

**MJF COLLEGE OF VETERINARY AND ANIMAL SCIENCE,  
CHOMU, JAIPUR**



**DEPARTMENT OF VETERINARY PATHOLOGY**

# PATHOLOGY OF RESPIRATORY SYSTEM

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- Pathology of upper respiratory passage

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- Nasal granuloma
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- Pathology of lungs

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- Pneumonia

- Pulmonary adenomatosis

- Hypersensitivity
- pneumonitis
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- Pathology of air sacs

- Air sacculitis

- Pathology of pleura

- Pleuritis

# PATHOLOGY OF UPPER RESPIRATORY TRACT

- *Rhinitis* is the inflammation of nasal mucosa of upper respiratory passage
- Nasal discharge
  - Catarrhal
  - Purulent
  - Fibrinous
- Infection may extend to lower part of respiratory tract and reach in lungs



# PATHOLOGY OF UPPER RESPIRATORY TRACT

- Rhinitis (porcine atrophic rhinitis)
  - *Bordetella bronchiseptica* in pigs
  - Mucopurulent exudate
  - Disappearance of nasal septum
  - Retarded growth of snout
  - Plugging of passage by solidified exudate and dead tissue

# PATHOLOGY OF UPPER RESPIRATORY TRACT

- *Epistaxis* is bleeding from nasal passage due to trauma, neoplasm and ulcerative lesions as a result of infections
- *Pharyngitis* is the inflammation of pharynx
- *Laryngitis* is the inflammation of larynx



# PATHOLOGY OF UPPER RESPIRATORY TRACT

- *Sinusitis* is the inflammation of sinuses
  - Frontal sinusitis in dehorned cattle
  - Larvae of botfly *Oestrus ovis* enters in nasal passage and migrate upto frontal sinuses and turbinate bones and cause mucopurulent inflammation
  - Leeches (*Dinobdella ferox*) is known to cause nasal cavity inflammation in domestic animals and suck blood

# NASAL POLYPS

- Nasal polyps are the inflammatory condition of respiratory mucosa resembling neoplastic growth caused by fungus and characterized by formation of new growth simulating benign neoplasm in nasal passage



# NASAL POLYPS

## Etiology

- *Rhinosporidium sceberi*, a fungus most commonly prevalent in southern India

# NASAL POLYPS

## Macroscopic features

- Formation of a single polyp in respiratory mucosa, pedunculated, elongated, fills nasal cavity
- Cauliflower like growth may cause bleeding

# NASAL POLYPS

## Microscopic features

- Fibrous covering by mucous membrane and heavily infiltrated by neutrophils, lymphocytes, eosinophils, macrophages around fungus

# NASAL GRANULOMA

- Nasal granuloma is the granulomatous inflammation of respiratory mucosa in nasal cavity caused by blood flukes and characterized by the presence of granulomatous growth filling the nasal passage causing obstruction

# NASAL GRANULOMA

## Etiology

- *Schistosoma nasalis*, a blood fluke.
- Type II hypersensitivity reaction of nasal mucosa to plant pollens, fungi, mites etc

# NASAL GRANULOMA

## Macroscopic Features

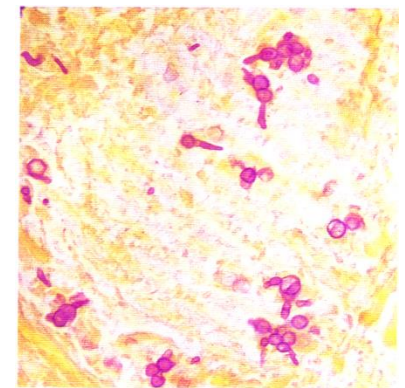
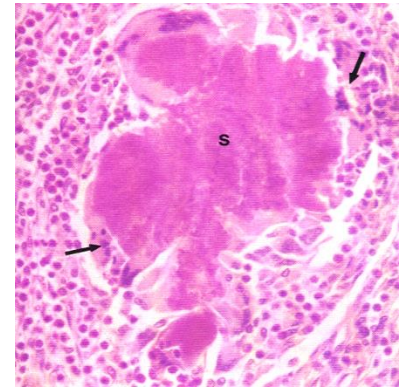
- Nasal pruritus
- Small tiny nodules on nasal mucosa later becomes cauliflower like growth filling the cavity and causing obstruction



# NASAL GRANULOMA

## Microscopic features

- Oedema in lamina propria
- Infiltration of eosinophils, mast cells, lymphocytes and plasma cells and absence of epithelioid cells
- Proliferation of fibroblasts
- Lesion is covered by squamous epithelium
- Mucous glands may have metaplastic pseudo stratified columnar epithelium



