CARDIOVASCULAR - 3

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HEART FAILURE

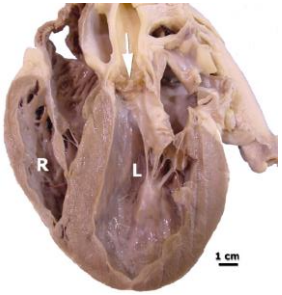
- The ability of the heart to respond to circulatory demands over and above those of the animal at rest is referred to as the **cardiac reserve**.
- Any cardiac lesion which impairs the efficiency of the heart, reduces the cardiac reserve.
- When the cardiac reserve is exhausted and the circulatory requirements at rest can no longer be met **"congestive heart failure"** ensues**.**
- Myocardium is no longer able to compensate for increase in workload.

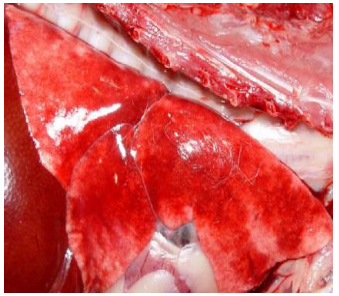
- Components of the cardiac reserve
  - Increased rate of contraction
  - increased stroke volume
- In cardiac failure
  - coordinated sympathetic nervous system stimulation occur
  - with reciprocal parasympathetic inhibition.
    - Sympathetic stimulation
      - increases the force of myocardial contractions
      - increases the tone in most of the blood vessels of the body
- One side heart failure – second side HF also

LEFT-SIDED HEART FAILURE

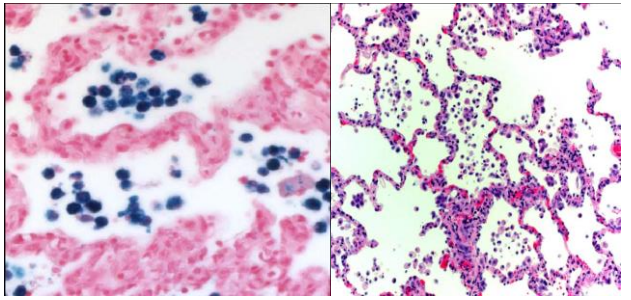
- Clinical signs — primarily pulmonary **(lungs),**
  - dyspnoea on exertion
  - cough
  - orthopnea.
- Common causes
  - myocarditis,
  - degeneration of the myocardium,
  - stenosis and insufficiency of the **mitral** and **semilunar valves**
  - congenital heart diseases.

LEFT-SIDED HEART FAILURE





LEFT-SIDED HEART FAILURE



LEFT-SIDED HEART FAILURE

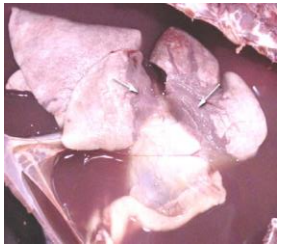
- Progressive **dilatation of the left ventricle and atrium** which may be followed by left ventricular and atrial hypertrophy**.**
- **Pulmonary (lung)** congestion, edema and induration**.**
- Reduction in pulmonary vital capacity and impaired gaseous exchange result in **hypoxic** stimulation of the **carotid sinus**.
- Eventually, right heart failure develops subsequent to increased pulmonary resistance and increased pressure in the pulmonary artery
- Coughing in dog — most distinctive and alarming feature

RIGHT-SIDED HEART FAILURE

- Clinical signs
  - manifestations by generalized venous congestion,
  - Include
    - » distention of the jugular and other superficial veins,
    - » liver and spleen enlargement,
    - » accumulation of fluid in serous cavities and in tissues **(generalized edema).**

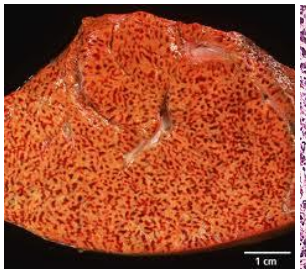
RIGHT-SIDED HEART FAILURE

Hydroperitoneum



Hydrothorax

RIGHT-SIDED HEART FAILURE (NUT-MEG Liver)



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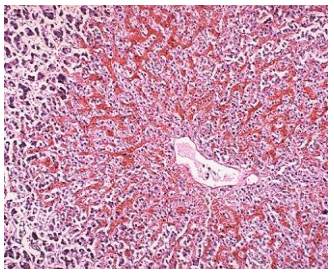


http://library.med.utah.edu/WebPath/LIVEHTML/LIVER042.html

RIGHT-SIDED HEART FAILURE

- **Common causes**
  - left-sided heart failure,
  - myocardial degeneration,
  - myocarditis,
  - factors that cause increased pulmonary resistance,
  - hydropericardium,
  - exudative pericarditis,
  - endocarditis
  - defective tricuspid and semilunar valves.
- Progressive **dilatation** of the right ventricle and atrium which may be followed by **right ventricular** and **atrial hypertrophy.**

- blood accumulates in the vena cava
  - leading to generalized venous congestion.
  - Centrilobular congestion, degeneration, necrosis, and fibrosis of the liver.
  - Splenic red pulp becomes engorged,
  - generalized edema **(ascites, etc.).**
  - Eventually, right heart failure
  - Generalized edema is a prominent feature
    - In the horse and cow, a dependent subcutaneous edema
    - subcutaneous oedema is scant or absent in other species.
    - In the dog, odemal in the peritoneal cavity **(ascites)**

