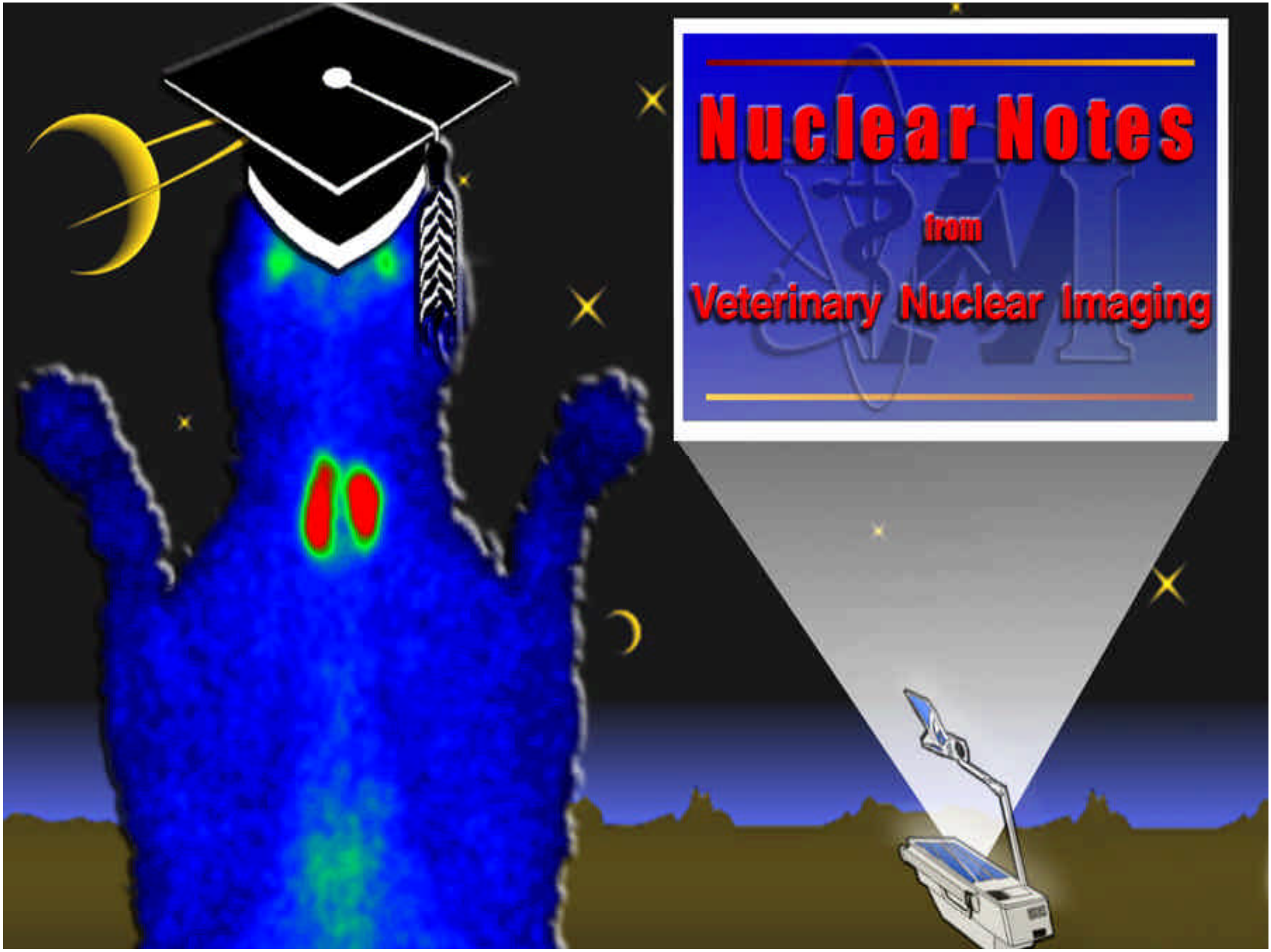

Nuclear Notes
from
Veterinary Nuclear Imaging

Portosystemic Shunts

Medical Perspectives

Definition:

Portosystemic shunts (PSS) are vascular communications between the portal and systemic venous systems that allow access of portal blood to the systemic circulation without first passing through the liver.

