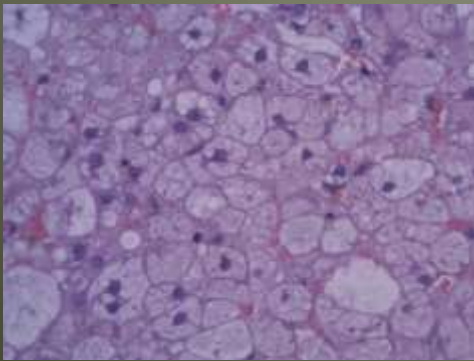


Liver: Medicine, Surgery and technology!

**AVSPNI Autumn Conference
6-8 Oct 2017**

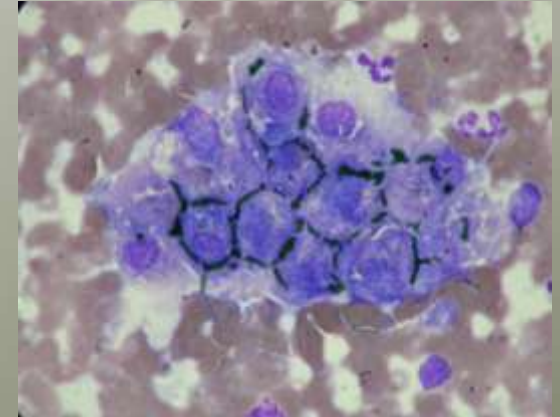


Craig Reilly BVM&S CertSAM MRCVS
Advanced practitioner (SAM)



Cedarmount Veterinary Clinic, Bangor





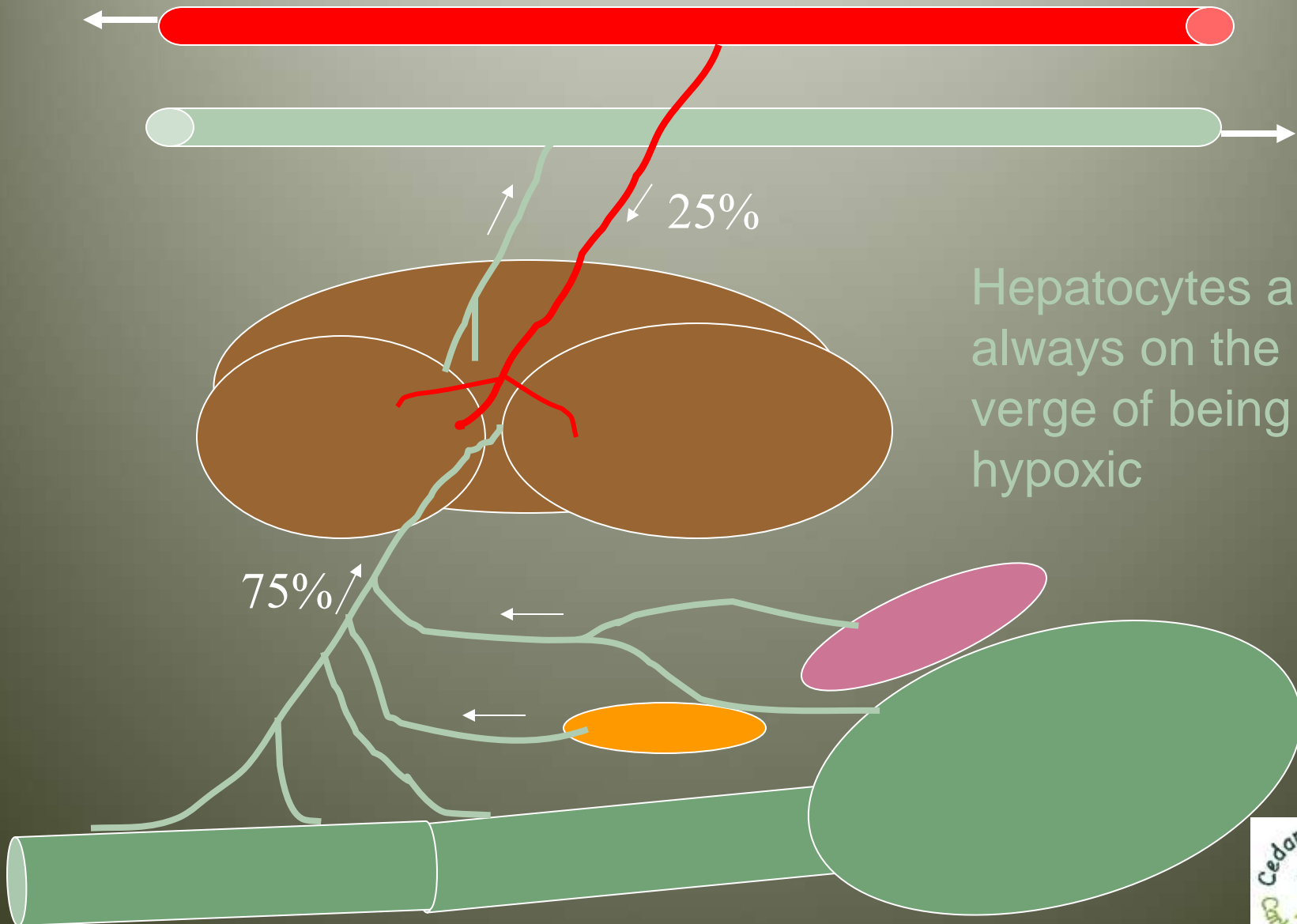
- Anatomy revision
- Signs
- Clinical exam
- Bloods/urine
- Xray
- Ultrasound
- Aspirate
- Biopsy - Keyhole
- Therapeutics
- Surgery tips

..and some cases!

