Hepatobiliary System Diseases

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Liver

- It the largest metabolic center of the body.
- It has important roles carbohydrate, protein and lipid metabolism.
- Its metabolic functions synthetic, catabolic, detoxified, secretory, and exchetic.

Developmental Anomalies and Incidental Findings

1-Cysts:

- Congenital Hepatic Cysts

❑Serous cysts

❑Intrahepatic congenital cysts/Congenital Bilier Cysts

2-Biliary atresia:

3-Congenital vascular anomalies:

- Congenital intrahepatic arteriovenous fistulae
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- Congenital portosystemic vascular anomalies
- Hepatoportal microvascular dysplasia

Cysts

- **Serous cysts** are occasionally found attached to the capsule on the diaphragmatic surface calves, lambs, and foals
- These cysts are usually small and multiple, but some are isolated and very
- Their origin is not known
- They do not contain bile.

❖Serous cysts should be differentiated parasitic cysts, and biliary cystadenomas.

- Congenital Bilier Cysts: Dogs, cats, and pigs, but all domestic species can be affected.
- The cysts are usually an incidental finding and can be found in animals of any age.
- **Grossly**, the cysts can be single or multiple clear fluid.
- **Histologically**, cysts a thin wall lined by a single layer of biliary epithelium.

❖Congenital parasitic cysts, particularly cysticerci.

Developmental Anomalies and Incidental Findings

- Congenital polycystic disease, characterized by numerous epithelial- liver, kidneys, and occasionally pancreas.
- It occurs in dogs, *Cairn terriers and West Highland white terriers* predisposed; cats *Persian cats* believed to have a higher risk for the disorder; and goats and lambs.
- Affected animals can die of either liver or renal failure.

Developmental Anomalies and Incidental Findings

Biliary atresia: Anomalies of the extrahepatic biliary system *absence of the gallbladder,* and *absence or atresia of one or more ducts.*

- Biliary atresia has been reported lambs, calves, foals, a cat, a dog, and a pig.

DISPLACEMENT, TORSION, and RUPTURE

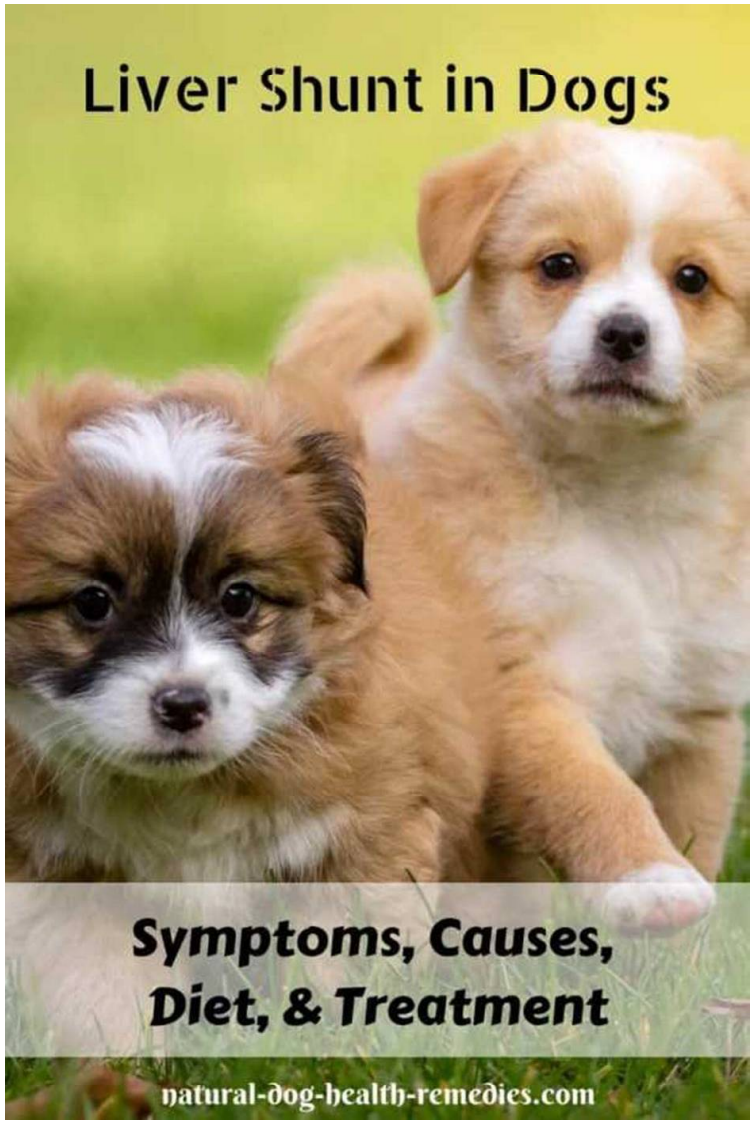
- DISPLACEMENT: Displacement of the liver into the thoracic cavity, diaphragmatic hernia, can occur when there is a defect in the
- TORSION
- RUPTURE: Rupture trauma.