# TRACHEITIS

- Tracheitis is the inflammation of trachea
- In canines, it is tracheobronchitis while in poultry it is manifested by laryngo tracheitis



# TRACHEITIS

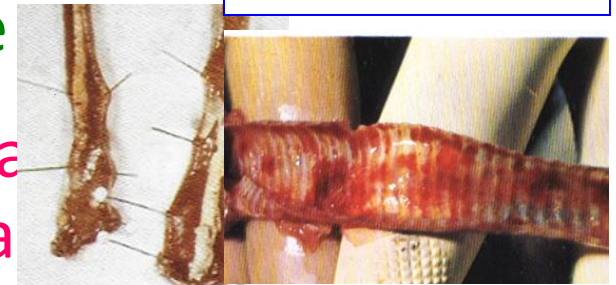
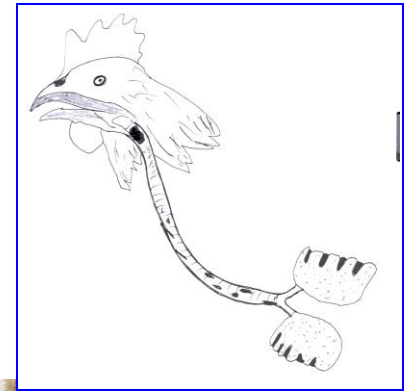
## Etiology

- Canine tracheobronchitis caused by adenovirus, influenza virus and herpes virus
- Avian infectious laryngotracheitis (ILT) is caused by herpes virus

# TRACHEITIS

## Macroscopic features

- Canine tracheobronchitis or *kennel cough* includes congestion of trachea and presence of catarrhal exudate
- In poultry, haemorrhage in trachea caseous plug in trachea towards la causing obstruction



typical bloody mucus in the trachea

# TRACHEITIS

## Microscopic features

- Inclusion bodies in tracheal and bronchial epithelium in canines
- Haemorrhagic tracheitis, presence of intra nuclear basophilic inclusions in tracheal epithelial cells in infectious laryngo tracheitis

# BRONCHITIS

- Bronchitis is the inflammation of bronchi, characterized by catarrhal, suppurative, fibrinous or haemorrhagic exudate

# BRONCHITIS

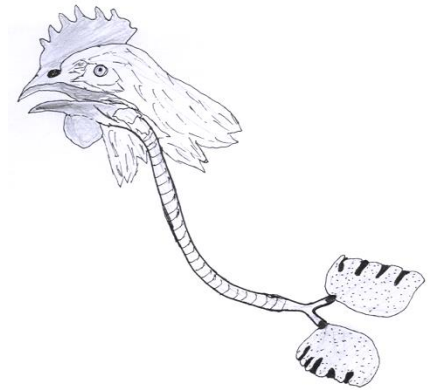
## Etiology

- Bacteria *e.g.* Pasteurella
- Virus *e.g.* Infectious bronchitis in poultry
- Parasites
- Allergy/ Inhalation of pollens etc.

# BRONCHITIS

## Macroscopic features

- Coughing, dyspnoea
- Mucous exudate in lumen
- Congestion and/or hemorrhages in bronchi
- Presence of caseaous plugs at the point where bronchi enters in lungs in infectious bronchitis of poultry



# BRONCHITIS

## Microscopic features

- Mucous exudate along with inflammatory cells in the lumen of bronchi
- Hyperplasia and/or necrosis of bronchiolar epithelium
- Accumulation of mononuclear cells in the bronchial mucosa and in peri bronchiolar area

# PATHOLOGY OF LUNGS



# ATELECTASIS

Atelectasis is the failure of alveoli to open or the alveoli are collapsed and thus do not have air

# ATELECTASIS

## Etiology

- Obstruction in bronchi/ bronchiole
- Pleuritis
- Atelectasis neonatorum in new born animals
  - In the absence of respiration, lung alveoli remain closed and thus sink in water indicating still birth

# ATELECTASIS

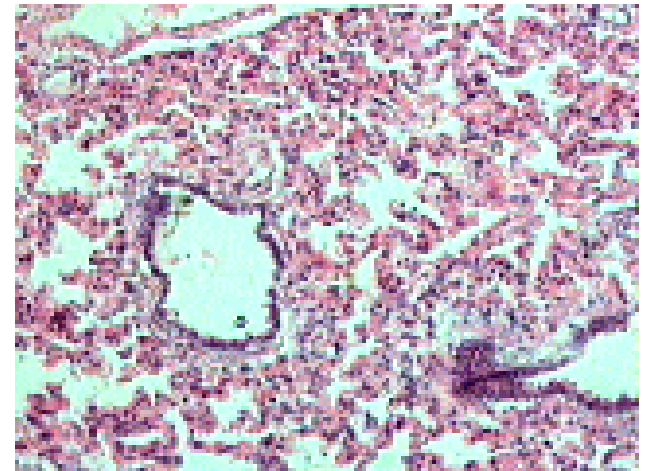
## Macroscopic features

- Dull red in color, hard area of lung like liver in consistency
- Atelectic lung sinks in water

