.....

- 60 years old man known diabetic ,hypertensive.few years back he got acute MI.Now he is short of breath, basal crepts on chest exam ,oedema of his feet...
chest x-rays show..

A blue-tinted photograph of a vast ocean under a cloudy sky. The text "The physiology of edema." is centered in the image.

The physiology of edema.

edema

It is the excess fluid in the tissues/interstitial space.

Edema ([American English](#)) or **oedema** ([British English](#))
from the [Greek](#) *oídēma*, "swelling")

formerly known as **dropsy** or **hydropsy**,

is an abnormal accumulation of fluid in the [interstitium](#),
or in one or more cavities of the body.

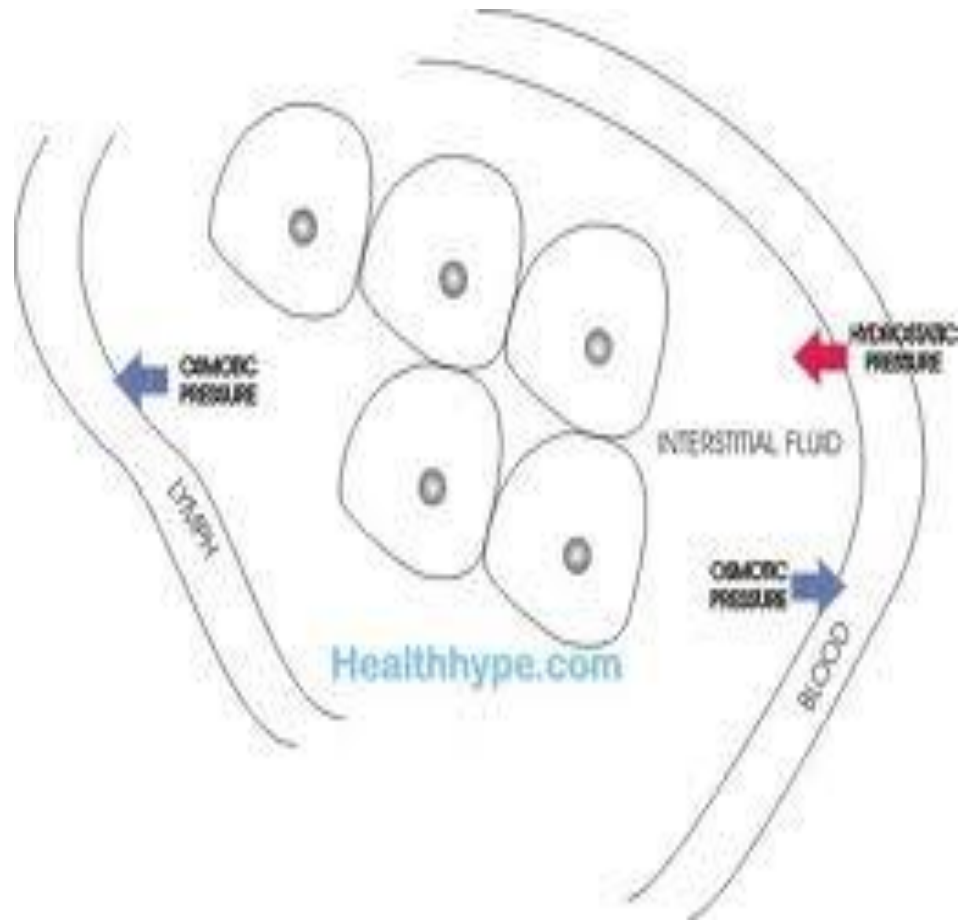
It is clinically shown as [swelling](#).

Generally, the amount of [interstitial fluid](#) is determined
by the balance of fluid [homeostasis](#), and increased
secretion of fluid into the interstitium or impaired
removal of this fluid may cause edema

Causes of Edema

- Edema will occur under these circumstances :
- **Increased hydrostatic pressure** will push fluid out of the vessels into tissue spaces.
- **Reduced osmotic pressure** within the vessels will not pull fluid from the tissue spaces into the vessel.
- **Increased vascular permeability** is when blood vessel wall allows fluid to pass out in interstium.
- **Lymphatic obstruction** . Lymphedema result from impaired lymph pump activity, lymphatic obstruction (e.g., microfilariasis), or surgical removal of lymph nodes, as occurs in the treatment of breast cancer

edema



- Factors that increase capillary filtration.
 1. Increased capillary filtration coefficient.
 2. Increased capillary hydrostatic pressure.
 3. Decreased plasma colloid osmotic pressure.