Circulatory Disorders Disturbances of Outflow

- Passive Congestion (Acute and Chronic):Passive congestion of the liver can occur in any species is almost always the consequence of cardiac dysfunction. Right-sided heart failure produces elevated pressure within the caudal vena cava that later involves
- Chronic passive congestion is particularly common in aged dogs and occurs secondary to right atrioventricular valve insufficiency resulting from valvular endocardiosis (myxomatous
- Acute passive congestion, on the other hand, can occur as a consequence of acute right sided heart failure, which has a wide variety of causes.

Congenital vascular anomalies

- Congenital portosystemic vascular are typically single anomalous vessels that directly connect the portal venous system with the systemic venous circulation.
- They occur dogs and cats, and, rarely, in pigs, foals, and calves.
- These vascular anomalies may be intrahepatic extrahepatic in location.
- An inherited basis is suspected for several breeds, Irish Wolfhounds, Maltese, Yorkshire Terriers, and Australian cattle dogs.



Extrahepatic portosystemic vascular shunt:

- Portocaval or Portoazygous
- Small breed dogs and

Intrahepatic PSS:

- Patent ductus venosus
- Large breed dogs

Congenital vascular anomalies

- The liver ➔ hypoplastic.
- These livers may be smooth surfaced with normal color and texture.
- Histologically, hepatocytes and acini are small with close spacing of portal triads. Portal veins in smaller triads may be small, collapsed.
- Hepatic arterioles are often more prominent, and may be multiple and tortuous, related to increased arterial perfusion.
- Dilated lymphatics may also be present in the connective tissue surrounding hepatic veins. Hepatic veins may have prominent smooth muscle.

Vascular Factors in Hepatic Injury and Circulatory Disorders

- Arteria hepatica blockage
- Vena porta blockage
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- Portosystemic shunts
- Telangiectasis
- Peliosis hepatis
- Portal hypertension

Telangiectasis

- Telangiectasis notable dilation of sinusoids in areas where hepatocytes have been lost.
- Grossly, these areas appear as variably sized dark red-blue foci within the liver that vary from pinpoint to several centimeters in size.

Telangiectasis

- Telangiectasis is particularly _____ in cattle and apparently is of no clinical significance old cats
- Histologically, there is ectasia of the sinusoidal space and a loss of hepatocytes no evidence of inflammation or fibrosis associated with this lesion.

Peliosis hepatis

- *designate a hepatic vascular disorder characterized by cystic, blood-filled spaces in the liver.*
- *The* histologic lesion is characterized by multiple, dilated, blood-filled spaces surrounded by fibromyxoid stroma containing inflammatory cells and dilated capillaries.

Metabolic Disturbances and Hepatic Accumulations
Hepatocellular Steatosis (Lipidosis- *Fatty Liver*)

- Hepatic lipidosis *is the term most often used to describe* *fatty livers of animals*, whereas in humans *steatosis* is more commonly used.
- Both refer to the visible accumulation of triglycerides (triacylglycerols) as round globules in the cytoplasm of hepatocytes.
- Hepatic lipidosis can physiological pathological. Increased mobilization of during late pregnancy or heavy lactation in ruminants is associated with hepatic lipidosis.
- It is common in injured hepatocytes.

Lipidosis- *Fatty Liver*

- Normally lipid droplets are found near the periportal and sinusoidal areas. In lipidosis the amount of oil droplets increases and most droplets are seen in the periphery of acinuses.
- At the beginning of the degeneration, the lipid is seen in the cytoplasm small globules, the core is in its normal position.

Lipidosis- *Fatty Liver*

- Severe and prolonged liver lipidosis most parenchymal cells are observed in the steatosis.
- The lipid droplets in the combine with one another to form a large globul The shape of the cell is distorted and the core is replaced The sinuses are under pressure and anemia develops.

Lipidosis- *Fatty Liver*

- In severe fatty liver, the liver grows more or less.
- it light yellow doughy. The edges rounded, the upper face flat and the section in grease.
- The severely fatty liver is not submerged in water or fixation solutions.