Etiology:

Congenital shunts are categorized as single extrahepatic, single intrahepatic, or multiple extrahepatic shunts.
Acquired PSS are collateral vessels that develop as a compensatory response to sustained portal hypertension caused by severe diffuse intrahepatic diseases such as chronic hepatitis, cirrhosis, or hepatic fibrosis.

Portosystemic Shunts

Medical Perspectives

Clinical Signs

Hepatic encephalopathy: hypersalivation, behavioral changes, episodic weakness, ataxia, head-pressing, dementia, disorientation, circling, pacing, altered consciousness (depression, stupor, coma), seizures, and cortical blindness

Hypersalivation: (ptyalism) is a prominent clinical feature in cats with PSS.

GI signs: intermittent anorexia, vomiting, and diarrhea are common and are not necessarily accompanied by overt signs of HE.

Urinary signs: Psychogenic polydipsia and subsequent polyuria are frequent findings in dogs. If urolithiasis is a complicating feature, pollakiuria, dysuria, and hematuria may occur.

Anesthetic complications: prolonged recovery, post-op neurologic signs, cardiac arrest.

Portosystemic Shunts

Medical Perspectives

Diagnosis

A congenital portosystemic shunt should be considered in:

1) any young animal with stunted growth or intermittent CNS, GI, or urinary tract signs

2) any dog (except Dalmatians) or cat with urate urolithiasis

3) dogs or cats of any age with clinical and biochemical evidence of hepatic insufficiency (especially hepatic encephalopathy) and absence of histologic evidence of severe intrahepatic disease

Pre- and post-prandial serum bile acid concentration is the clinical screening test of choice for PSS. Although a congenital PSS might be highly suspected because of historical, physical, laboratory and radiographic findings, a definitive diagnosis requires identification of a shunt by ultrasonography, contrast radiography, scintigraphy, or exploratory laparotomy.

Portosystemic Shunts

Medical Perspectives

Signalment:

Congenital PSS are more common in purebred dogs.
Domestic shorthair cats are affected more commonly than purebred cats.
No sex predilection has been noted.
Affected male dogs are commonly cryptorchid.
Age is an important diagnostic clue since most animals develop signs by 6 months of age.
A congenital PSS should still be a diagnostic consideration in middle-aged to older dogs, since signs may be subtle and some dogs go undiagnosed until 10 or 12 years of age.

Portosystemic Shunts

Medical Perspectives

History:

Stunted growth or failure to gain weight

Prolonged recovery after general anesthesia or excessive sedation

Signs of encephalopathy may be exacerbated by a protein-rich meal, GI bleeding

Clinical improvement after fluid therapy is common

Improvement after broad-spectrum antibiotic therapy such as amoxicillin or ampicillin

Physical examination:

May be unremarkable except for small body size and thin condition.

Ptyalism is common in cats.

Neurologic examination is normal, or if overt signs of HE are present, neurologic findings are consistent with diffuse cerebral disease.

Ascites and edema are infrequent unless PSS is complicated by portal hypertension or severe hypoalbuminemia.

Portosystemic Shunts

Medical Perspectives

Laboratory evaluation:

Routine hematologic and biochemical findings are often unremarkable.
Hepatocellular dysfunction w/ absence of significant cholestasis or hepatocellular necrosis.
Microcytosis , target cells, poikilocytosis, and mild nonregenerative anemia.
Microcytosis in PSS does not appear to be caused by iron deficiency.
Urinalysis - low sp.gr., ammonium biurate crystalluria, and mild bilirubinuria.
Coagulation tests are normal

Hepatocellular dysfunction:

suggested by hypoproteinemia, hypoalbuminemia, hypoglobulinemia, hypoglycemia, decreased BUN, and hypocholesterolemia.
Total serum bilirubin concentration is usually normal.
Liver enzymes (ALP/ALT) are normal to mildly increased.