Clinical Causes of Pedal (Interstitial) Edema

<u>Abnormal Factor</u>	<u>Systemic Causes</u>	<u>Local Causes</u>
<u>Increased Hydrostatic Pressure</u>	<ul style="list-style-type: none"> ● <u>Right Heart Failure</u> 	<ul style="list-style-type: none"> ● Deep Vein Thrombosis ● Iliac Vein Compression by Fibroids ● Iliac Vein Compression by Metastatic Lymph Node Disease
<u>Decreased Oncotic Pressure</u>	<ul style="list-style-type: none"> ● Kwashiorkor (decreased albumin synthesis) ● <u>Liver Cirrhosis</u> (decreased albumin synthesis) ● Protein-losing nephropathy (<u>Nephrotic Syndrome</u>) ● Protein-losing enteropathy (e.g. inflammatory bowel disease) ● Protein-losing dermopathy (e.g. burns, Stevens-Johnson's syndrome) 	
<u>Increased Capillary Permeability</u>	<ul style="list-style-type: none"> ● Sepsis 	<ul style="list-style-type: none"> ● Cellulitis ● Vasculitis
<u>Decreased Lymphatic Drainage</u>		<ul style="list-style-type: none"> ● Elephantiasis ● Lymphangectasia ● Metastatic Lymph Node disease

Edema Terminology

- **Anasarca** is the term for severe generalized edema.
- **Ascites** is the term for excessive fluid accumulation within the peritoneal cavity.
- **Pleural effusion** is the term for fluid in the pleural space.
- **Pericardial effusion** is the term for edema within the pericardial space.
- **Pulmonary edema** is the term for edema within the lungs.
- **Cerebral edema** is the term for edema within the brain.
- **Lymphedema** is the excessive fluid accumulation within tissues because the tissue fluid cannot be drained by the lymphatic vessels in that area.
- **Cardiac edema** is the term for excessive fluid accumulation in tissues due to heart failure.
- **Renal edema** is the excessive fluid accumulation in they body's tissues due to kidney disease or failure.

Pitting and Non-pitting edema

- Pitting edema can be demonstrated by applying pressure to the swollen area by depressing the skin with a finger. If the pressing causes an indentation that persists for some time after the release of the pressure, the edema is referred to as pitting edema.
- In non-pitting edema, which usually affects the legs or arms, pressure that is applied to the skin does not result in a persistent indentation.
- Non-pitting edema can occur in certain disorders of the lymphatic system such as lymphedema, which is a disturbance of the lymphatic circulation that may occur after a mastectomy, lymph node surgery, or congenitally.
- Another cause of non-pitting edema of the legs is called pretibial myxedema, which is a swelling over the shin that occurs in some patients with hyperthyroidism.

Two types of edema

1. Intracellular edema.
2. Extracellular edema

There are 3 causes of intracellular edema

1. Depressed metabolism of the tissues.
2. Lack of nutrition to the cell.
3. Inflammed tissues.



Extracellular edema

causes of extracellular edema are

1. Increased leakage of fluid from the plasma into the interstitial spaces.
2. blockage of the lymphatic's to return fluid from interstitium to the blood.

Causes of extracellular edema

1. Increased capillary pressure

a. Excessive kidney retention of salt and water.

- Acute or chronic renal failure.
- Mineralocorticoid excess.

b. High venous pressure.

- Heart failure
- Venous obstruction.
- Failure of venous pump.
- Paralysis of muscle.
- Immobilized parts of the body.
- Failure of venous valves.

Causes of extracellular edema

2. Decreased plasma proteins.

a. Loss of proteins in urine (nephrotic syndrome).

b. Loss of protein from denuded skin areas.

– burns.

– wounds.

c. Failure to produce proteins.