# ATELECTASIS

## Microscopic features

- Compressed alveoli
- Absence of air spaces
- Collapsed bronchioles
- In inflammatory condition, exudate compresses alveoli



# EMPHYSEMA

- Emphysema is the increase in amount of air in lungs characterized by dilation of the alveoli
- It may be acute or chronic and focal or generalized

# EMPHYSEMA

## Etiology

- Bronchitis
- Atelectasis in adjoining area of lung
- Pneumonia
- Allergy to dust, Pollens etc
- Pulmonary adenomatosis

# EMPHYSEMA

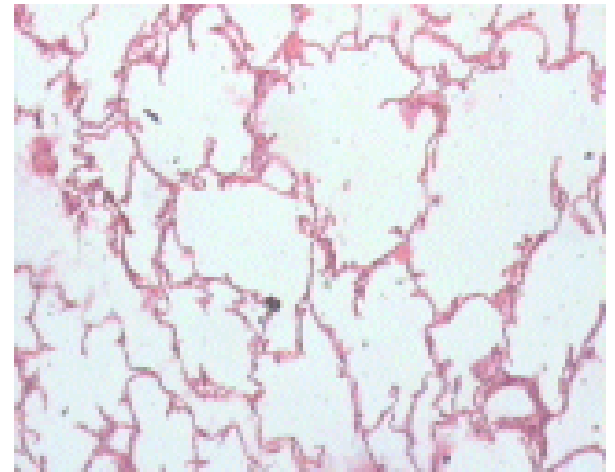
## Macroscopic features

- Lungs are enlarged and flabby
- Imprints of ribs can be seen. Colour of lungs becomes pale
- Cut surface is smooth and dry

# EMPHYSEMA

- Microscopic features

- Alveoli are distended
- Some alveoli may rupture and form giant alveoli
- Alveolar wall becomes thin due to stretching
- Mild bronchitis
- Hyperplasia of lymphoid tissue





# PULMONARY OEDEMA

- In pulmonary edema, there is accumulation of serous fluid in alveoli of lungs

# PULMONARY OEDEMA

## Etiology

- Bacteria
- Virus
- Allergy

# PULMONARY OEDEMA

## Macroscopic features

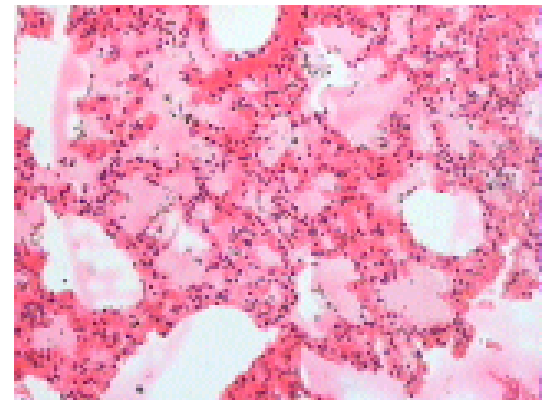
- Lungs become enlarged
- Weight of lungs increases
- Cut surface releases fluid and frothy exudate in trachea and/or bronchi



# PULMONARY OEDEMA

## Microscopic features

- Serous fluid accumulation in alveoli of lungs
- Fluid may also be seen in some bronchi/ bronchioles
- Infiltration of inflammatory cells
- Congestion of lungs



# PNEUMONIA

- Pneumonia is the inflammation of lungs characterized by congestion and consolidation of lungs
- Various stages of pneumonia
  - Stage of Congestion
  - Red hepatization
  - Grey hepatization
  - Resolution



# BRONCHOPNEUMONIA

- Bronchopneumonia is the inflammation of lungs involving bronchi or bronchioles along with alveoli
- It is thought to be spread through bronchogenous route and is the common type of pneumonia in animals

# BRONCHOPNEUMONIA

## Etiology

- Virus
- Bacteria
- Mycoplasma
- Chlamydia
- Parasites
- Fungus
- Chemicals
- Mainly through bronchogenous route