Portosystemic Shunts

Medical Perspectives

Serum bile acid

Serum bile acid concentrations should be used to screen for hepatic dysfunction in dogs and cats suspected of congenital PSS. Fasting SBA may be normal or increased but PPSBA are consistently abnormal and usually exceed 100 umol/L. The pattern of normal FSBA with markedly increased PPSBA is characteristic of PSS. Consistently normal PPSBA excludes a diagnosis of congenital PSS. Hyperammonemia is a common finding in animals with PSS but blood ammonia concentration may be normal. The oral ammonia tolerance test (ATT) is consistently abnormal and has a sensitivity equal to PPSBA in detecting hepatic dysfunction associated with PSS; however, the ATT is more difficult to run and may be associated with side effects.

Portosystemic Shunts

Medical Perspectives

Microhepatica is a common radiographic finding in dogs, but is inconsistent in cats.

Mild renomegaly of unknown clinical significance is also common.

Intraabdominal detail may be poor due to lack of abdominal fat.

Ammonium urate urinary calculi may be visible.

Abdominal ultrasonography can identify both intrahepatic and extrahepatic shunts.

Portal scintigraphy is an excellent noninvasive screening test.

Mesenteric portography represents the gold standard for characterizing a PSS.

Transcolonic Portal Scintigraphy

Technique

Radionuclide: $^{99m}TcO_4^-$

Physiology: Radionuclide acts as a blood flow indicator.
Normal - Uptake by rectal veins into portal vein and liver, then systemic circulation
Shunt - Uptake by rectal veins into shunt and systemic circulation with poor visualization of the liver

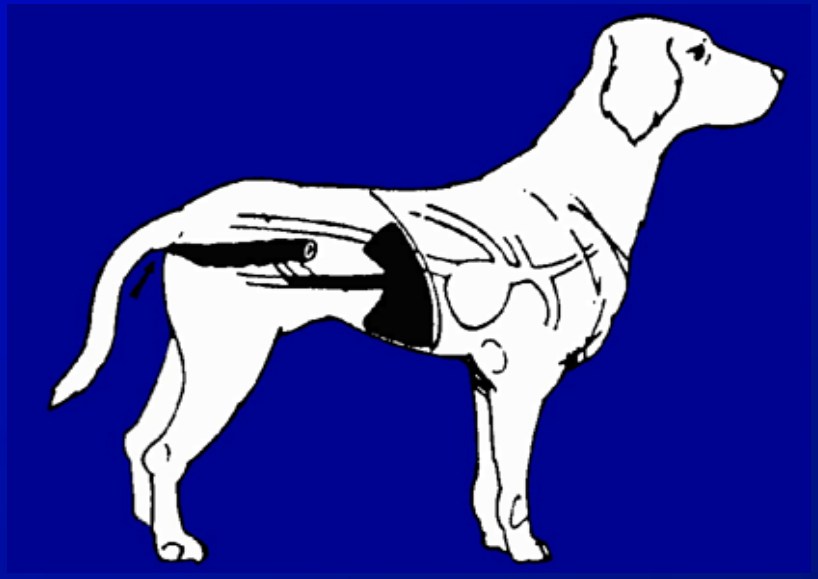
Protocol: Dynamic images acquired for 200 seconds following the intracolonic administration of the radionuclide