– Liver disease.

– Severe protein or caloric malnutrition.

Causes of extracellular edema

3. Increased capillary permeability.

- a. Immune reactions that cause release of histamine and other immune products.
- b. toxins.
- c. infections.
- d. Vitamin deficiency especially vitamin c.
- e. Prolong ischemia.
- f. Burns.

Causes of extracellular edema

4. Blockage of lymph return.

- a. Cancer.
- b. Infections (filaria nematodes).
- c. surgery.
- d. Congenital absence or abnormality of lymphatic vessels.

edema



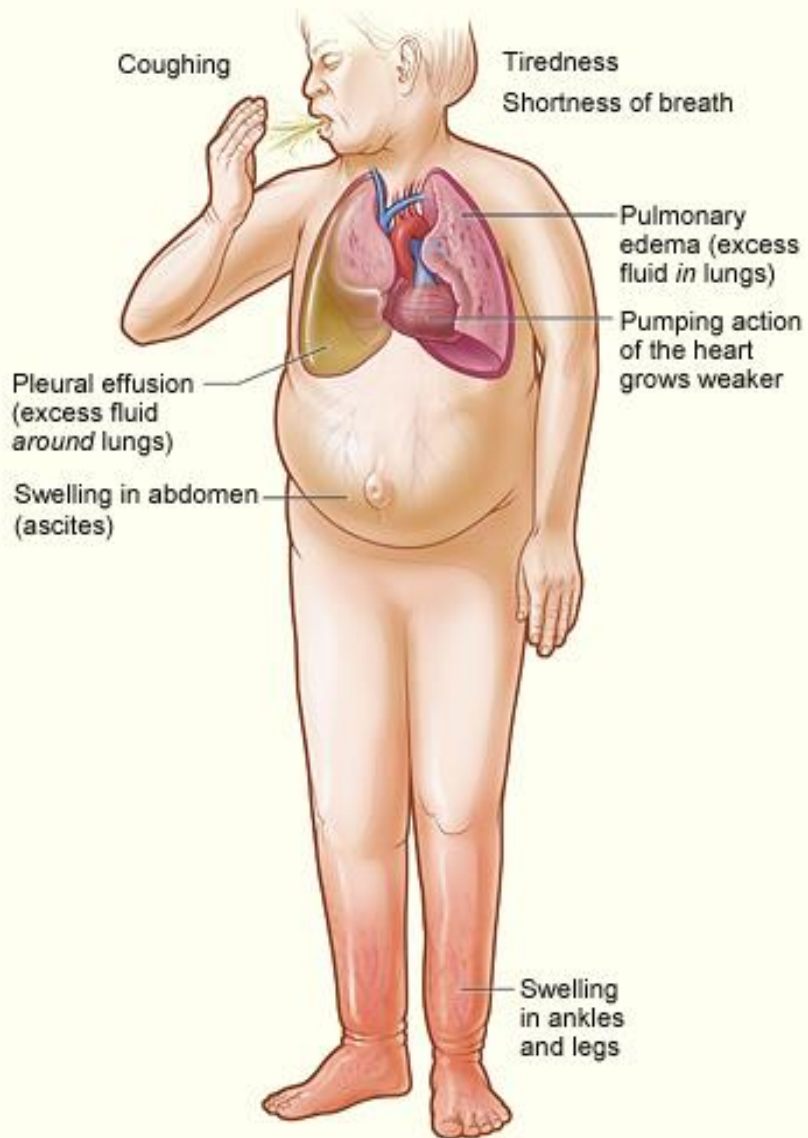
edema