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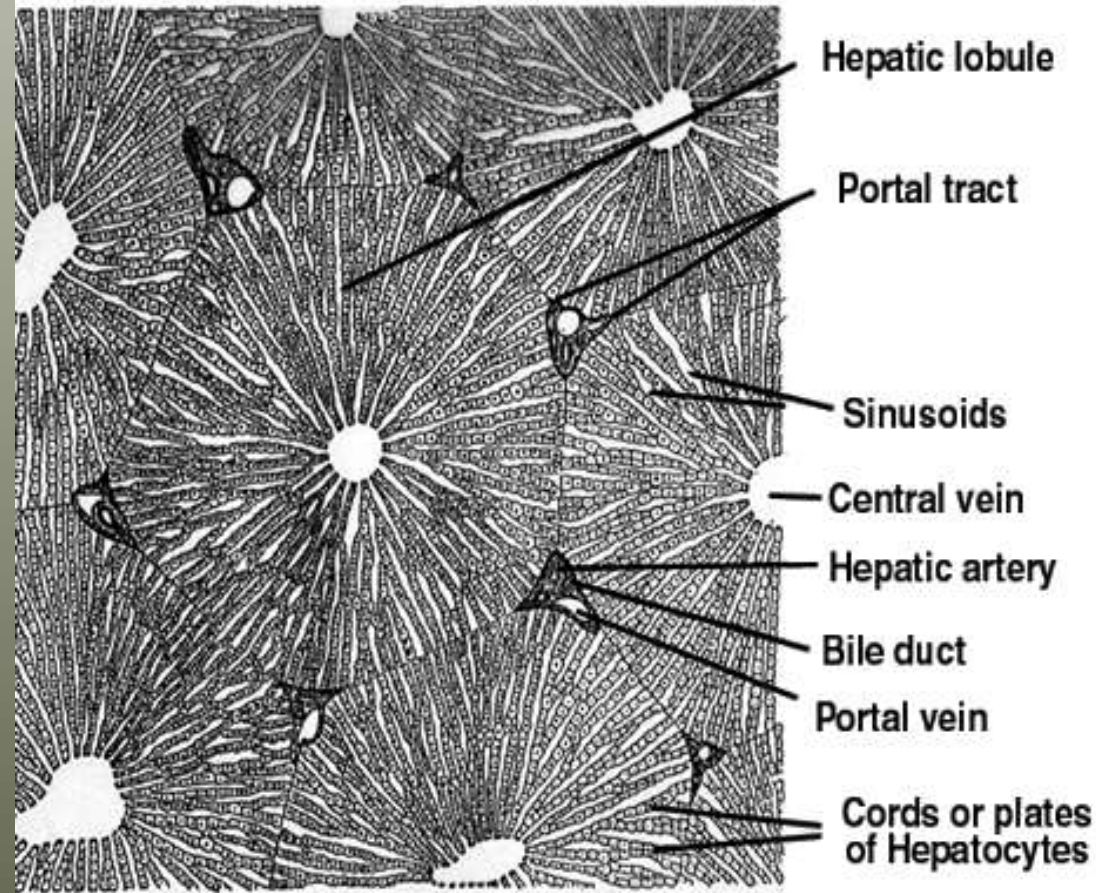
Liver : Blood supply



Hepatocytes are always on the verge of being hypoxic

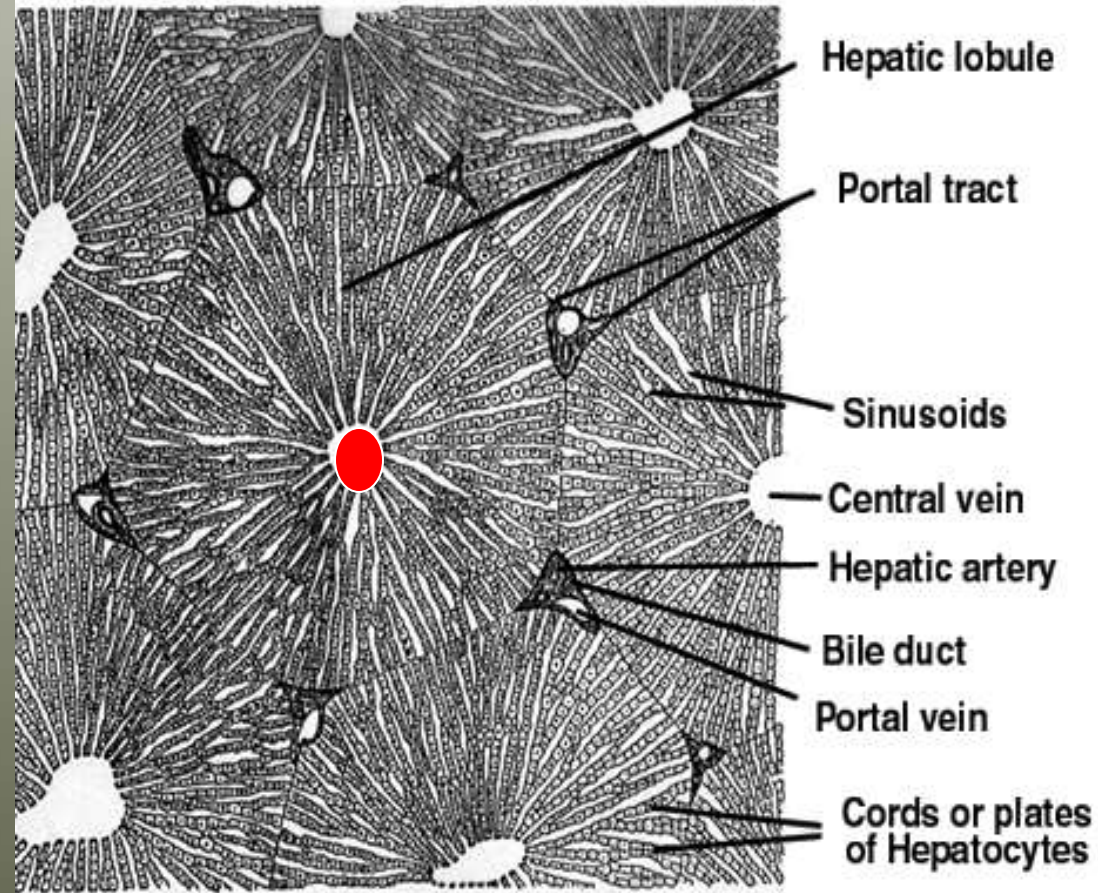
Hepatic structure

- ‘Classic’ lobule
 - Central vein
 - Portal area
 - Bile duct
 - Portal vein
 - Hepatic artery
 - Cellular cords / sinusoids
 - Space of Disse
 - Kupffer cells
 - Stellate cells