Uses: Diagnosis of porto-systemic shunts

Transcolonic Portal Scintigraphy

Normal Anatomy

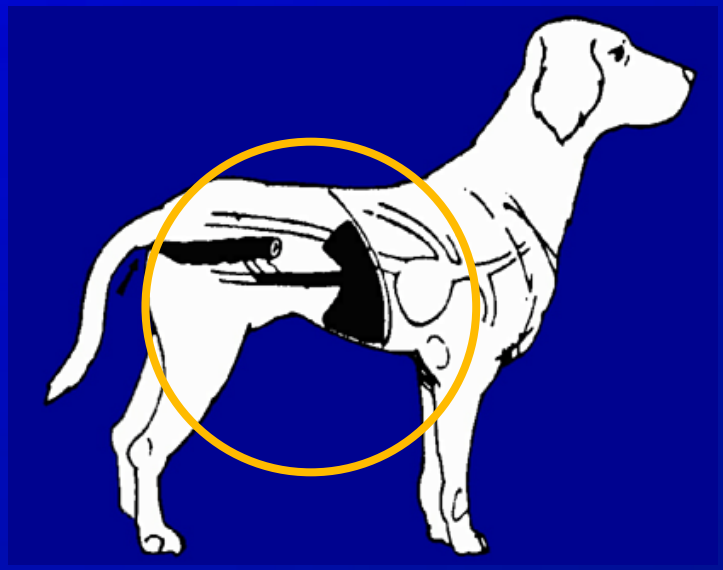
The radionuclide is administered into the colon. Absorption across the colonic mucosa results in visualization of the portal vein and liver first.



Transcolonic Portal Scintigraphy

Normal Dog

The radionuclide is absorbed from the colon into the portal vein and travels first to the liver



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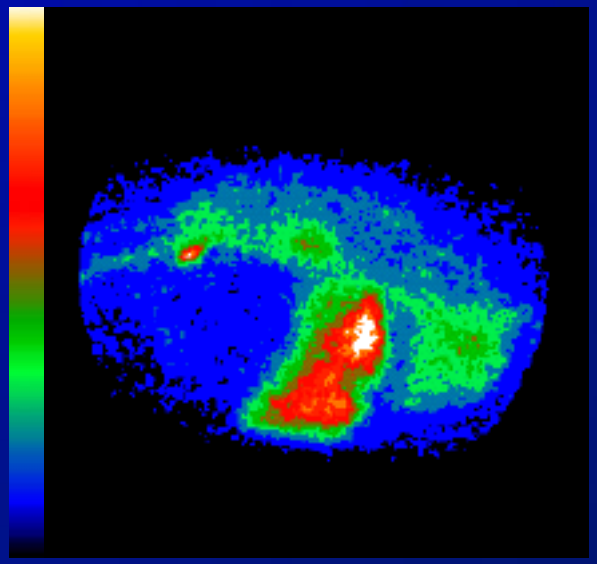


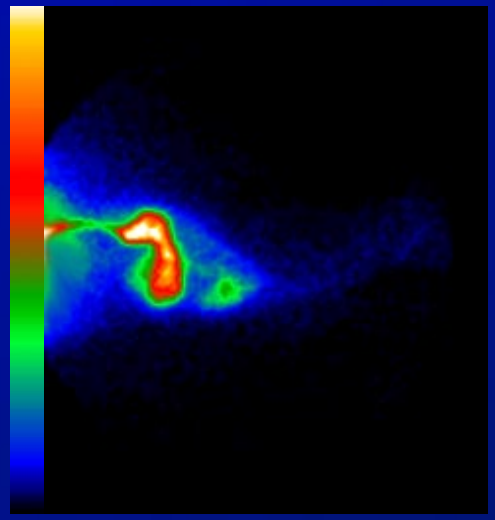
composite scintiscan

Transcolonic Portal Scintigraphy

Normal Cat

The radionuclide is absorbed from the colon into the portal vein and travels first to the liver and then to the systemic circulation.

schematic drawing
(yellow = camera view)



