DISEASES OF THE ENDOCARDIUM

Endocardial Factoids

1. Innermost layer of heart
2. Atrial endocardium thicker than ventricular
3. Purkinje fibers are distributed throughout the ventricular subendocardium
4. Primary endocardial disease
   − Not common
   − Non-inflammatory
   − Cause not known
   − Examples
     • Endocardial fibroelastosis
     • Endocardiosis
Endocardial fibroelastosis

• Causes
  – Familial disease in the Burmese cat
  – Viral infections
  – parvovirus (dog)
  – Encephalomyocarditis virus (man, mouse, pig)
  – Hypoxemia
  – Trauma
  – Extreme dilatation of ventricular chamber
Endocardial fibroelastosis

- **Pathogenesis**
  - Progressive edema of endocardium
  - Fibroblast proliferation
  - Increased amount of collagen and elastin within +/- immediately beneath endocardium.

May restrict cardiac output and lead to CHF.
May incarcerate subendocardial Purkinje fibers - left bundle branch block
Form of Restrictive Cardiomyopathy
Focal Subendocardial Fibroelastosis

- When See in Atria
- “Jet Lesions”
- Look for Abnormal Valve!

Believed to be a reaction of endocardium to abnormal jets of blood or to turbulence following congenital or acquired valvular disorders.

7-yr-old St Bernard - healed mitral endocarditis, endocardial fibroelastosis and myocardial infarcts
Myxomatous Valve Disease
Valvular Endocardiosis

• Synonyms:
  – Chronic valvular fibrosis
  – Valvular mucoid degeneration
  – Myxomatous degeneration of the valves
  – Myxomatous transformation of the atrioventricular valves
Valvular Endocardiosis

- **Pathogenesis:**
  - Degenerative lesion
  - Characterized by proliferations of loose, fibroblastic tissue in the spongiosa
  - Deposits of acid mucopolysaccharides
  - Collagen within the fibrosoa region of valve becomes degenerative
  - Genetic predisposition
Valvular Endocardiosis
Lesions

• Gross

Histo

NOTE: Not Inflammation!!!
Valvular Endocardiosis

• **Incidence:**
  – Occurs most frequently in dogs > 5 yr
  – Males > females
  – Cavalier King Charles spaniel
    • > 50% affected at 4 years
    • 100% at 10 years
  – Cocker spaniels more commonly than expected
  – German Shepherds less commonly than expected
  – In one study of 4831 dogs, 11.3% had cardiac disease. Of these 11.3%, 72% had endocardiosis (ie: common disease)
  – Breeds:
    • Beagles, Dachshund, Poodle, Schnauzer, Chihuahua, Fox terrier, Boston terrier, Pekinese, Wolfhound, Deerhound and Doberman pinscher
Valvular Endocardiosis

- Valves affected
  - Left atrioventricular alone 85%
  - LAV and RAV 15%
  - Aortic valve may be affected with LAV +/- RAV
Valvular Endocardiosis

Sequela

A. Valvular insufficiency - resulting in volume overload
   LVH  ➔  LVF  ➔  Congestive Heart Failure

B. Rupture of chordae tendinae acute left heart failure
   pulmonary edema  death

C. Chronic left heart failure --- pulmonary fibrosis

D. Rupture of left atrium --- cardiac tamponade
Blood Cysts

- **Synonyms**
  - Hematocyst
  - Valvular Hematomas
  - Hemocyst/lymphocyst

- **Incidence**
  - Occurs on AV valves

- **Significance**
  - Incidental finding

- **Species affected**
  - Calves
  - Foals
  - Puppies
Secondary Endocardial Disease

- Definition = Disease of the endocardium resulting from metabolic, toxic, infectious, or neoplastic disease
Mineralization

• **Pathogenesis**
  – Endocardium is susceptible to mineralization because of high elastin content.