# BRONCHOPNEUMONIA

## Macroscopic features

- Congestion and consolidation of anterior and ventral parts of lungs (Lobular pneumonia)
- Patchy lesions on one or several lobes and adjacent area shows emphysema
- Mediastinal lymphnodes are swollen

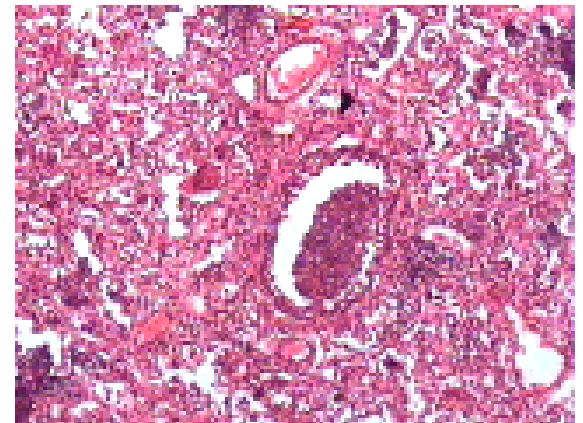




# BRONCHOPNEUMONIA

## Microscopic features

- Congestion, edema or hemorrhage in lung
- Infiltration of neutrophils, mononuclear cells in and around bronchioles/ bronchi
- Catarrhal inflammation of bronchi
- Proliferation of bronchiolar epithelium



# INTERSTITIAL PNEUMONIA

- Interstitial pneumonia is the inflammation of the lungs characterized by thickening of alveolar septa due to serous/ fibrinous exudate along with infiltration of neutrophils and/or mononuclear cells and proliferation of fibroblasts
- It is also known as **lobar pneumonia**

# INTERSTITIAL PNEUMONIA

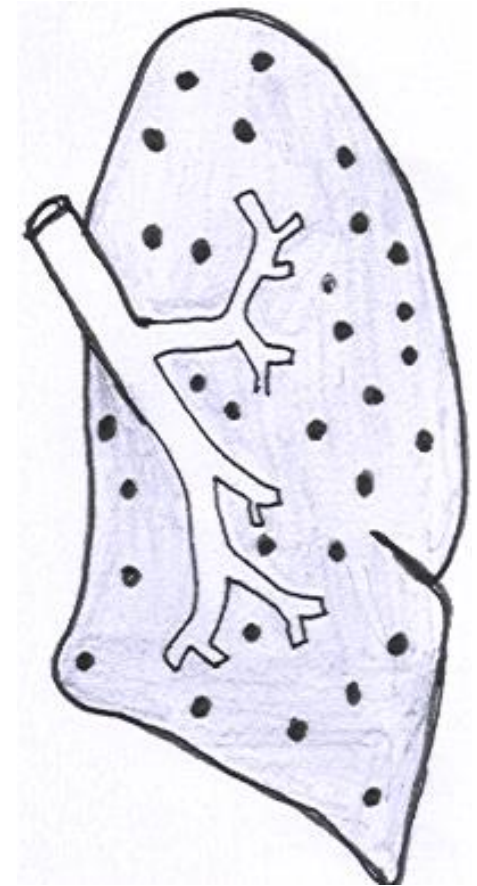
## Etiology

- Bacteria
- Virus
- Chlamydia
- Parasites
- Mainly through hematogenous route

# INTERSTITIAL PNEUMONIA

## Macroscopic features

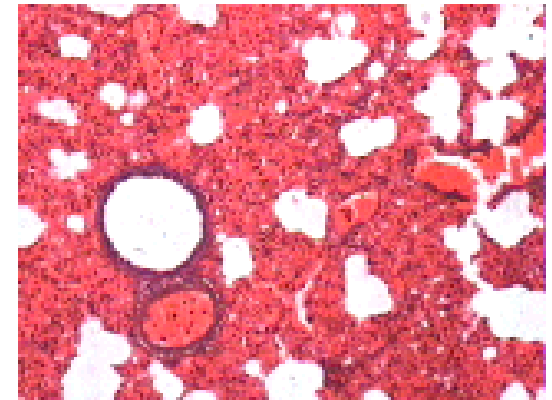
- Lungs are pale or dark red in colour
- Oedema, dripping of fluid from cut surface



# INTERSTITIAL PNEUMONIA

## Microscopic features

- Alveoli may have serous or fibrinous exudate
- Thickening of alveolar septa due to accumulation of exudate, inflammatory cells and in chronic cases, proliferation of fibrous tissue
- Infiltration of mononuclear cells in alveolar septa