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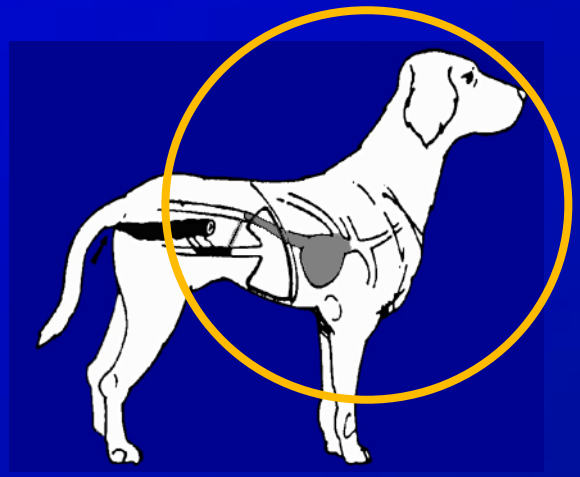
Transcolonic Portal Scintigraphy

Single Extrahepatic Porto-Systemic Shunt

The radionuclide is absorbed from the colon into the portal vein and travels first to the systemic circulation.



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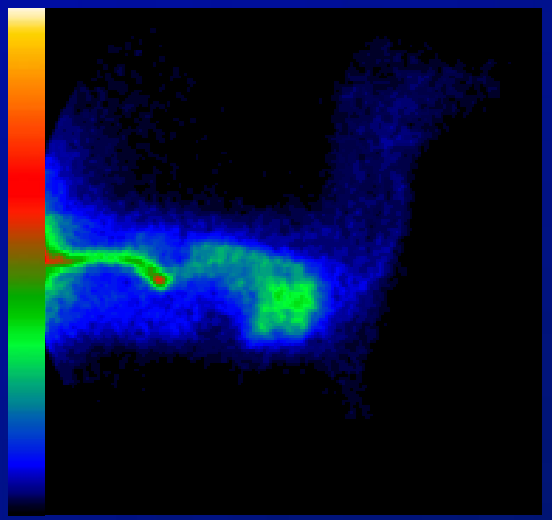

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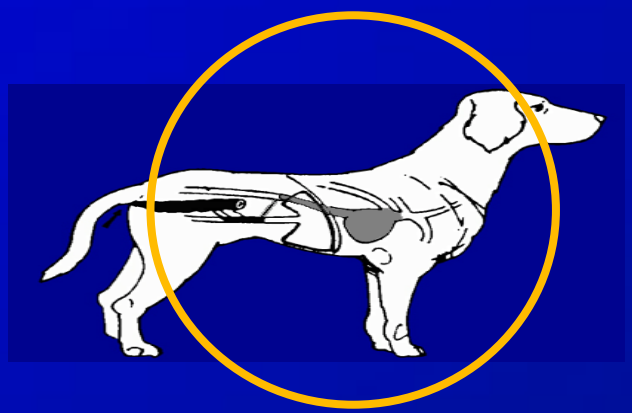
Transcolonic Portal Scintigraphy

Single Extrahepatic Porto-Systemic Shunt

The radionuclide is absorbed from the colon into the portal vein and travels first to the systemic circulation.



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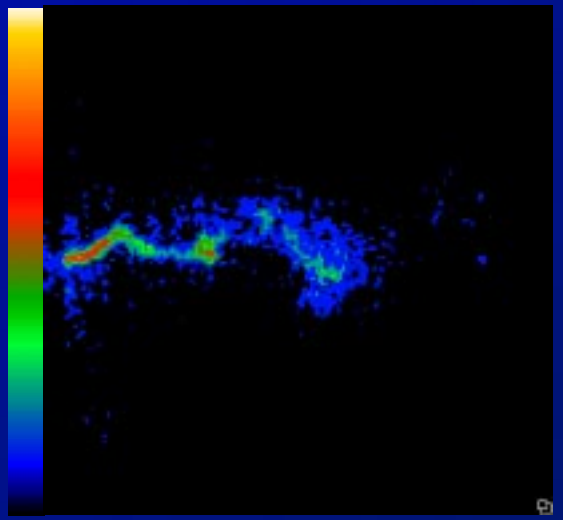

