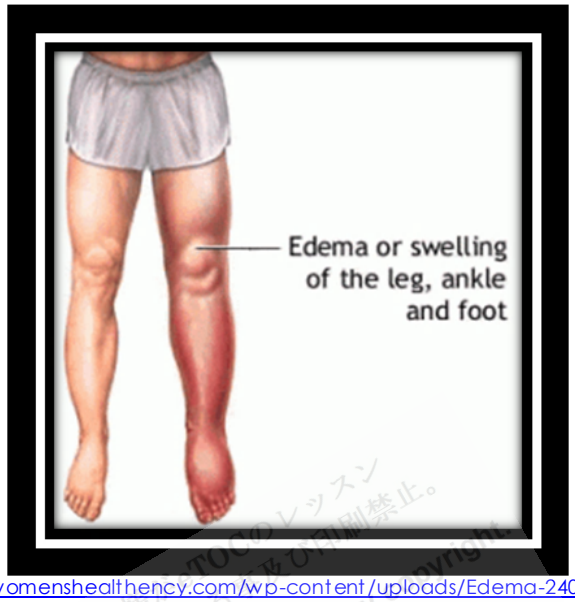
Edema



http://womenshealthency.com/wp-content/uploads/Edema-240x245.gif

Edema is swelling of soft tissues due to increased **interstitial fluid**. The fluid is predominantly water, but protein and cell-rich fluid can accumulate if there is infection or **lymphatic obstruction**.

Edema may be generalized or local (eg, limited to a single **extremity** or part of an extremity). It sometimes appears abruptly; patients complain that an extremity suddenly swells. More often, edema develops **insidiously**, beginning with weight gain, puffy eyes at awakening in the morning, and tight shoes at the end of the day. Slowly developing edema may become massive before patients seek medical care.

Edema itself causes few symptoms other than occasionally a feeling of tightness or fullness; other symptoms are usually related to the underlying disorder. Patients with edema due to heart failure (a common cause) often have dyspnea during exertion, **orthopnea**, and **paroxysmal nocturnal dyspnea**. Patients with edema due to deep **venous thrombosis** (DVT) often have pain.

Edema due to **extracellular fluid** volume expansion is often dependent. Thus, in **ambulatory patients**, edema is in the feet and lower legs; patients requiring bed rest develop edema in the buttocks, genitals, and posterior thighs. Women who lie on only one side may develop edema in the dependent breast. Lymphatic obstruction causes edema **distal** to the site of obstruction.

Pathophysiology

Edema results from increased movement of fluid from the **intravascular** to the **interstitial space** or decreased movement of water from the **interstitium** into the capillaries or lymphatic vessels. The mechanism involves one or more of the following:

- Increased **capillary hydrostatic pressure**
- Decreased **plasma oncotic pressure**
- Increased **capillary permeability**
- Obstruction of the **lymphatic system**

http://www.tabletsmanual.com/img/wiki/edema.jpg

As fluid shifts into the interstitial space, intravascular volume is **depleted**. Intravascular volume depletion activates the renin-angiotensin-aldosterone-ADH system, resulting in renal Na retention. By increasing osmolality, renal Na retention triggers water retention by the kidneys and helps maintain plasma volume. Increased renal Na retention also may be a primary cause of fluid overload and hence edema. Excessive **exogenous Na** intake may also contribute.

Less often, edema results from decreased movement of fluid out of the interstitial space into the capillaries due to lack of adequate plasma oncotic pressure as in **nephrotic syndrome**, **protein-losing enteropathy**, or **starvation**.

Increased capilliary permeability occurs in infections or as the result of toxin or inflammatory damage to the capillary walls.

The lymphatic system is responsible for removing protein and WBCs (along with some water) from the interstitium. Lymphatic obstruction allows these substances to accumulate in the interstitium.

Etiology

Generalized edema is most commonly caused by

- Heart failure
- Liver failure
- Kidney disorders (especially nephrotic syndrome)

Localized edema is most commonly caused by

- DVT or another venous disorder or venous obstruction (eg, by tumor)
- Infection
- **Angioedema**
- Lymphatic obstruction

Chronic venous insufficiency may involve one or both legs.

Common causes are listed by primary mechanism in Table 3: Symptoms of Cardiovascular Disorders: Some Causes of Edema.