# FIBRINOUS PNEUMONIA

- Fibrinous pneumonia is the inflammation of lungs characterized by the presence of fibrin in alveoli or bronchioles and may give rise to hyaline membrane formation over the surface of alveoli or bronchiole

# FIBRINOUS PNEUMONIA

## Etiology

- Bacteria
- Virus
- Parasites
- Toxin/ Poisons

# FIBRINOUS PNEUMONIA

## Macroscopic features

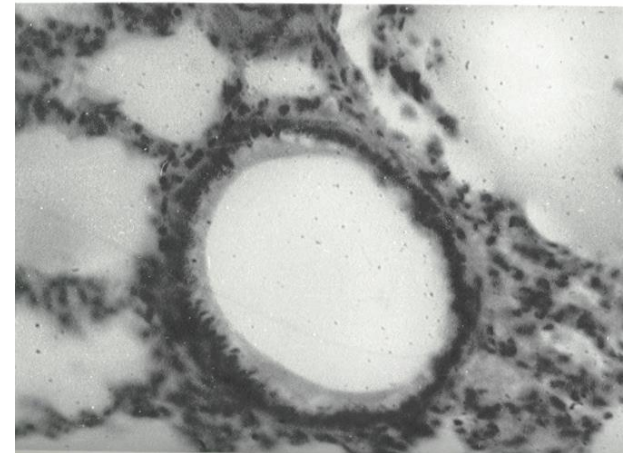
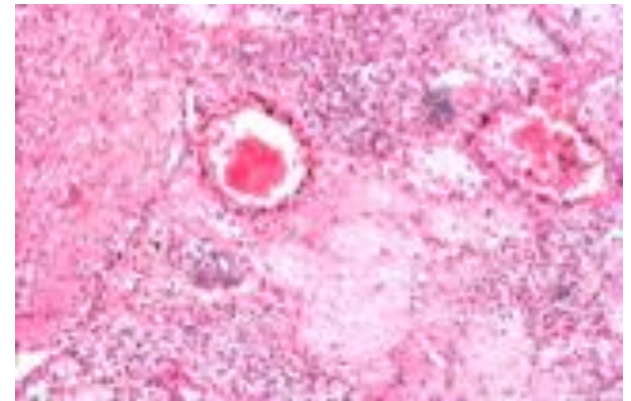
- Antero-ventral portion of lung is congested and consolidation
- Colour of lungs become deep red due to congestion
- Surface of lungs is covered by fibrin sheet
- Interlobular septa are prominent due to accumulation of plasma and fibrin



# FIBRINOUS PNEUMONIA

- Microscopic features

- Principal exudate is fibrin, fills alveoli, bronchioles and bronchi
- Congestion and/or hemorrhages
- Infiltration of neutrophils, macrophages and giant cells
- Formation of eosinophilic false membrane of fibrin over the surface of alveoli and bronchiole and then known as *hyaline membrane pneumonia*



# VERMINOUS PNEUMONIA

- Verminous pneumonia is caused by parasites and characterized by the presence of lesions of broncho-pneumonia along with parasites or their larva

# VERMINOUS PNEUMONIA

## Etiology

- *Metastrongylus apri* in pig
- *Dictyocaulus filariae* in sheep and goat
- *D. viviparus* in cattle and buffaloes
- *Capillaria aerophila* in dogs and cats
- *D. arnfieldi* in horse and donkeys

# VERMINOUS PNEUMONIA

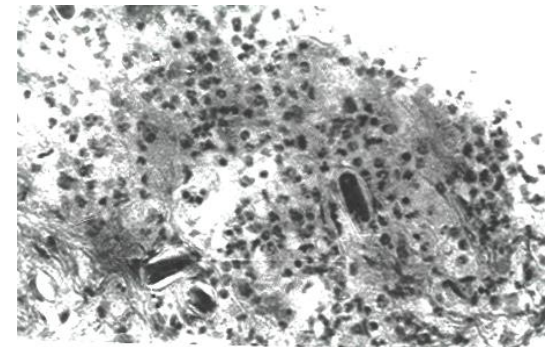
## Macroscopic features

- Multiple petechial hemorrhage in lungs at the site of parasite penetration
- Mature worms in alveoli, bronchioles and bronchi
- Mucopurulent exudate in alveoli/bronchi
- Pulmonary oedema, emphysema

# VERMINOUS PNEUMONIA

## Microscopic features

- Dilation of bronchiole/ bronchi
- Lesions of chronic suppurative bronchiolitis
- Focal areas of inflammation in the vicinity of parasites and around bronchioles
- Hyperplasia of bronchiolar epithelium
- Infiltration of eosinophils and lymphocytes