edema



edema





Edema in heart failure

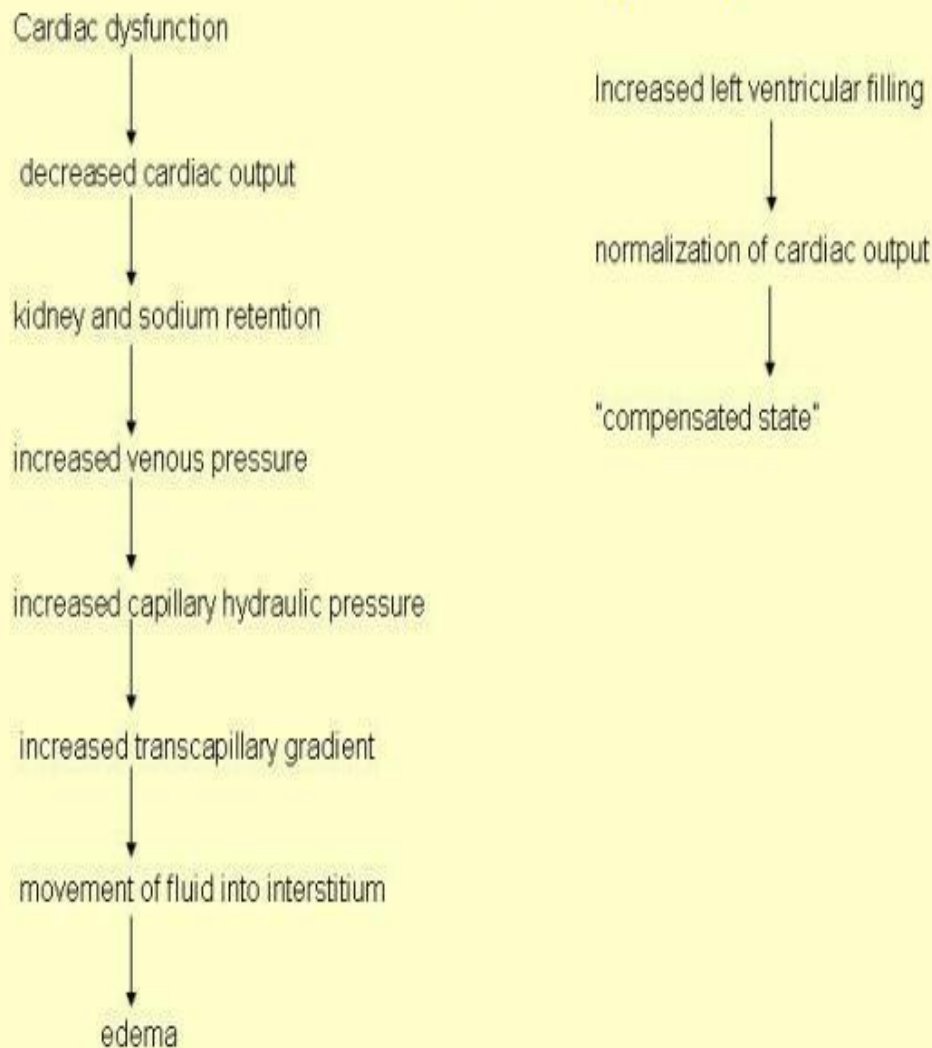
- In heart failure the heart fails to pump the blood into the arteries, the edema in heart failure is by
 1. Increased capillary filtration due to increased venous and capillary hydrostatic pressure.
 2. Decreased excretion of salt and water by the kidney causing increase in blood volume and edema.

Edema in heart failure

3. Increased secretion of renin causing increase formation of angiotensin II and aldosterone. As a result additional water and salt retention occurs by the kidneys.