Lipidosis- *Fatty Liver*

- Histologically, hepatocellular clear round vacuole. The vacuoles are clear.
- Macrovesicular steatosis is most common and arge vacuoles that are larger than the displace the nucleus hepatocyte.
- Microvesicular steatosis multiple small, round, and clear vacuoles not displace the nucleus and can be associated significant hepatocellular dysfunction.

Specific causes and syndromes of hepatocellular lipidosis in domestic animals include the following:

1 Dietary causes, including simple dietary excess in monogastric animals, such as a high-fat and/or high-cholesterol diet, or dietary deficiencies of cobalt and vitamin B12 in sheep and goats

Toxic and anoxic causes leading to sublethal (reversible) injury to hepatocytes

Ketosis, which is a metabolic disease that results from impaired metabolism of carbohydrate and volatile fatty acids.

4 Bovine fatty liver syndrome, also known as fatty liver disease, which is mechanistically similar to ketosis and is especially common in ruminants with high energy demands.

Specific causes and syndromes of hepatocellular lipidosis in domestic animals include the following:

5 Feline fatty liver syndrome, which is a distinct syndrome of idiopathic hepatocellular steatosis recognized in cats.

6 Hepatocellular steatosis in ponies, miniatures horses, and donkeys.

7 Endocrine disorders, such as diabetes mellitus and hypothyroidism, in a variety of species.

Amyloidosis

- Hepatic amyloidosis occurs in most species of domestic animals. Amyloid deposition in the liver is usually seen cattle, horses, dogs and cats.
- Amyloidosis is not a single disease entity
- Affected livers enlarged, friable, and pale.
- It can easily ruptured.
- Its consistency soft in horses hard in cattle.

Amyloidosis

- Histologically, Hepatic amyloid appears as bright eosinophilic amorphous deposits that are usually found in the space of Disse along the sinusoids, but they can be found in the portal tracts and within blood vessel walls.
- Remark cords undergo atrophy.

Patterns of Cell Death in The Liver

❖Apoptosis

❖Necrosis

- Single-cell necrosis
- Focal necrosis
- Zonal necrosis

❑Zone 1 (periportal) necrosis

❑Zone 2 (midzonal) necrosis

❑Zone 3 (periacinar necrosis) necrosis

❑Paracentral

- Massive necrosis
- Piecemeal necrosis
- Necrosis of sinusoidal lining cells
- Necrosis of bile duct epithelium

Necrosis

- Single-cell necrosis: Hepatocytes sometimes die in a spotty or random manner in a form of cell death. Example: The Councilman body in viral hepatitis
- Focal necrosis is very common in necropsy material. The lesions are microscopic or barely visible to the naked eye and are usually numerous. many infections, parasitic migrations, and instances of biliary obstruction causes may be viral, such Equid herpesvirus 1 in the fetus, or bacterial.
- Many septicemic bacterial infections consistently produce focal hepatic lesions; salmonellosis, tularemia, pseudotuberculosis, listeriosis in the fetus and newborn, and Mannheimia haemolytica septicemia in lambs.

Zonal necrosis

Zonal necrosis

- Zone 1 (periportal) necrosis is also an uncommon lesion, perhaps more often seen than midzonal necrosis.
- It can be caused by direct-acting hepatotoxins.

Zonal necrosis

Some intoxications can produce zone 2 (midzonal) necrosis, affecting only a narrow, sharply defined band of hepatocytes.

Zonal necrosis

- Zone 3 necrosis (periacinar necrosis) is the most common form of zonal necrosis in domestic animals.
- The hepatocytes in the periacinar zone are particularly vulnerable to necrosis, in part they are farthest from incoming arterial and portal venous.
- *Severe viral infections,* such *Canine adenovirus 1* and *Rift Valley fever virus,* can produce periacinar necrosis blood bearing oxygen and essential nutrients.
- Periacinar degeneration and are seen commonly in animals that died rather slowly.

- Paracentral necrosis, a form of coagulative necrosis, occurs when an isolated complete hepatic acinus dies is viewed in transverse section.
- Occlusion and rupture of a bile ductule or cholangiole are other potential causes of paracentral necrosis.

Massive necrosis

- **Massive necrosis** necrosis of entire hepatic acini, not necessarily necrosis of the liver as a whole.
- Collapse, condensation, and subsequent scarring are characteristic, the end result being known as postnecrotic scarring.
- A liver may of normal size or smaller. There mosaic appearance of red, gray, or yellow areas.
- The intermingled red areas represent areas of necrosis, hemorrhage, and collapse.
- Example: **Hepatosis dietetica** *of swine*

Piecemeal Necrosis

- This pattern of necrosis amid sites of more active inflammation is sometimes referred to as piecemeal necrosis.
- Models of immune-mediated hepatocyte necrosis have emerged from human viral hepatitis some forms of drug-induced chronic hepatitis.