HEART FAILURE

RIGHT-SIDED HEART FAILURE

- whereas in the cat, it is in the thorax **(hydrothorax).**
- **Cor pulmonale** — heart failure due to lung disease

HYPERTROPHY AND DILATATION

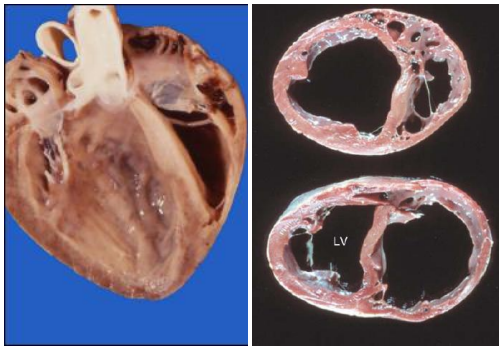
- Myocardial hypertrophy is an increase in bulk of cardiac muscle due to an increase in size of component fibers.
  - **SIMPLE** HYPERTROPHY
    - » hypertrophy in the absence of dilatation.
  - **ECCENTRIC** HYPERTROPHY
    - » both hypertrophy and dilatation of the heart.
  - **CONCENTRIC** HYPERTROPHY
    - » hypertrophy results in a decrease in size of the heart chambers.

- Hypertrophy affects
  - the left heart more frequently than the right
  - the ventricles more frequently than the atria.
- Hypertrophy of the **right heart makes the heart broader at the base**
- Hypertrophy of the **left heart increases the organ length.**
- **Bilateral hypertrophy results in a more rounded shape than normal.**
- Grossly,
  - increased thickness and
  - rubbery firmness

HYPERTROPHY AND DILATATION

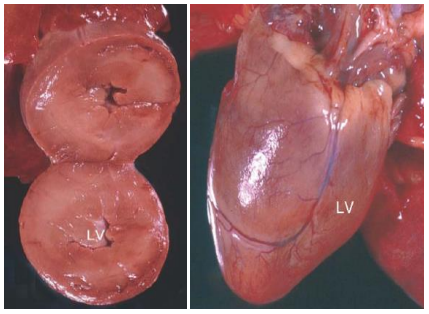
- Cardiac dilatation may involve one or both chambers of the heart.
  - Grossly,
    - the dilated heart is globose (spherical) shaped,
    - the walls are soft, pliable, and thin.
- Endocardium is usually diffusely thickened and opaque.

DILATATION



Ventricular Dilatation

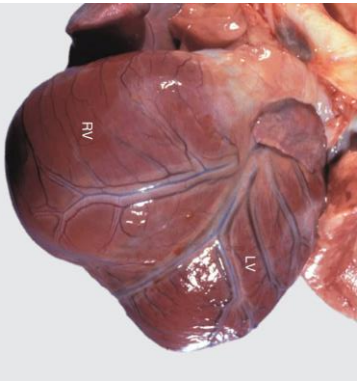
HYPERTROPHY AND DILATATION



Left Ventricular Hypertrophy

HYPERTROPHY AND DILATATION

Right Ventricular Hypertrophy and Dilatation



HIGH ALTITUDE DISEASE OF CATTLE

(Bovine High Mountain Disease, Brisket Disease and Pulmonary Hypertensive Heart Disease)

- Develops subsequent to **chronic hypoxia** in lungs that causes increased pulmonary vascular resistance and increased pulmonary arterial pressure.
- The disease is characterized by dilatation and hypertrophy of the **right ventricle** and **atrium** with the ultimate development of cardiac decompensation and signs related to "**congestive heart failure**"
- Affected cattle reside at usually **above 5,000 feet.**
- There is a failure of the cardio-respiratory system to adjust to the chronic anoxia.

HIGH ALTITUDE DISEASE OF CATTLE

- The disease usually develops **slowly** and **generalized edema** is a prominent feature.
- Oedematous swelling in the ventral pectoral region is responsible for the term **"brisket disease."**
- Due to chronic venous congestion, liver lesions may vary from early **"nutmeg"** appearance to severe centri-lobular fibrosis.
- The **lungs** exhibit varying degrees of **atelectasis** and **emphysema**.
- Microscopically, **hypertrophy of the media of small pulmonary arteries** may be observed.

HIGH ALTITUDE DISEASE OF CATTLE

- **Young** cattle are more susceptible than adults
- morbidity rate is highest in animals exposed to high altitudes for the **first time** after 3-4 weeks.
- Pleural effusion and ascites are usually abundant.
- Marked distention and pulsation of the jugular veins are usually prominent.
- Appetite may be decreased.
- Profuse diarrhea may develop as a result of intestinal venous hypertension. Respiration is labored, and animals may appear cyanotic.

HIGH ALTITUDE DISEASE OF CATTLE

- With forced exertion, severely affected animals may collapse and die.
- In the terminal stages, the animal is often anorexic, recumbent, and unable to rise.
- animals transported from low altitudes to above **5,000 feet**, the incidence of severe pulmonary hypertension may not affect more than **2% of animals.**
- Ascites, hydrothorax, and hydropericardium are consistent findings.

References

- Jubb, Kennedy & Palmer's, 2007. Pathology of Domestic Animals (Fifth Edition). Saunders Ltd.
- McGavin, MD and JF Zachary, 2006. Pathologic basis of Veterinary Disease, 4th Edition. Mosby Elsevier, Elsevier Health Sciences