• **Lesions:**
  – **Gross:** White, elevated, firm gritty plaques which are granular and generally subendocardial in location
Mineralization

• Lesions
  – Micro:
    Accumulations of basophilic, acellular material usually with little or no inflammatory cells
Mineralization

• Causes:
  – Any disease leading to an imbalance of Ca:P ratio

  – **Endocrine/Metabolic Diseases**
    • Pseudohyperparathyroidism
    • Hyperphosphatemia
    • Nutritional (excess phosphate diet)
    • Renal failure

  – **Toxic Substances**
    • Vitamin D poisoning
      – Plants containing Vitamin D analogs
        » "Manchester wasting disease" Jamaica
        » "Naalehu disease" Hawaii
        » "Entique Seco" Argentina
        » Plants in potato family

  – **Miscellaneous Causes**
    • Endocardial fibrosis when chambers are acutely dilated
    • Chronic debilitating disease, ruminants
    • Jet lesions – can become mineralized
Endocarditis  

**Infectious Agents**

- **Definition**
  - Inflammation of the endocardium
  - Usually bacterial in origin
- **Valvular Endocarditis**
  - Most common
  - Usually valves are affected
    - valvular endocarditis
Endocarditis

Infectious Agents

- **Mural Endocarditis**
  - Less common
  - Involvement of the non-valvular endocardium
Endocarditis

Pathogenesis

• Valves may be predisposed
  – Lack of blood supply
  – Nutrition and immune effector cells come primarily from passing blood
  – Continual trauma predisposes valves

• How bacteria lodge on valves not clear
  – Bacteria tend to localize along appositional surfaces
    – Mitral > Aortic > Tricuspid > Pulmonary
Endocarditis

**Etiology**

- **PIG**
  - *Erysipelothrix rhusiopathiae*
    - Usually LAV
  - *Strep suis* LAV +/- aortic valve
  - *Staph aureus*

- **COW & SHEEP**
  - *Arcanobacterium pyogenes*
    - Mastitis, metritis, and or hepatic abscesses
  - *Strep sp*
    - Lambs - polyarthritis
Endocarditis

Etiology

• HORSE
  – *Streptococcus equi*
  – *Actinobacillus equuli*
  – *E. coli*
  – *Pseudomonas aeruginosa*

• CAT & DOG
  – beta hemolytic *Streptococcus sp*
  – *Erysipelothrix rhusiopathiae*
  – *Bartonella* species (dog)
Endocarditis

Lesions

• Gross:
  – proliferative lesions (vegetations)
Endocarditis

Lesions

- Micro:
  - Bacterial colonies are numerous.
  - Accumulations of fibrin, neutrophils and variable amounts of granulation material dependent upon the length of time the lesion has been present.
Endocarditis

Sequela

• **Chronic lesions**
  – Organize by granulation from the base of the valve
  – May undergo mineralization
  – Complete resolution is uncommon

• **Right Heart**
  – Valvular distortion = right heart failure
  – Pulmonary thrombosis and abscessation (embolic pneumonia)
Endocarditis

Sequela

Left Heart

• Valvular distortion leading to left heart failure
• Thromboemboli
  – Kidney
  – Spleen
  – Myocardium
  – Brain
  – Joints
• Ruptured chordae tendinae
• Inflammatory induced septal defects or pericarditis can occur
  – Not Common
Endocardial Pathology

Miscellaneous

• Uremia (usually acute)
  – **Uremic Endocarditis**
  – Causes endocardial necrosis, inflammation, mineralization and thrombosis
    • Left atrium
  – Exact mechanism unknown
Endocardial Pathology

Miscellaneous

- **Subendocardial hemorrhage**
  - Bacterial septicemias
  - Bluetongue (sheep)
    - Hemorrhage at base of pulmonary artery
  - Infectious canine hepatitis
  - Toxemias – ruminants
  - Agonal findings
    - Especially adult cattle
Endocardial Pathology

Miscellaneous

• **Atrial thrombosis**
  – Seen in cat
    • Often associated with cardiomyopathies
  – Failing hearts
  – Laboratory animals

• **Strongylus vulgaris** larvae
  – Rarely migrate aberrantly through the endocardium

• Mycotic infections are rare