# ASPIRATION PNEUMONIA

- Aspiration pneumonia is caused by faulty medication through drenching which reaches in lungs instead of target place (digestive track) and characterized by necrosis and gangrene of lung paranchyma

# ASPIRATION PNEUMONIA

## Etiology

- Drugs, food, foreign body and oil drench which reaches in lungs through trachea
- Paresis of throat predisposes the animal for aspiration pneumonia

# ASPIRATION PNEUMONIA

## Macroscopic features

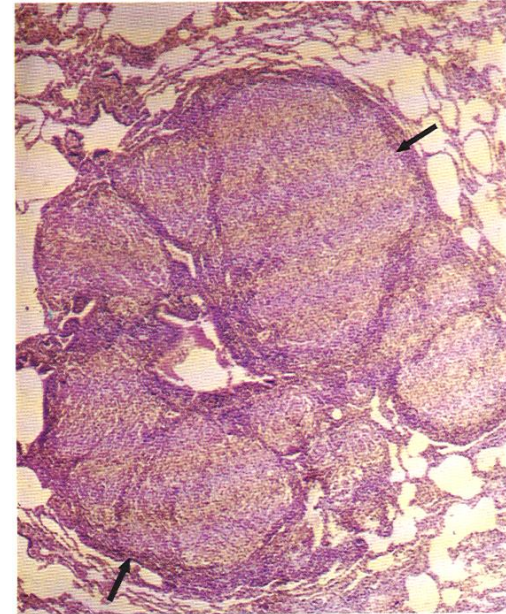
- Congestion and consolidation of anterior and ventral portion of lung
- Affected part becomes green/ black in colour, moist gangrene
- Affected lungs are often foul smelling
- Presence of foreign body like heads of wheat, parts of corn, oil, milk etc



# ASPIRATION PNEUMONIA

## Microscopic features

- Thrombosis of blood vessels
- Necrosis in lungs
- Presence of saprophytes, leucocytes and bacteria cause liquefaction and gangrene
- Gangrenous lesions surrounded by intense inflammation
- Congestion



# MYCOTIC PNEUMONIA

- Mycotic pneumonia is caused by a variety of fungi and characterized by the presence of chronic granulomatous lesions in lungs

# MYCOTIC PNEUMONIA

## Etiology

- *Aspergillus fumigatus*
- *Blastomyces* sp.
- *Coccidioidomyces immitis*
- *Cryptococcus* sp.

# MYCOTIC PNEUMONIA

## Macroscopic features

- Nodules in lungs
- On cut, cheese like caseative mass comes out from nodules
- Caseation involves both bronchiole and alveoli
- Such lesions may also present in trachea, bronchi and air sacs



# MYCOTIC PNEUMONIA

## Microscopic features

- Presence of granulomatous lesions *i.e.* caseative necrosis, macrophages, epithelioid cells, lymphocytes, giant cells, fibroblasts etc.
- Presence of branched hyphae of fungi in the necrosed area

# TUBERCULOUS PNEUMONIA

- Tuberculous pneumonia is caused by *Mycobacterium* sp. and characterized by the presence of chronic granulomatous lesions in the lungs

# TUBERCULOUS PNEUMONIA

## Etiology

- *Mycobacterium tuberculosis*
- *M. bovis*

# TUBERCULOUS PNEUMONIA

## Macroscopic features

- Grey, white or light yellowish nodules in lungs
- Nodules are hard, painful and/or calcified
- Animal carcass is cachectic, weak or emaciated
- On cut, the cheesy material comes out from the nodules

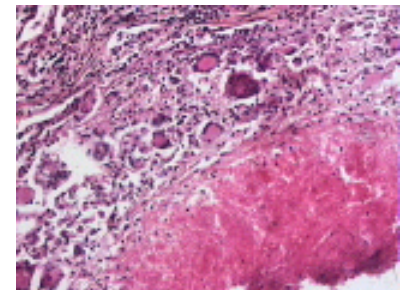
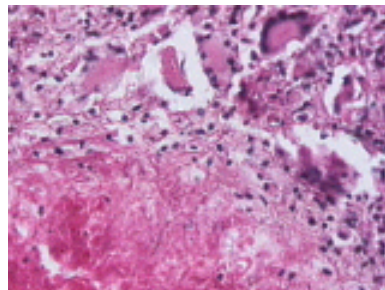
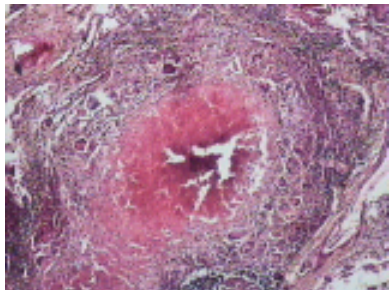