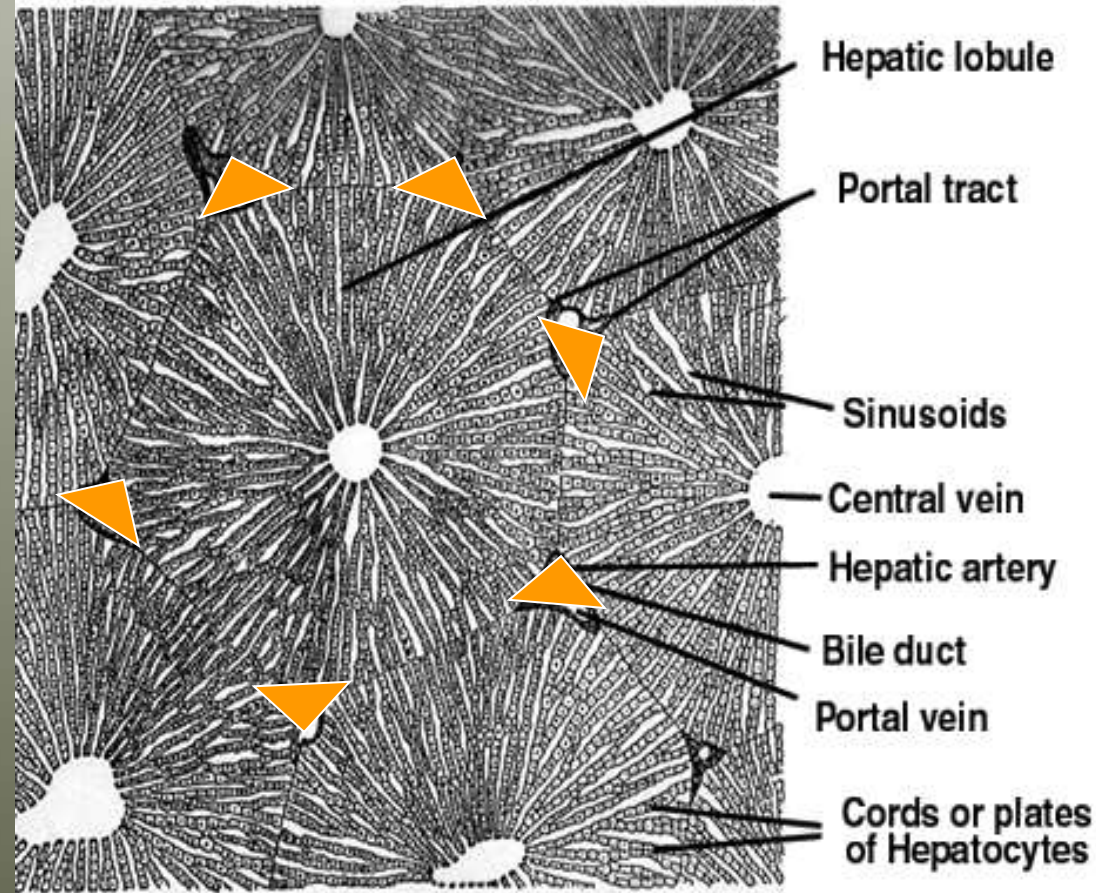
Hepatic structure

- Lobule
 - **Central vein**
 - Portal area
 - Bile duct
 - Portal vein
 - Hepatic artery
 - Cellular cords / sinusoids
 - Space of Disse
 - Kupffer cells
 - Stellate cells



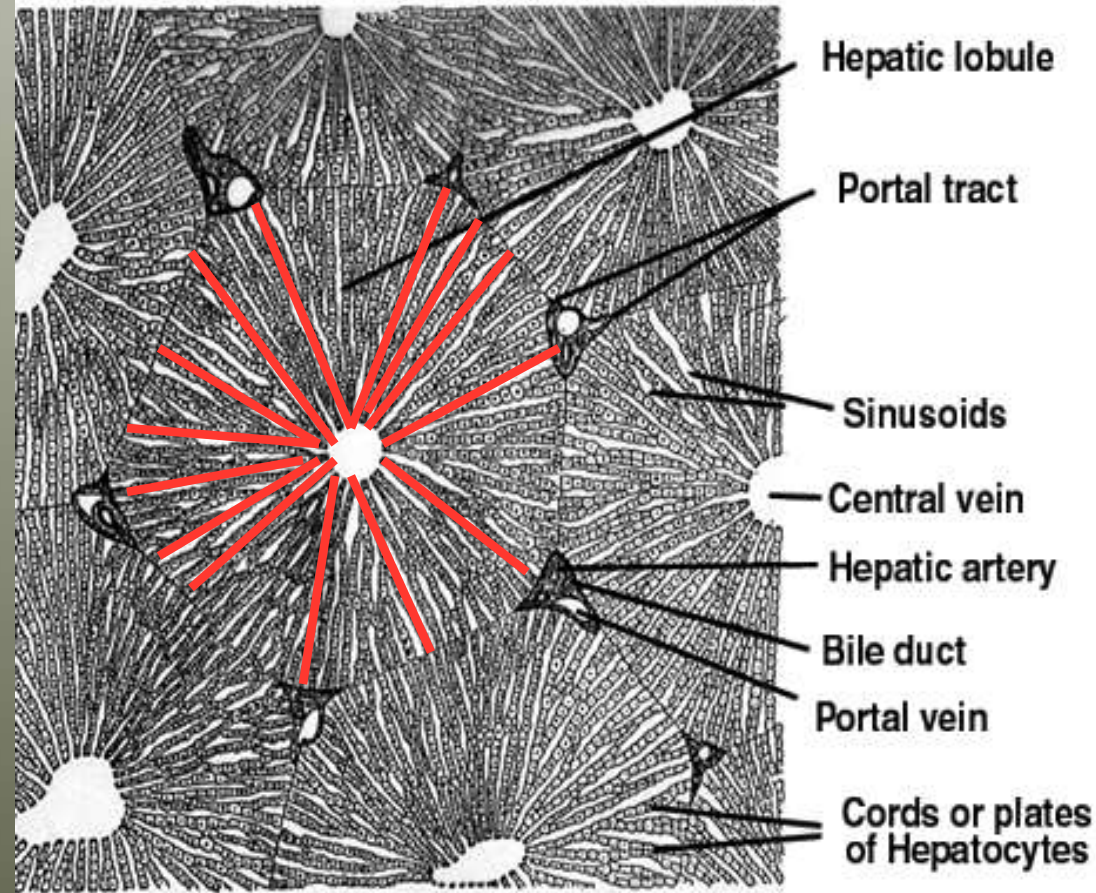
Hepatic structure

- Lobule
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 - Kupffer cells
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Hepatic structure