Table 3

Some Causes of Edema

Cause	Suggestive Findings	Diagnostic Approach*
Increased hydrostatic pressure, fluid overload		
Heart failure induced by right- or left-sided disease (directly increases venous pressure)	Symmetric, dependent, painless, pitting edema, often with dyspnea during exertion,	Chest x-ray and ECG Usually echocardiography

	orthopnea, and paroxysmal nocturnal dyspnea Commonly, **lung crackles**, S_3 or S_4 gallop or both, and jugular venous distention, hepatojugular reflux, and **Kussmaul sign**	
Pregnancy and **premenstrual state**	Apparent by history	Clinical evaluation
Drugs (eg, minoxidil, NSAIDs, estrogens,fludrocortisone, dihydropyridine,diltiazem, other Ca channel blockers)	Symmetric, dependent, painless, usually mild pitting edema	Clinical evaluation
Iatrogenic (eg, excessive IV fluids)	Apparent by history and medical record	Clinical evaluation
Increased hydrostatic pressure, venous obstruction		
DVT	Acute, nonpitting edema in a single, usually lower extremity, usually with pain;	**Ultrasonography**

	sometimes Homans sign (pain in the calf when the foot is **dorsiflexed**) Redness, warmth, and tenderness; possibly less marked than in soft-tissue infection Sometimes a **predisposing factor** (eg, recent surgery, trauma, immobilization, hormone replacement, cancer)	
Chronic venous insufficiency	Chronic edema in one or both lower extremities, with brownish discoloration, discomfort but not marked pain, and sometimes skin ulcers Often associated with varicose	Clinical evaluation

	veins	
Extrinsic venous compression (by tumor, a gravid uterus, or marked abdominal obesity)	Non-painful, slowly developing edema If tumor compresses the superior vena cava, usually facial plethora, distended neck veins, and absent venous pulse waves above the obstruction	Clinical evaluation Ultrasonography or CT if tumor is suspected
Prolonged absence of skeletal muscle pumping activity on extremity veins	**Bedbound patient** Painless, symmetric, dependent edema	Clinical evaluation
Decreased plasma oncotic pressure†		
Nephrotic syndrome	Diffuse edema, often significant **ascites**, and sometimes **periorbital edema**	24-h urine collection to check for protein loss **Plasma protein assay**
Protein-losing enteropathy	Significant	Testing for cause

	diarrhea	
Reduced **albumin** synthesis (eg, in liver disorders or undernutrition)	Often with significant ascites Causes often apparent by history If cause is a chronic liver disorder, often **jaundice**, spider **angiomas**, **gynecomastia**, palmar **erythema**, and **testicular atrophy**	**Serum albumin**, liver function tests, PT/PTT
Increased capillary permeability		
Angioedema (allergic, idiopathic, hereditary)	Sudden, focal, asymmetric, nondependent, pink or skin-colored edema that is sometimes uncomfortable	Clinical evaluation
Injury (eg, burns, chemicals, toxins, blunt trauma)	Apparent by history	Clinical evaluation
Severe **sepsis** (causing **vascular endothelial leakage**)	Obvious sepsis syndrome with fever, **tachycardia**,	Cultures Imaging studies as needed

	focal infection Painless, symmetrical edema	
Soft-tissue infection (eg, **cellulitis**, **necrotizing myofasciitis**)	If due to cellulitis, usually redder and more painful and tender than that due to angioedema and more circumscribed than that due to DVT With necrotizing infections, severe pain, constitutional symptoms	Clinical evaluation Cultures Sometimes ultrasonography to rule out DVT
Lymphatic obstruction		
Iatrogenic (eg, after lymph node dissection in cancer surgery or after radiation therapy)	Etiology usually apparent by history Initially pitting edema, with fibrosis developing later	Clinical evaluation
Congenital (rare)	Often onset in childhood, but for some types, only	Sometimes lymphoscintigraphy

	later onset	
Lymphatic filariasis	History of being in an endemic area in a developing country Usually focal edema, sometimes involving the genitals	Microscopic examination of **blood smear**

- *Most patients with generalized edema require CBC, electrolytes, BUN, creatinine, liver function tests, serum protein measurement, **urinalysis** (to check for proteinuria), and sometimes measurement of **plasma** and urine **oncotic pressure**.
- †Decreased plasma oncotic pressure often triggers secondary Na and water retention, leading to fluid overload.
- DVT = deep venous thrombosis; S_3 = 3rd heart sound; S_4 = 4th heart sound.

Evaluation

History: **History of present illness** should include location and duration of edema and presence and degree of pain or discomfort. Female patients should be asked whether they are pregnant and whether edema seems related to menstrual periods. Having patients with chronic edema keep a log of weight gain or loss is valuable.

Review of systems should include symptoms of causative disorders, including dyspnea during exertion, orthopnea, and paroxysmal nocturnal dyspnea (heart failure); alcohol or **hepatotoxin exposure**, jaundice, and easy bruising (a liver disorder); **malaise** and **anorexia** (cancer or a liver or kidney disorder); and immobilization, extremity injury, or recent surgery (DVT).

Past medical history should include any disorders known to cause edema, including heart, liver, and kidney disorders and cancer (including any related surgery or radiation therapy). The history should also include predisposing conditions for these causes, including **streptococcal infection**, recent viral

infection (eg, **hepatitis**), chronic alcohol abuse, and **hypercoagulable disorders**. Drug history should include specific questions about drugs known to cause. Patients are asked about the amount of Na used in cooking and at the table.