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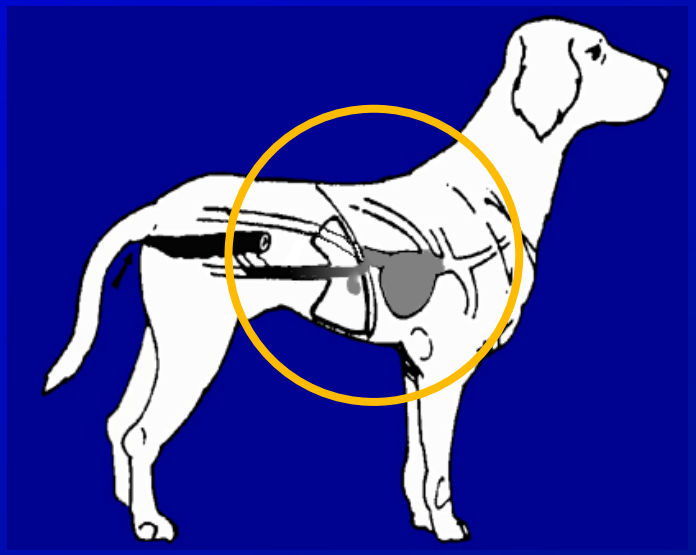
Transcolonic Portal Scintigraphy

Intrahepatic Shunt - Large Dog

The radionuclide is absorbed from the colon into the portal vein and bypasses the liver via a persistent ductus venosus.



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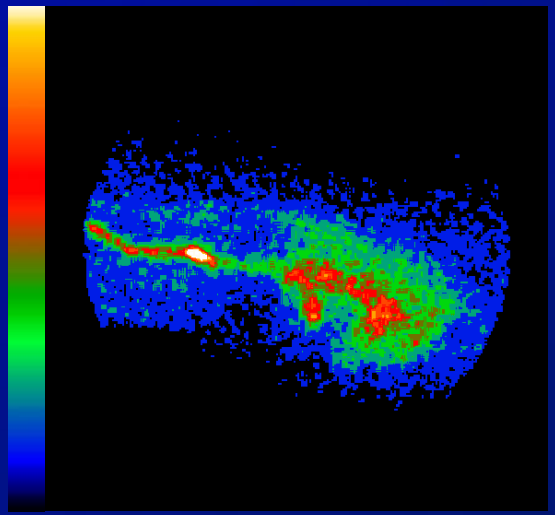

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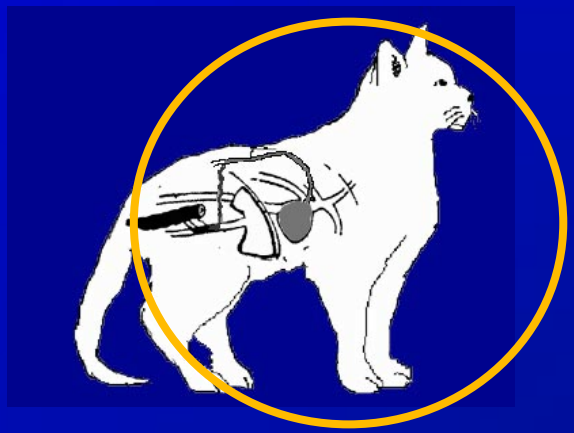
Transcolonic Portal Scintigraphy

Extrahepatic Porto-Systemic Shunt - Cat

The radionuclide is absorbed from the colon into the portal vein and travels first to the systemic circulation via a portal-azygous shunt.