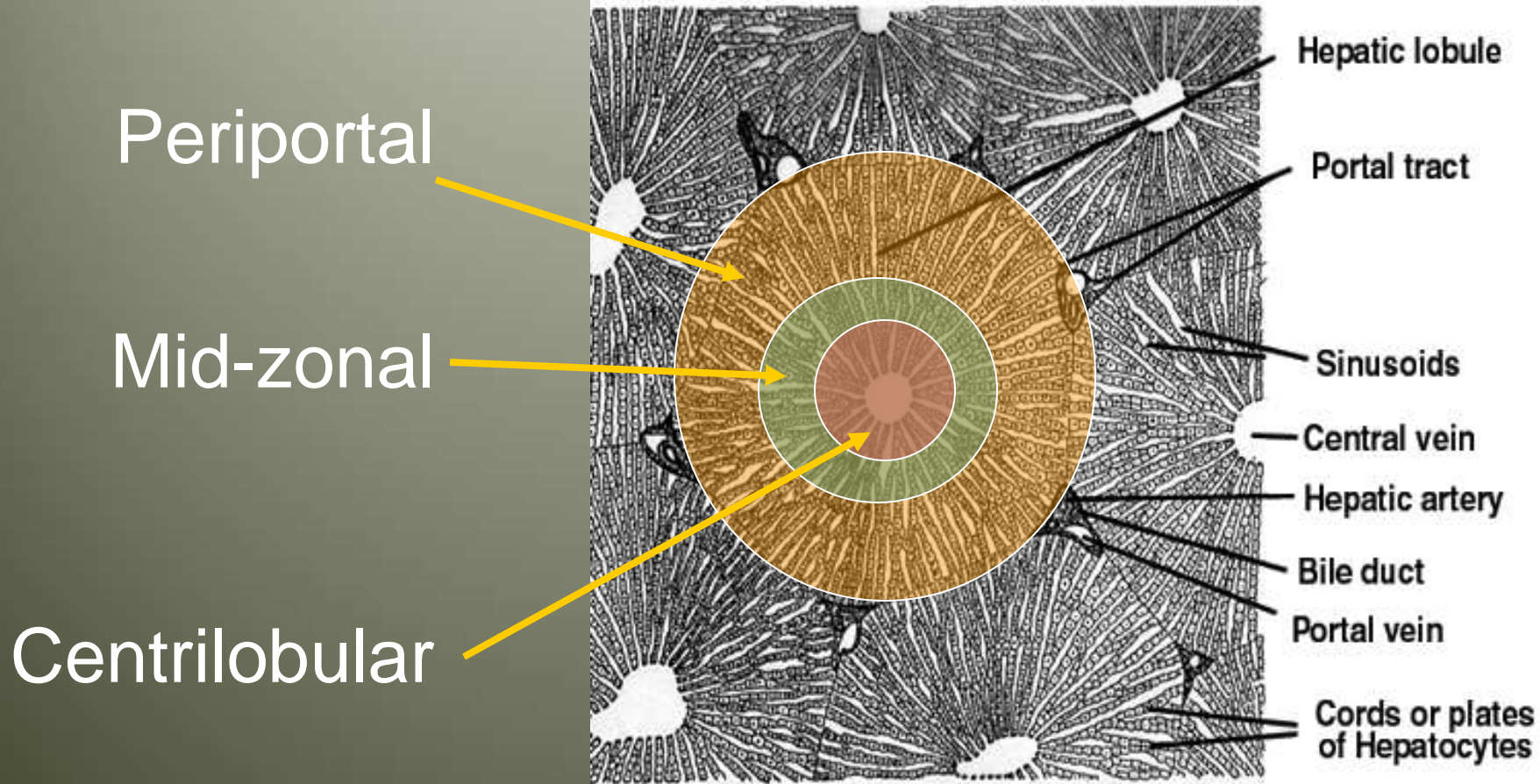
- Lobule
 - Central vein
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 - Space of Disse
 - Kupffer cells
 - Stellate cells



