Hyperemia & Congestion
(Web Review module)
Hyperemia and Congestion

- both terms indicate a local increase in blood within a tissue
Hyperemia and Congestion

**Hyperemia - active**
- increased blood going into tissue
- oxygenated (red)

**Congestion - passive**
- decreased outflow of blood
- not oxygenated (blue)
Hyperemia

- active engorgement of vascular beds due to increased arteriolar inflow

Appearance
- tissue red (oxygenated Hb) and warm

[Diagram showing increased inflow with labels: Increased inflow, (e.g., exercise, inflammation), HYPEREMIA Erythema]
Hyperemia

Physiologic

- digestion
- exercise
- dissipate heat
- neurovascular (blushing)
Pathological

- result of an underlying pathologic process (usually inflammation)
- arteriolar dilation in response to inflammatory stimuli / mediators
- is a **cardinal sign of inflammation** = “Hyperemia of Inflammation”
- often see associated edema
Hyperemia of the conjunctiva in a fish and human

Hyperemia of segment of small intestine in a cat with parvoviral enteritis
Congestion

- passive engorgement of vascular beds due to decreased blood outflow

Appearance

- tissue dark red to blue / black (cyanotic) due poorly oxygenated Hb
**Congestion**

**Gross**

- dark red to blue / black $\rightarrow$ depending on degree of stagnation
- cut surfaces ooze blood and often wet (accompanying edema)

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**Gastric volvulus (torsion) in a dog** $\rightarrow$ twisting of vessels $\rightarrow$ obstructs gastric portion of portal venous system $\rightarrow$ severe venous congestion (acute, local, congestion) $\rightarrow$ ischemia (necrosis) $\rightarrow$ loss of endothelial integrity $\rightarrow$ hemorrhage $\rightarrow$ shock $\rightarrow$ death

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Fig. 13-47A (McGavin) Congested bloody spleen. This condition occurs secondary to compromises in vascular flow into and out of the spleen (e.g., torsion), from intravenous barbiturates (e.g., euthanasia or anesthesia), and from acute hyperemia from septicemia.
**Histopathology**

**Acute**
- engorged capillaries
- some edema

**Chronic**
- hypoxia ($\downarrow O_2$)
  - atrophy
  - degeneration / necrosis
Two factors used to define types of congestion

1. **Duration**
   a. Acute (sudden)
   b. Chronic (long-term)

2. **Extent**
   a. Localized – change confined to a discrete area
   b. Generalized - indicates systemic change (e.g., cardiac failure)
Localized Congestion

Congestion of segments of small intestine – intussusception (right) and intestinal vovulus / mesenteric torsion (below)
Acute Generalized Congestion

- sudden death due to heart failure or euthanasia with barbiturates
- blood accumulates in lung, spleen and liver
Congestion

- often associated with pathology in heart or lungs

Left-sided Heart Failure
- congestion (& edema) of lungs
Pulmonary Congestion

- usually due to left heart failure
- when acute → lungs are red (congestion), wet (edema) and heavy

**Fig. 9-36 (McGavin) Acute pulmonary congestion, lungs, dog.** The lung parenchyma is red because of congestion of pulmonary vasculature and alveolar capillaries.

Capillaries in alveolar wall are distended with blood (ie congested). Also note the edema (most visible in the top right photo where it is protein-rich) and red cells within the alveolar spaces.
Chronic Pulmonary Congestion

- with chronicity, lungs can be lightly tan colored (due to hemosiderin accumulation)
Consequences of chronicity:

1. Intra-alveolar hemorrhages
   • “heart failure cells”

2. Pulmonary edema

3. Interstitial Fibrosis
   • ↑ capillary pressure

4. Pulmonary hypertension
   • ↑ pressure in pulm. art.
   (cor pulmonale)

Note “heart failure cells” ie alveolar macrophages with abundant brown granular cytoplasmic pigment (hemosiderin) on H&E (above) and which stains positive for iron with Prussian blue staining (below)
Congestion

Right-sided Heart Failure

- systemic congestion (esp liver) & edema (eg subQ, ascites, hydrothorax)
Lung

• certain types of lung disease ➔ progressive damage of pulmonary vascular bed ➔ increased resistance / pulmonary hypertension ➔ right heart failure

• cor pulmonale = right heart failure resulting from pulmonary disease
Hepatic Congestion

Causes

- mostly due to diseases of the right side of the heart
- occasionally secondary to pulmonary hypertension (ie cor pulmonale)
Hepatic Congestion

Gross appearance

- liver is enlarged with rounded edges and dark red-brown
Hepatic Congestion

Gross appearance

- cut surface has reticular / zonal appearance ("Nutmeg liver")
1 = caudal vena cava
21 = hepatic veins
38 = portal vein
Histopathology

Acute

- Zone 3 - congested sinusoids and hepatocyte degeneration / necrosis / loss
- Zone 2 - fatty change (partial hypoxia)
- Zone 1 - relatively normal

Acute hepatic congestion,
Note the marked congestion of the sinusoids in the centrolobular (zone 3) region and the lipidosis (fatty degeneration) of the hepatocytes at the margin of the congestion in zone 2.
Histopathology
Acute hepatic congestion, Higher magnification showing the marked dilation and congestion of the sinusoids in the centrolobular (zone 3) region, with loss of hepatocytes and the lipidosis of the hepatocytes at the margin of the congestion
Chronic Hepatic Congestion

Histopathology

Chronic

- hemosiderin within macrophages (kupffer cells)
- in zone 3 hepatocyte loss &/or atrophy and dilated sinusoids
- increased connective tissue around central veins

Fig. 8-36 (McGavin) Chronic passive congestion, liver, dog. The liver is firm because of hepatic fibrosis that is most severe in centrilobular areas (arrows). The central vein is surrounded by a mild amount of connective tissue from which fine fibrous septa extend out into the lobule. Note the macrophages containing hemosiderin, the result of erythrocyte breakdown in this area as a result of chronic congestion. H&E stain.
Hemorrhage Vs Hyperemia/Congestion

**Congestion / Hyperemia** – rbc’s are within the blood vessels (asterisks)

**Hemorrhage** – rbc’s are outside vessels (arrows)