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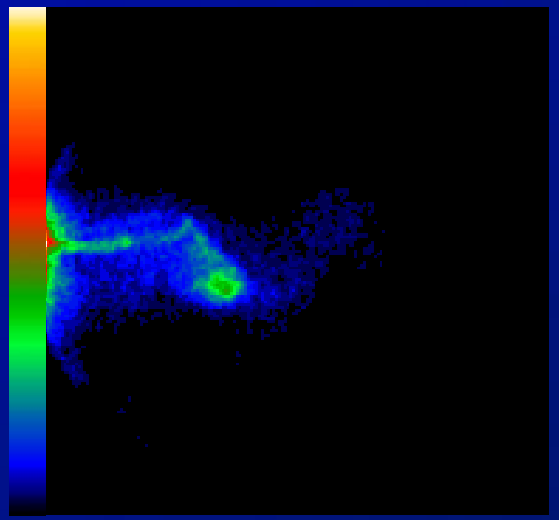

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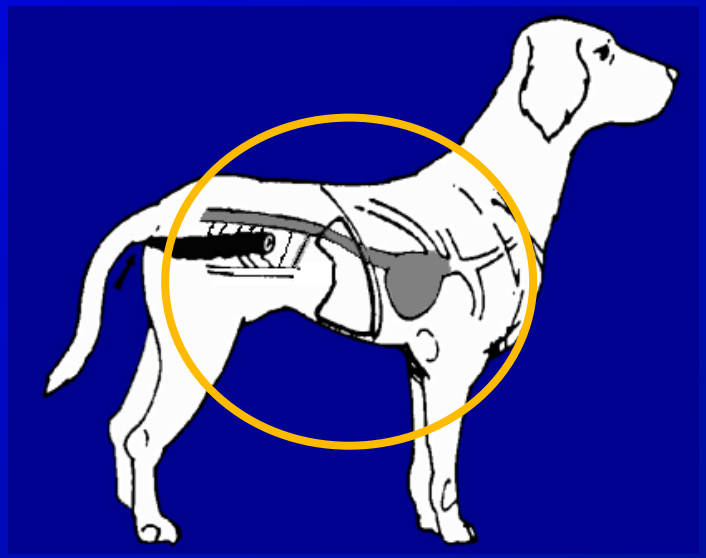
Transcolonic Portal Scintigraphy

Multiple extrahepatic PSS

Note the visualization of the caudal vena cava rather than the visualization of the portal vein



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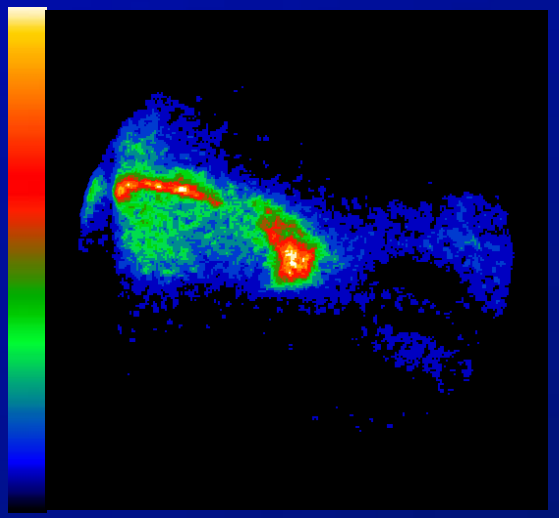

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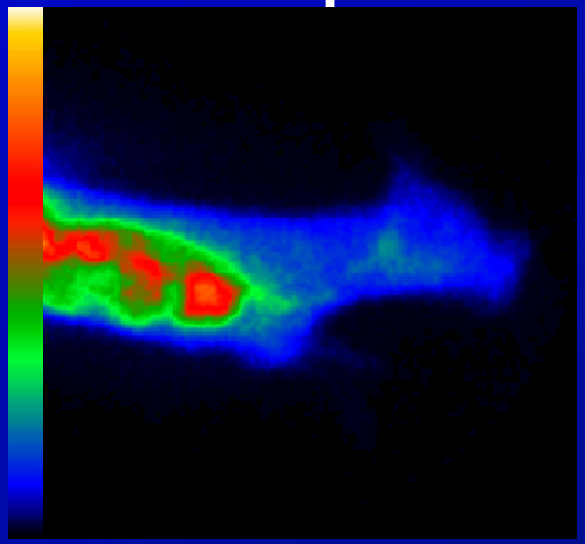
Transcolonic Portal Scintigraphy

Single extrahepatic PSS Preop & Postop-Typical Outcome

Note the change in radionuclide distribution following ligation of the single extrahepatic shunt vessel. The presurgical shunt fraction of 65% was reduced to a "normal" postsurgical shunt fraction of 12%.