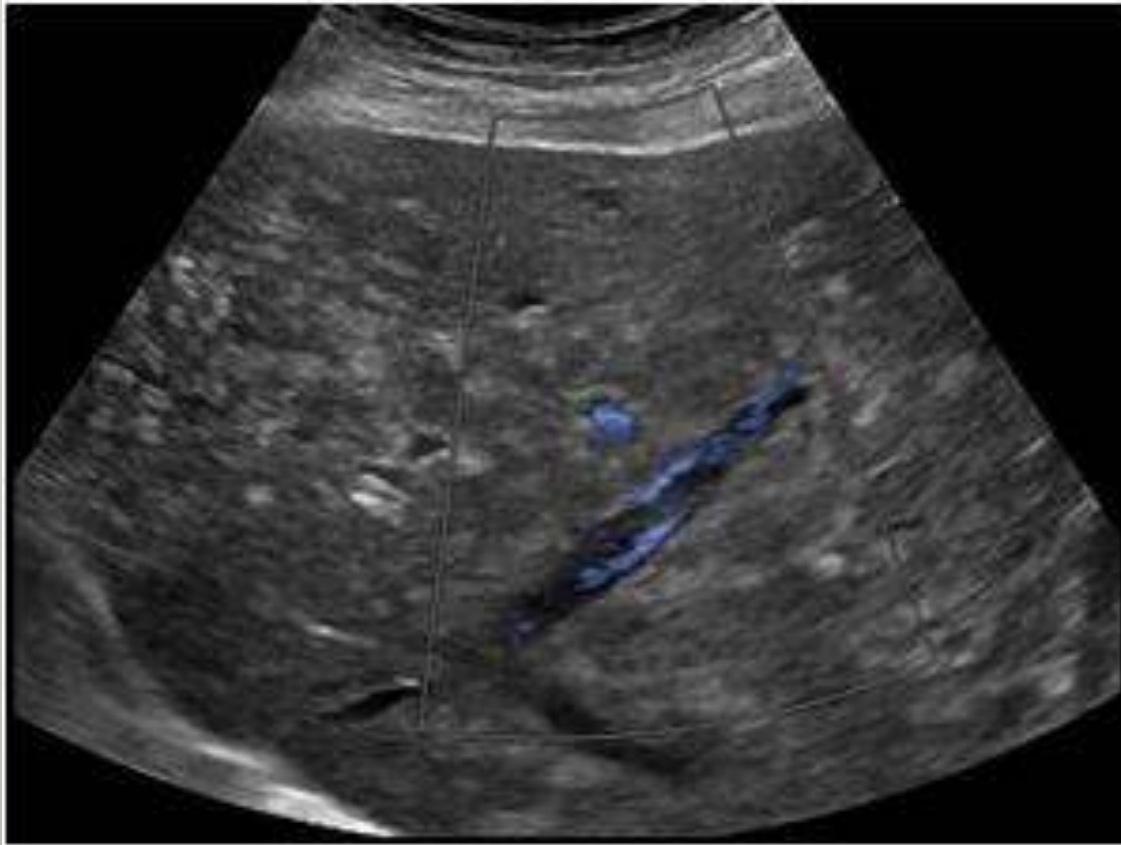
<http://www.ck12.org/health/liver/>



Hepatic structure



Portal veins show as echogenic walls



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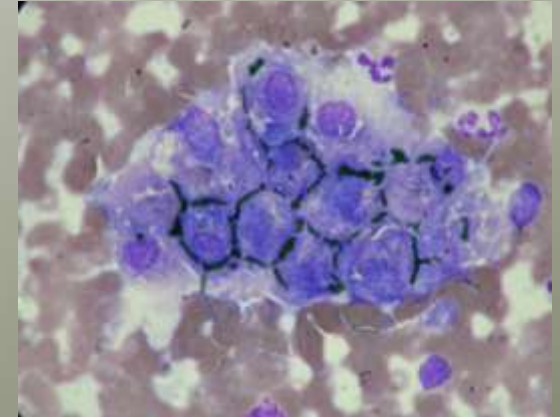
**..none
at all?**

- Aids digestion (especially of fats)
- Synthesis of proteins and hormones
- Regulating energy and protein metabolism
- Metabolism and elimination of toxic and waste products
- Immune regulation



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- Anatomy revision
- Signs
- **Clinical exam**
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- Xray
- Ultrasound
- Aspirate
- Biopsy
- Therapeutics
- Surgery tips

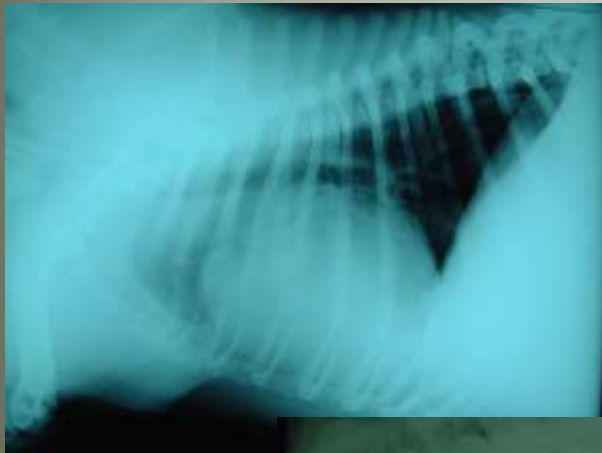
..and some cases!

Ascites?

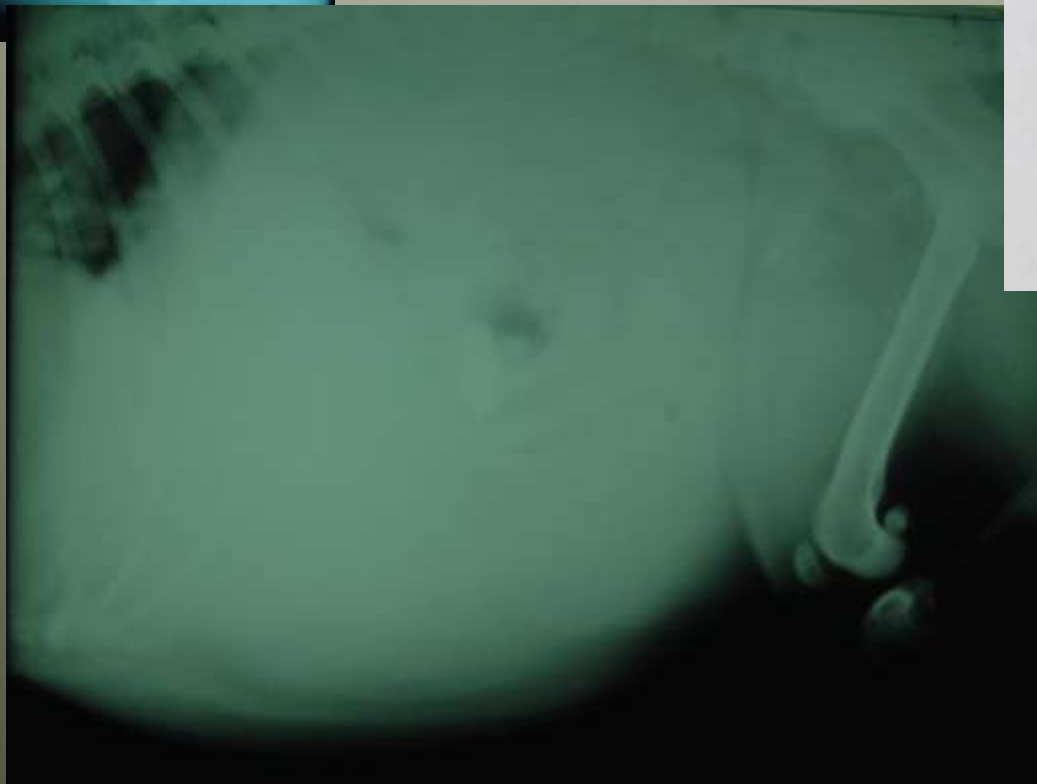


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Alb ↓ ?
If not...portal
hypertension?