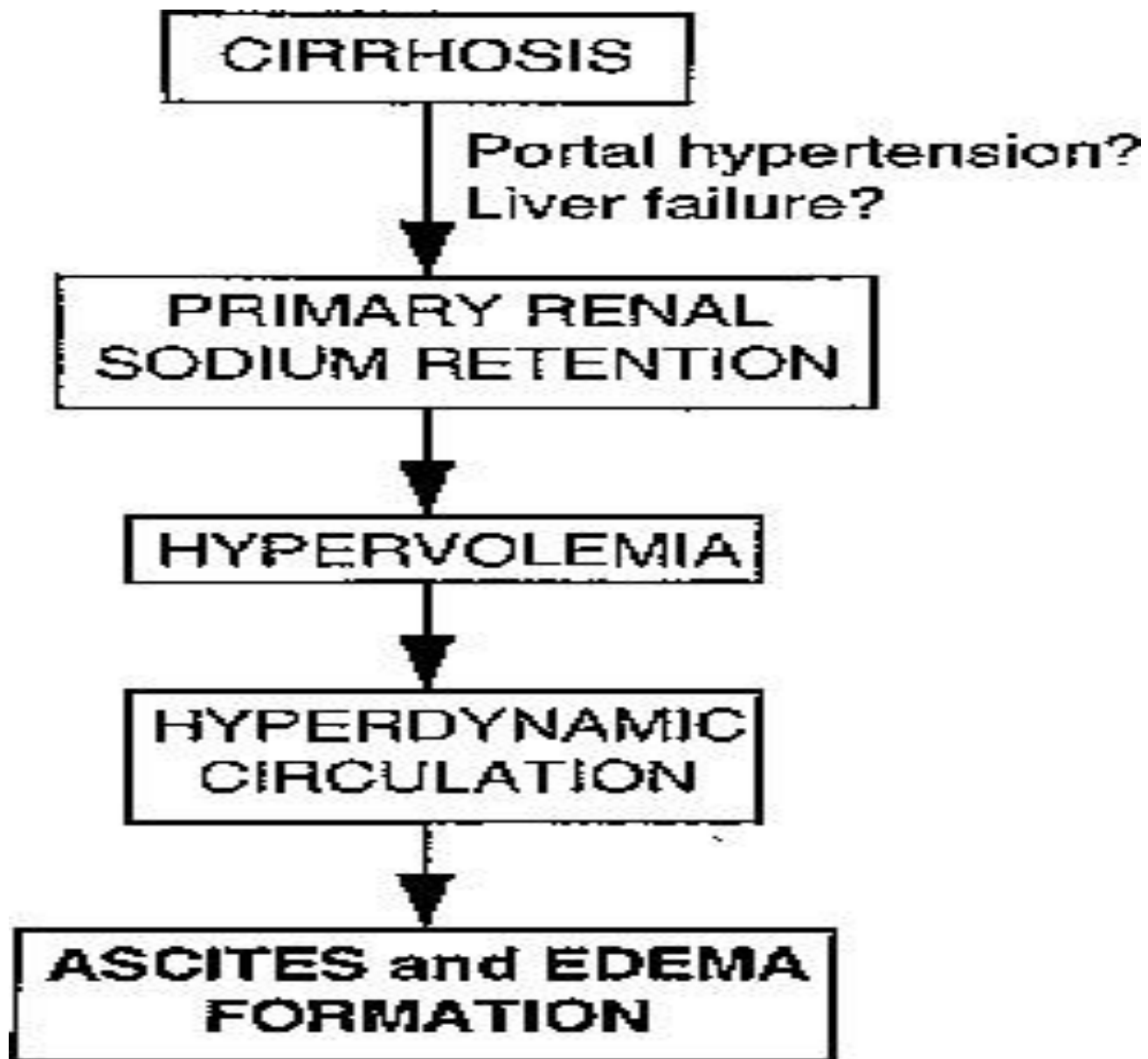
In left heart failure due to weak left heart, the pulmonary pressure rises which cause pulmonary edema. Untreated pulmonary edema results death within hours.

Pathophysiology of edema in heart failure (HF)



Hepatic /renal edema

- In liver disease like cirrhosis, the hepatic cells fail to produce sufficient proteins, leading to decrease plasma colloid osmotic pressure and generalized edema.
- in cirrhosis, there occurs formation of fibrous tissue through the liver parenchyma, which compresses the abdominal portal venous system raising capillary hydrostatic pressure through out the gastro intestinal area, increasing filtration and edema.
- In nephrotic syndrome due to loss of proteins in the urine the plasma colloid osmotic pressure decreases the resultant increase in capillary hydrostatic pressure causes edema.



SAFETY FACTORS THAT PREVENT EDEMA.

Low Tissue compliance in the negative pressure range.... 3mmHg.

Increased Lymphatic flow.....7 mmHg.

Washdown of proteins from the interstitial spaces...7 mmHg

INTERSTITIAL GEL IN PREVENTING EDEMA.

PROTEOGLYCAN FILAMENTS IN PREVENTING RAPID FLOW OF FLUIDS.