Physical examination: The area of edema is identified and examined for extent, warmth, **erythema**, and tenderness; symmetry or lack of it is noted. Presence and degree of pitting (visible and palpable depressions caused by pressure from the examiner's fingers on the edematous area, which displaces the interstitial fluid) are noted.

In the general examination, the skin is inspected for jaundice, bruising, and **spider angiomas** (suggesting a liver disorder).

Lungs are examined for dullness to percussion, reduced or exaggerated breath sounds, crackles, **rhonchi**, and **pleural friction rub**.

The internal jugular vein height, waveform, and reflux are noted.

The heart is **palpated for thrills**, **thrust**, **parasternal lift**, and **asynchronous abnormal systolic bulge**. Auscultation for loud P_2, 3rd (S_3) or 4th (S_4) heart sounds, murmurs, and pericardial rub or knock is done; all suggest cardiac origin.

The abdomen is inspected, palpated, and percussed for ascites, **hepatomegaly**, and **splenomegaly** to check for a liver disorder or heart failure. The kidneys are palpated, and the bladder is percussed. An abnormal abdominal mass, if present, should be palpated.

Red flags: Certain findings raise suspicion of a more serious etiology of edema:

- Sudden onset
- Significant pain
- Shortness of breath
- History of a heart disorder or an abnormal cardiac examination
- Hemoptysis, dyspnea, or pleural friction rub
- Hepatomegaly, jaundice, ascites, splenomegaly, or **hematemesis**
- Unilateral leg swelling with tenderness

Interpretation of findings: Potential acute life threats, which typically manifest with sudden onset of focal edema, must be identified. Such a presentation

suggests acute DVT, soft-tissue infection, or **angioedema**. Acute DVT may lead to pulmonary embolism (PE), which can be fatal. Soft-tissue infections range from minor to life threatening, depending on the infecting organism and the patient's health. Acute angioedema sometimes progresses to involve the airway, with serious consequences.

Dyspnea may occur with edema due to heart failure, DVT if PE has occurred, acute respiratory distress syndrome, or angioedema that involves the airways.

Generalized, slowly developing edema suggests a chronic heart, kidney, or liver disorder. Although these disorders can also be life threatening, complications tend to take much longer to develop.

These factors and other clinical features help suggest the cause.

Testing: For most patients with generalized edema, testing should include CBC, serum electrolytes, BUN, creatinine, liver function tests, serum protein, and urinalysis (particularly noting the presence of protein and microscopic hematuria). Other tests should be done based on the suspected cause -- eg, **brain natriuretic peptide (BNP)** for suspected heart failure or **D-dimer** for suspected PE.

Patients with isolated lower-extremity swelling should usually have venous obstruction excluded by ultrasonography.

http://www.biogetica.com/prods/edema-treatments.jpg

Treatment

Specific causes are treated.

Patients with Na retention often benefit from restriction of dietary Na. Patients with heart failure should eliminate salt in cooking and at the table and avoid prepared foods with added salt. Patients with advanced cirrhosis or nephrotic syndrome often require more severe Na restriction (≤ 1 g/day). K salts are often substituted for Na salts to make Na restriction tolerable; however, care should be taken, especially in patients receiving K-sparing **diuretics**, ACE inhibitors, or **angiotensin receptor blockers** and in those with a kidney disorder because potentially fatal **hyperkalemia** can result.

People with conditions involving Na retention may also benefit from loop or **thiazide diuretics**. However, diuretics should not be given only to improve the appearance caused by edema. When diuretics are used, K wasting can be dangerous in some patients; K-sparing diuretics (eg, amiloride, triamterene, spironolactone, eplerenone) inhibit Na reabsorption in the distal nephron and collecting duct. When used alone, they modestly increase Na excretion. Both triamterene and amiloride have been combined with a thiazide to prevent K wasting. An ACE inhibitor–thiazide combination also reduces K wasting.

http://slism.com/wpsystem/wp-content/uploads/easy-edema-treatment-01.gif

Geriatrics Essentials

In the elderly, use of drugs that treat causes of edema requires special caution, such as the following:

- Starting doses low and evaluating patients thoroughly when the dose is changed
- Monitoring for orthostatic hypotension if diuretics, ACE inhibitors, angiotensin receptor blockers, or β-blockers are used
- Evaluating for **bradycardia** or heart block if **digoxin**, rate-limiting Ca channel blockers, or β-blockers are used
- Frequently testing for **hypokalemia** or **hyperkalemia**
- Not stopping Ca channel blockers because of pedal edema, which is benign

Logging daily weight helps in monitoring clinical improvement or deterioration immensely.

Key Points

- Edema may result from a generalized or local process.

- Main causes of generalized edema are chronic heart, liver, and kidney disorders.
- Sudden onset should trigger prompt evaluation.
- Edema may occur anywhere in the body, including the brain.
- Not all edema is harmful; consequences depend mainly on the cause.

Reference: http://www.merckmanuals.com