?cardiac

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Abdominal distension + bilaterally distended jugulars = CHF (right-sided)

+/- Hepatojugular reflux (**not pulsatile!!**)



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- Cats also have an increased susceptibility because they lack some metabolic pathways in the liver that would be able to deal with some toxins



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But dogs too get liver poisoned!

Xylitol



← **GROUPON**



Two or Four Cycad King Sago Palm Trees from £29.99 With Free Delivery (62% Off)

~~£79.95~~ **£29.99** [Buy!](#)

62% Discount	£49.96 savings
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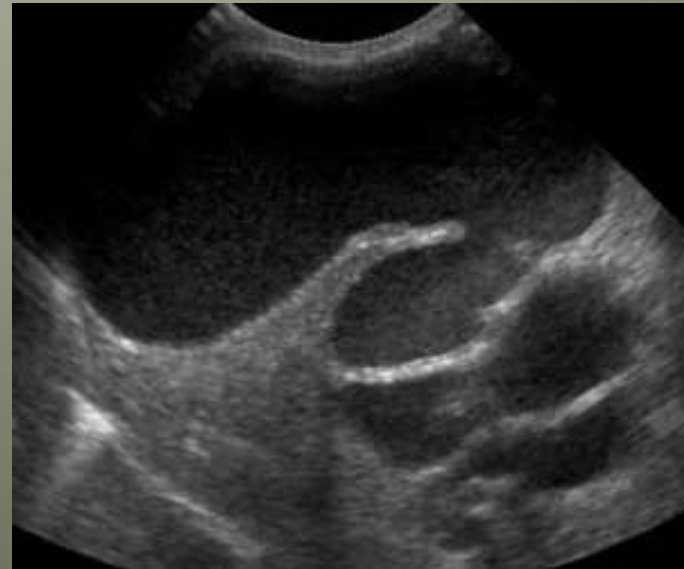
© SWNS.com

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Do you have
Anaemia?

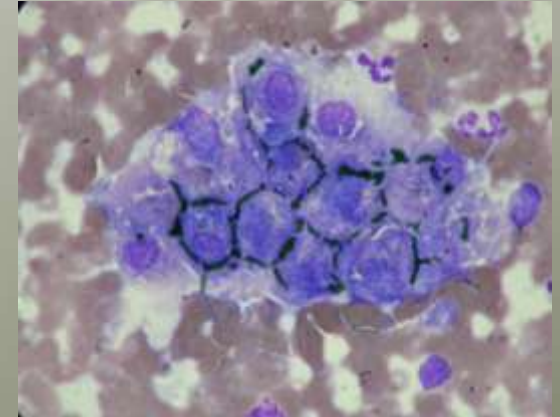


4-5 mm

4-5 dd

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..and some cases!

COMMONLY MEASURED LIVER ENZYMES AND THEIR INTERPRETATION

<i>Enzyme</i>	<i>Interpretation</i>
Alkaline phosphatase (ALP) Dog: often secondary	Induced enzyme released from canalicular parts of biliary tract; elevation therefore suggests cholestasis Non-specific liver enzyme: isoenzymes produced from other organs including bone and gut Usually the last enzyme to normalise after an acute insult Commonly elevated in older dogs as a result of secondary hepatopathies and benign hepatic hyperplastic nodules Also induced by certain drugs (eg, phenobarbitone and steroids)
Gamma glutamyl transferase (GGT)	Induced enzyme released from biliary tract epithelium further distally than ALP Induced by cholestasis, but exhibits less drug induction than ALP so is often a useful parameter to distinguish cases of suspected steroid hepatopathy
Alanine aminotransferase (ALT) Beware rapid fall	Hepatocellular enzyme – increased levels suggest leakage from hepatocytes Elevations also common in secondary hepatopathies Degree of elevation does not correlate with severity of liver damage Also released by regenerating hepatocytes, so elevation for days to weeks after an acute insult does not necessarily equate to a poor prognosis
Aspartate aminotransferase (AST) 	Hepatocellular enzyme – increased activity indicates increased leakage from cells Not liver specific; also released in muscle damage (skeletal and cardiac)

SAP always signif in cats!

GGT normal in hepatic lipidotic cats!

ALT in cats often parallels T4

In Practice SEPTEMBER 2006

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Epilepsy

Haematology + serum biochemistry every 6 to 12 months

(for interpretation of liver parameters we use the following guidelines reproduced from Rusbridge (2013a), reference Webster and Cooper (2009))



- **Double ALT**
- **SAP X5**



Guidelines: Increases greater than these levels, or if the GGT, AST, bilirubin, bile acids, albumin or cholesterol are abnormal all suggest that there may be genuine liver damage happening, and will warrant further investigation/s.