# TUBERCULOUS PNEUMONIA

## Microscopic features

- Tubercle comprises a central necrosed area surrounded by macrophages, epithelioid cells, lymphocytes, giant cells and covered by fibrous covering
- Acid-fast bacilli bacteria may present in necrosed area
- Central area may be calcified



# PULMONARY ADENOMATOSIS

- Pulmonary adenomatosis is a slow viral disease of sheep and characterized by metaplasia of alveolar squamous epithelium to cuboidal and/or columnar epithelium leading to glandular appearance of alveoli

# PULMONARY ADENOMATOSIS

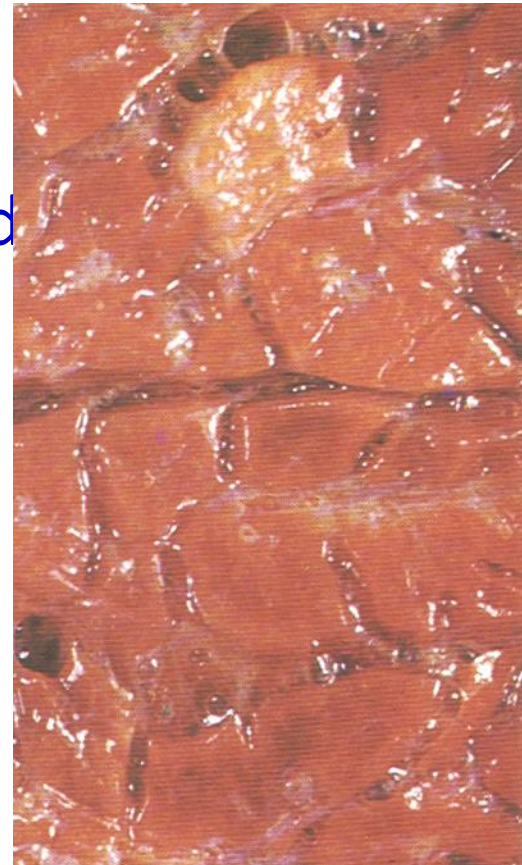
## Etiology

- Retrovirus
  - Pulmonary adenomatosis virus

# PULMONARY ADENOMATOSIS

## Macroscopic features

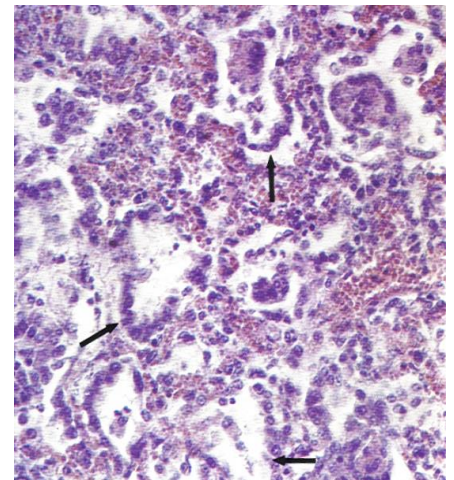
- Multiple focal areas of consolidation in lungs
- Imprint of ribs on lungs
- Congestion and hardening of mediastinal lymphnodes



# PULMONARY ADENOMATOSIS

## Microscopic features

- Metaplasia of alveolar epithelium leading to formation of glandular structures in alveoli
- Metaplasia of simple squamous epithelium to cuboidal or columnar epithelium which gives alveoli a gland like look
- Mild inflammatory reaction
- Proliferation of fibrous tissue



# HYPERSENSITIVITY PNEUMONITIS

- Hypersensitivity pneumonitis is the inflammation of lung caused by an allergic reaction of antigen (allergen) and characterized by interstitial pneumonia, emphysema, hyaline membrane formation and hyperplasia of alveolar epithelium

# HYPERSENSITIVITY PNEUMONITIS

## Etiology

- Allergens
- Parasites— *Dictyocaulus viviparous*
- Moldy hay
- Fungus- *Aspergillus* sp.