Responses of The Liver to Injury

- Hepatocellular replication
- Bile duct hyperplasia
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- **Cirrhosis**
- Acquired portosystemic shunting

Cirrhosis

- The term cirrhosis is most correctly used the end-stage of diffuse hepatic disease characterized nodular regeneration fibrovascular bridging scars.
- Cirrhosis disruption of the architecture of the entire liver, reflection of diffuse parenchymal injury, subsequent fibrosis.
- It is a chain of events where degenerative and regenerative changes are seen together with the increase of dense fibrous tissue in the liver.

Cirrhosis

- Cirrhosis is usually the end-result of several pathogenetic processes, cell death (necrosis or apoptosis) active inflammation with chronic fibrosis.
- Cirrhosis is not a synonym for chronic hepatic fibrosis, although some insults that cause chronic diffuse fibrosis in the liver can lead to cirrhosis.
- The vascular changes in cirrhosis are generally as irreversible.

The potential causes of an end-stage (cirrhotic) liver are numerous;

- Chronic toxicity (therapeutic agents or naturally occurring toxins) e.g., herbivores ingesting toxic plants, such as those that contain pyrrolizidine alkaloids, and the long-term administration of drugs with hepatotoxic potentials, such as primidone for dogs).

Chronic cholangitis and/or obstruction

Chronic congestion (Right Side Heart Failure)

Inherited disorders of metal metabolism (copper or iron)

Chronic hepatitis

Idiopathic

Cirrhosis

- Mononuclear cell infiltrations are often formed at portal intervals. This indicates that the inflammatory reaction is active
- Newly formed bile ducts that are not functional in portal areas are seen.
- areas of necrosis in the lobulus.
- regenerative areas of hepatocytes.
- disruption of the lobular structure in the liver.

Types of Cirrhosis

- Atrophic cirrhosis (Laennec cirrhosis),

(Postdystrophic cirrhosis - Postnecrotic cirrhosis

- Hypertrophic Cirrhosis (Hannote cirrhosis
- Biliary Cirrhosis
- Glisson Cirrhosis
- Central cirrhosis (Cardiac - congestive cirrhosis
- Pigment Cirrhosis
- Parenchyma lipidosis related cirrhosis
- Xanthomatous cirrhosis
- Parasitic cirrhosis
- Cirrhosis of hypertrophic liver in calves

At the end of Cirrhosis;

- It not always function disorders.
- The liver (in humans) may lose the function of inactivating estrogens. (In atrophy and feminization develop in the testes. The same can be observed in male animals).
- prothrombin and other coagulation factors can be produced scantly.
- Vitamin A and protein values in the blood decrease.

At the end of Cirrhosis;

- Portal blood circulation is prevented.
- Passive hyperemia develops in the spleen and digestive tract. This is followed by mild digestive disorders.
- ultimately ascites occurs.
- icterus can also develop (biliary cirrhosis→all the time).

At the end of Cirrhosis;

- The most important negativity in cirrhosis is that the proliferating connective tissue itself has an irritant effect and stimulates the formation of new connective tissue.
- Thus, even if the cause of cirrhosis is eliminated, the connective tissue growth continues to develop until death.

Hepatic Failures

- icterus
- Photosensitisation
- Hepatic encephalopathy
- Hemorrhage
- Nephropathy
- Edema

Jaundice (icterus)

- ***Jaundice (icterus)*** is the discoloration of tissues and body fluids by excess of bile pigments. Jaundice prehepatic cholestatic origins

❖**Prehepatic jaundice:** is usually related to overproduction of bilirubin heme catabolism in hemolytic disease. (Hemolitic ic

❖**Cholestatic jaundice** hepatic posthepatic

❑ In *hepatic jaundice,* there may be impaired uptake, metabolism, secretion, and transport of bile pigments within the liver.

❑In *posthepatic jaundice,* cholestasis is related to obstruction of bile flow at the level of the major bile ducts or gallbladder.

Prehepatic jaundice (Hemolitic icterus)

- heighten the blood's rate of hemolysis. red blood cells are broken down releasing hemoglobin and converting into bilirubin
- There is usually no disorder in the liver
- Erythrocytes in this icterus have an extreme destruction.
- When the liver parenchyma is not capable of processing excess bilirubin I and cannot be excreted from the kidneys, it begins to accumulate in the blood and bilirubinemia occurs.
- At the same urobilin values increase in urine .