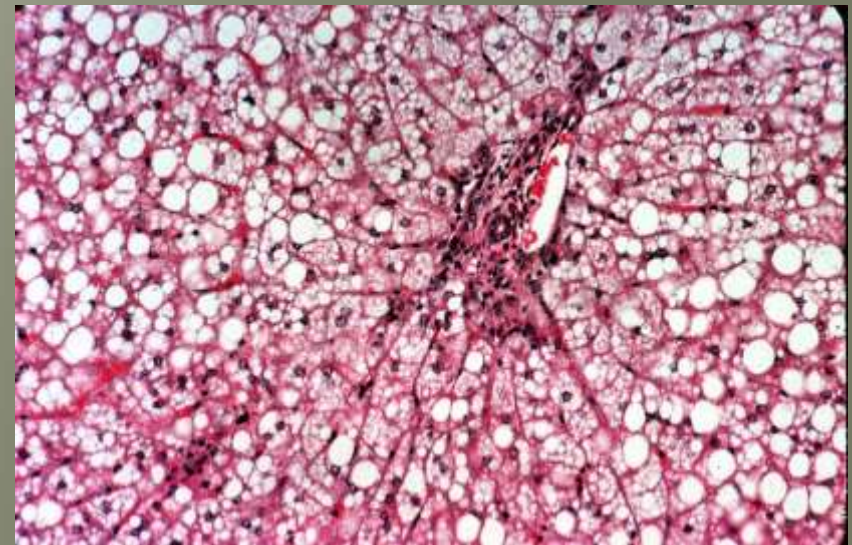
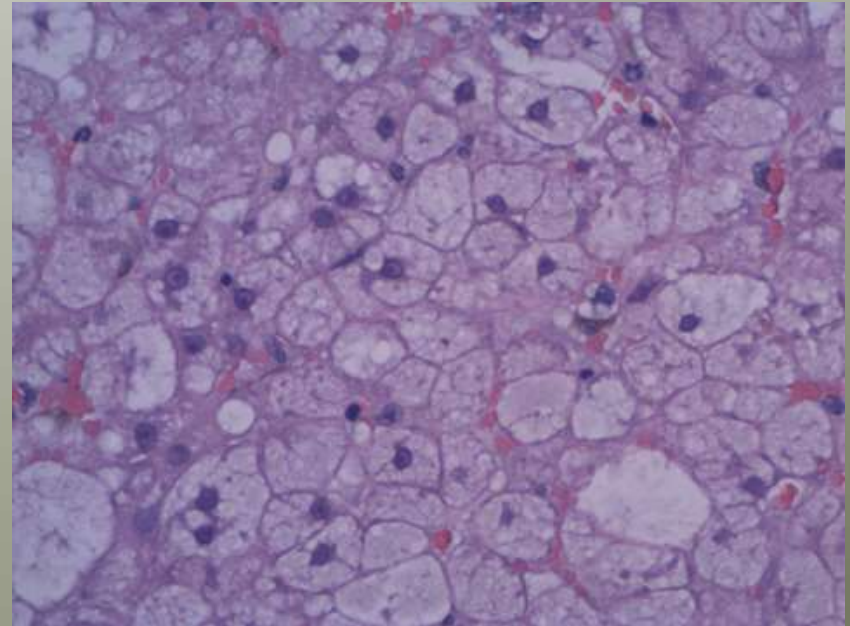
Periodic thyroid function testing is advised in older breeds predisposed to hypothyroidism. A diagnosis of hypothyroidism cannot be made on the basis of thyroid hormone concentrations alone as epilepsy and phenobarbitone therapy can result in a euthyroid sick syndrome.

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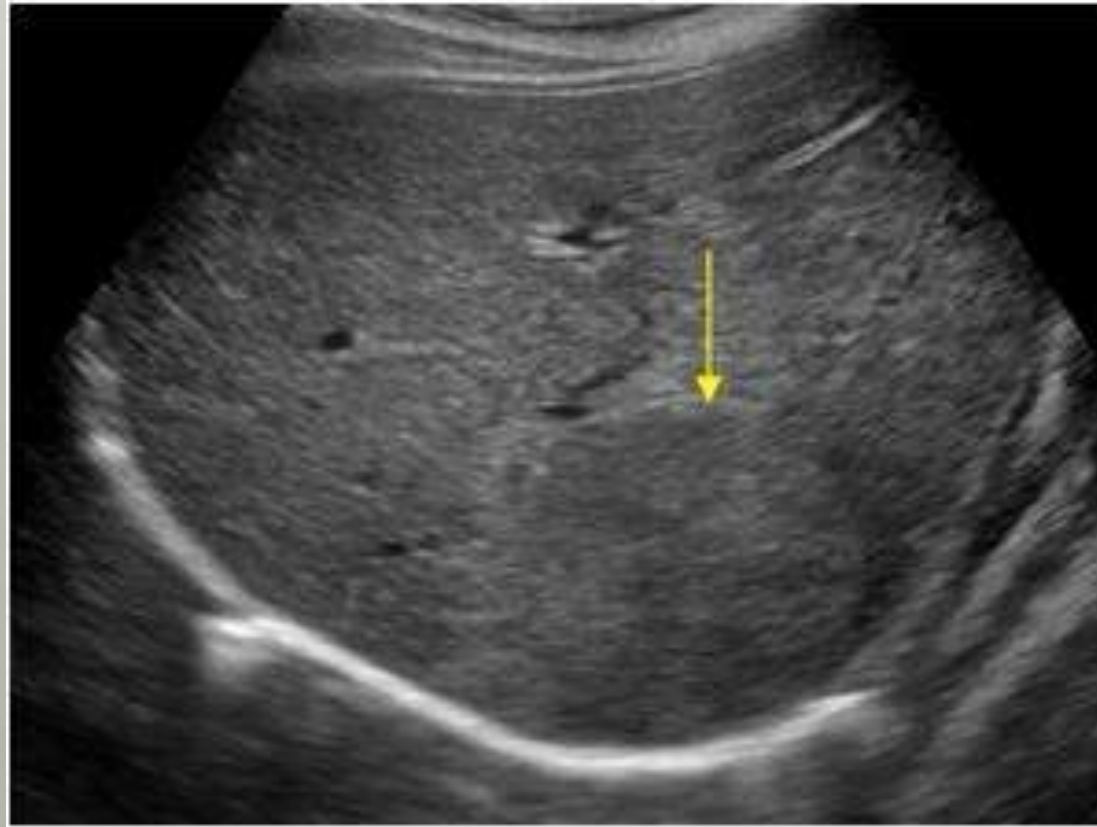


Secondary hepatopathies common!