Preop



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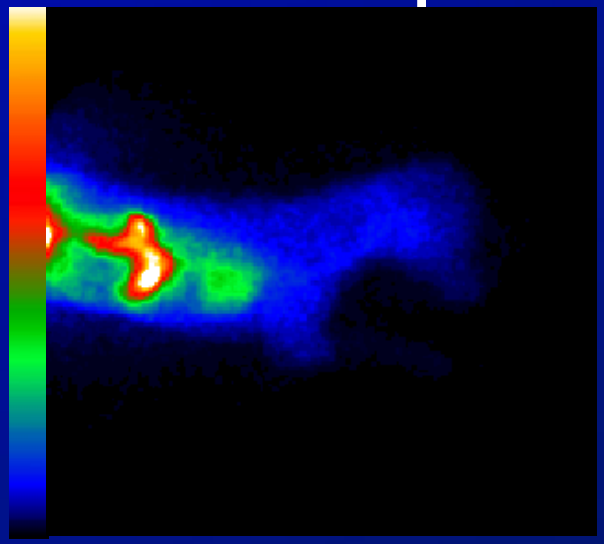
Post op



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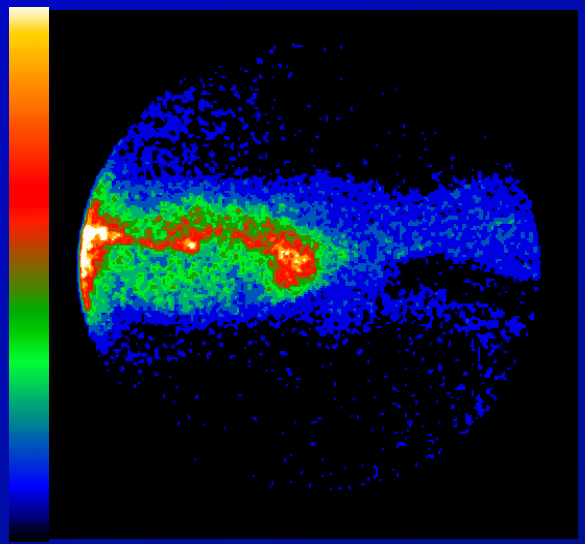
Transcolonic Portal Scintigraphy

Single extrahepatic PSS Preop & Postop - Unusual Outcome

Note the change in radionuclide pattern from the portal vein to the caudal vena cava in this dog with multiple acquired extrahepatic PSS following ligation of the initial single extrahepatic PSS and the developement of portal hypertension.

Preop



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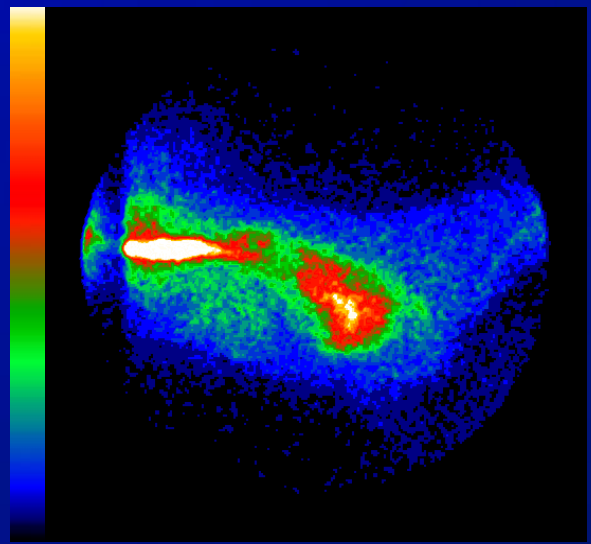

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