# HYPERSENSITIVITY PNEUMONITIS

## Macroscopic features

- Lobes may contain small grey foci
- Presence of yellow and dense mucus in lumen of bronchi
- Excessive accumulation of air in lungs due to emphysema
- Presence of worms/larvae



# HYPERSENSITIVITY PNEUMONITIS

## Microscopic features

- Extensive infiltration of lymphocytes, monocytes and eosinophils around the bronchi and bronchioles
- Catarrhal exudate in bronchi/ bronchiole
- Emphysema as a result of widening of alveoli
- Hyperplasia of bronchiolar musculature
- Small granulomas in interalveolar septa
- Formation of hyaline membrane over alveolar and bronchiolar epithelium

# PNEUMOCONIASIS

- Pneumoconiosis is the granulomatous inflammation of lungs caused by aerogenous dust particles of sand, silica, beryllium, carbon or asbestos
- It is also known as anthracosis

# PNEUMOCONIOSIS

## Etiology

- Silica
- Asbestos
- Beryllium
- Bauxite
- Graphite
- Carbon
- Bronchogenous/ aerogenous administration of particles inhaled with air, mostly around mines / factories
- Generator smoke

# PNEUMOCONIOSIS

## Macroscopic features

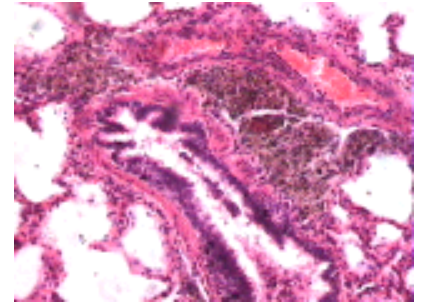
- Dense fibrous nodules in lungs
- Presence of carbon particles in trachea/ bronchi mixed with mucous exudate



# PNEUMOCONIOSIS

## Microscopic features

- Granuloma formation around the particles of silica/ asbestos infiltrated by macrophages, lymphocytes and giant cells
- Silica produces cellular reaction 'Silicosis'
- Beryllium granuloma looks like tubercule without caseation
- Asbestosis is characterized by the presence of club shaped filaments bearing cells in lesion.



# PATHOLOGY OF AIR SACS

# AIR SACкулITIS

- Air sacculitis is inflammation of air sacs caused by *E. coli*, *Mycoplasma*, reovirus etc. and characterized by thickening of the wall of air sacs and presence of cheesy exudate

# AIR SACкулITIS

## Etiology

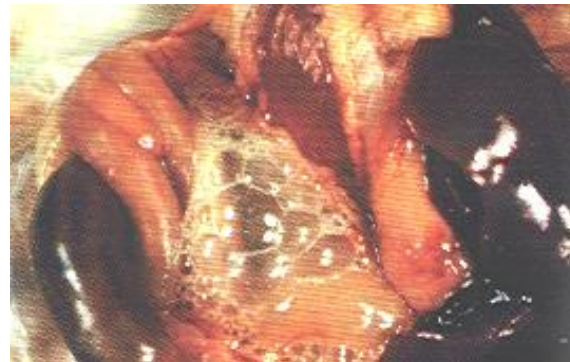
- *Escherichia coli*
- *Mycoplasma gallisepticum*
- Avian reovirus



# AIR SACкулITIS

## Macroscopic features

- Thickening of the air sac wall, which becomes dirty and cloudy
- Presence of cheesy exudate in air sacs, congestion of lungs
- Fibrinous pericarditis
- Liver is covered with thin fibrinous membrane



# AIR SACкулITIS

## Microscopic features

- Oedema and infiltration of neutrophils and lymphocytes in air sacs
- Caseous exudate in lungs and air sacs

# PATHOLOGY OF PLEURA

# PLEURITIS

- Pleuritis is the inflammation of pleura characterized by serous, fibrinous or purulent exudate
- It is also known as *pleurisy*

# PLEURITIS

## Etiology

- *Mycobacterium tuberculosis*
- *Mycoplasma mycoides*
- *Haemophilus suis*
- Organisms responsible for pneumonia / traumatic pericarditis may also cause pleuritis

# PLEURITIS

## Macroscopic features

- Congestion of pleura
- Serous, fibrinous or purulent exudate.
- Accumulation of clear fluid in pleura/thoracic cavity is called as *hydrothorax*
- Presence of blood in thoracic cavity is known as *Hemothorax*
- Suppurative exudate in thoracic cavity is known as *pyothorax*

# PLEURITIS

## Macroscopic features

- Presence of air in pleural cavity is termed as *pneumothorax*
- Presence of lymph in pleural cavity is called as *chylothorax*
- Tuberculous pleuritis is characterized by small nodules on pleura and is known as “*pearly disease*”
- In chronic cases, development of fibrous tissue causes adhesions and is known as *adhesive pleuritis*

# PLEURITIS

## Microscopic features

- Congestion of blood vessels
- Infiltration of neutrophils and lymphocytes
- Thickening of pleura due to oedema
- Proliferation of fibroblasts producing adhesive lesions



thank you!