Prehepatic jaundice (Hemolitic icterus)

- pyroplasmosis, anaplasmosis, leptospirosis and anemia infectious disease of horses.
- Hemolytic streptococcal infections, bacilli hemoglobinuride and anthrax are also encountered.
- infectious diseases, chemicals and herbal toxins as well as snake poisons can cause haemolytic icterus.

malaria, a blood infection caused by a parasite

sickle cell anemia, a genetic condition in which red blood cells become crescent-shaped rather than the typical disc shape

spherocytosis, a genetic condition of the red blood cell membrane that causes them to be sphere-shaped rather than disc-shaped

thalassemia, a genetic condition that causes your body to make an irregular type of hemoglobin that limits the number of healthy red blood cells in your bloodstream.

Cholestatic jaundice

- In hepatic jaundice: Hepatic jaundice happens when the liver tissue is scarred cirrhosis), damaged, or dysfunctional.
- This less effective at filtering out bilirubin from the blood.
- Since it can not be filtered into your digestive system for removal, bilirubin builds up to high levels in blood.

most common causes of hepatic jaundice are:

liver cirrhosis, which means that liver tissues are scarred by long-term exposure to infections or toxic substances, such as high levels of alcohol

viral hepatitis, an inflammation of the liver caused by one of several viruses that can get into your body through infected food, water, blood, stool.

primary biliary cirrhosis

can’t process bile, causing it to build up in your liver and damage liver tissue

most common causes of hepatic jaundice are:

alcoholic hepatitis, in which your liver tissues are scarred by the heavy, long-term drinking of alcohol

leptospirosis, is a bacterial infection that can be spread by infected animals or infected animal urine or feces

liver cancer, in which cancerous cells develop and multiply within liver tissues.

Cholestatic jaundice

- In posthepatic jaundice: *Post-hepatic, or obstructive jaundice*, happens when bilirubin can not be drained properly into the bile ducts or digestive tract because of a blockage.

❑ most common causes of post-hepatic jaundice are:

gallstones, hard calcium deposits in the gallbladder that can block bile ducts

pancreatic cancer, the development and spread of cancer cells in pancreas, an organ that helps produce digestive substances

bile duct cancer, the development and spread of cancer cells in your bile ducts

pancreatitis, an inflammation or infection of your pancreas

biliary atresia, a genetic condition in which you have narrow or

- cholangitis,
- gallstones, neoplasm, abscess and granuloma,
- parasites.

Biliary System

- The inflammation of the gallbladder cholecystitis.
- Colangitis is the inflammation of the bile ducts.
- **Cholangiohepatitis** is the inflammation of the liver and bile ducts. Cholangiohepatitis is a common hepatic disorder in cats is second only to hepatic lipidosis in frequency. There are two forms of cholangiohepatitis acute and chronic.
- The parasites bacterial agents.

Pigment Accumulation

- Bile Pigments
- Hemosiderin
- Lipofuscin
- Ceroid
- Parasite Hematin
- Melanin

Disorders of Dogs

- Canine Chronic Hepatitis (Chronic-Active Hepatitis
- **Infectious Canine Hepatitis**
- Lobular Dissecting Hepatitis
- Copper Toxicosis
- Glucocorticoid-Induced Hepatocellular Degeneration (Steroid Hepatopathy)
- Hepatocerebellar Degeneration

Disorders of Cats

- **Feline Fatty Liver Syndrome**
- Lymphocytic Cholangitis
- Neutrophilic (Suppurative) Cholangitis

Disorders of Ruminants (Cattle, Sheep, and Goats)

- Ketosis
- Bovine Fatty Liver Syndrome
- Copper
- Rift Valley Fever
- Wesselsbron Disease
- Bacillary Hemoglobinuria
- Infectious Necrotic Hepatitis
- White Liver Disease

Disorders of Horses

- Equine Serum Hepatitis
- Equine Hepatocellular Steatosis

Disorders of Pigs

- **Hepatosis Dietetica:** Hepatosis dietetica (nutritional hepatic necrosis) is a syndrome of acute hepatic necrosis that occurs in young, rapidly growing pigs
- **Cresols**: Cresols once were incorporated in clay pigeons and asphalt shingles.
- If pigs ingest cresols, centrilobular to massive hepatic hemorrhage and necrosis result, a pattern that can also be seen in pigs with hepatosis dietetica or in those that ingest cottonseed meal.

Viral Diseases of The Liver

- **Infectious Canine Hepatitis (Hepatitis Contagiosa Canis – HCC)**
- **Wesselborn Disease**
- **Rift Valley Fever**