- Hypoxia – anaemia/CHF
- GI disease
- Pancreatic disease
- DM
- Hypo/hyper thyroidism
- Cushings/Addisons
- Starvation/protein restriction
- Septicaemia/bacterial infections
- Shock



Nodular hyperplasia is common –
causes ALT and SAP elevation



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Other blood tests

Liver function tests

- Albumen (remember falls in acute phase of inflammation)
- Ammonia
- Bile acids (PPSBA) up to 50 may be non-specific, over 100 is liver!
- Cholesterol

Others

- Bilirubin – remember anorexic cats!
- Coagulation times esp if considering surgery
- PT/APTT prolongation in dogs very poor prognostic indicator

Never I/V in cats!

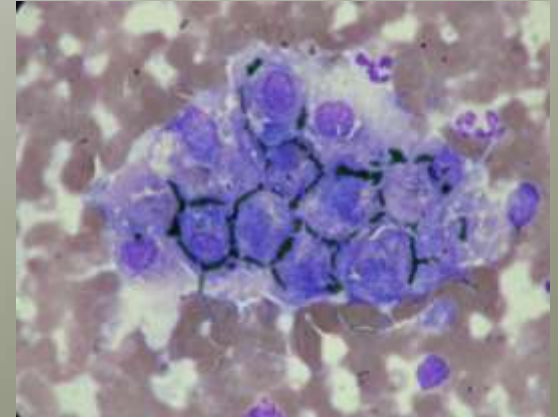


Not unusual to detect liver shunt on urinalysis



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- Anatomy revision
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- Aspirate
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- Surgery tips

• **Xray**
..and some cases!

Radiography: great for general size and shape

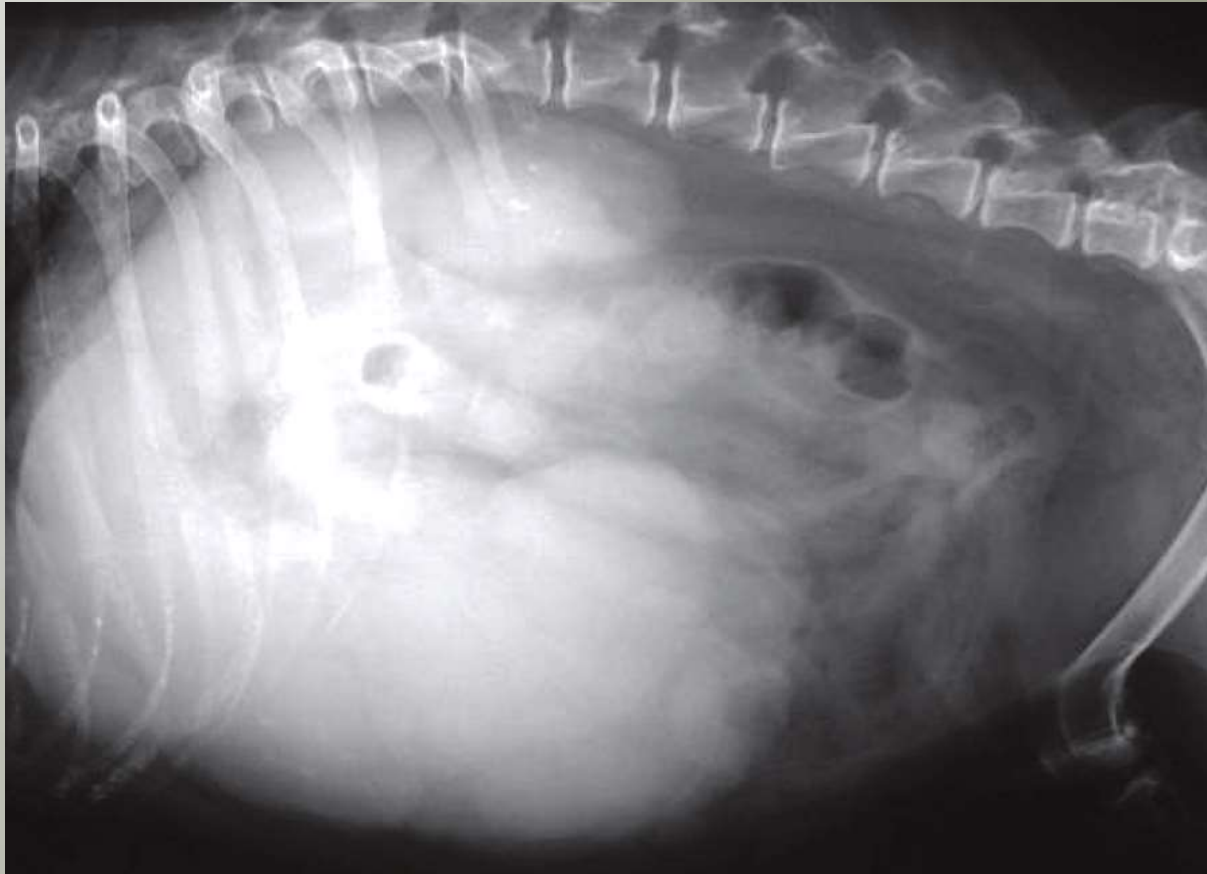
Breed
variation!



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Sometimes very useful...



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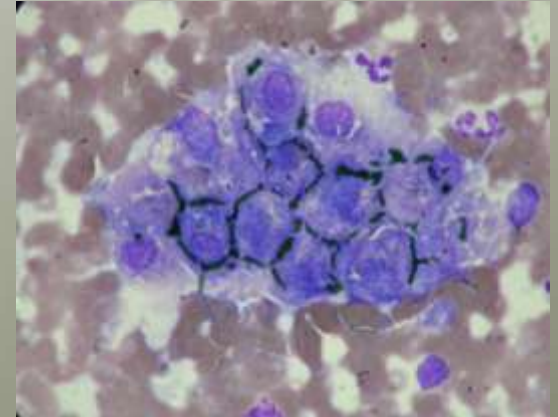


Sometimes incidental...



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- Anatomy revision
- Signs
- Clinical exam
- Bloods/urine
- Xray

- **Ultrasound**

- Aspirate
- Biopsy
- Therapeutics
- Surgery tips

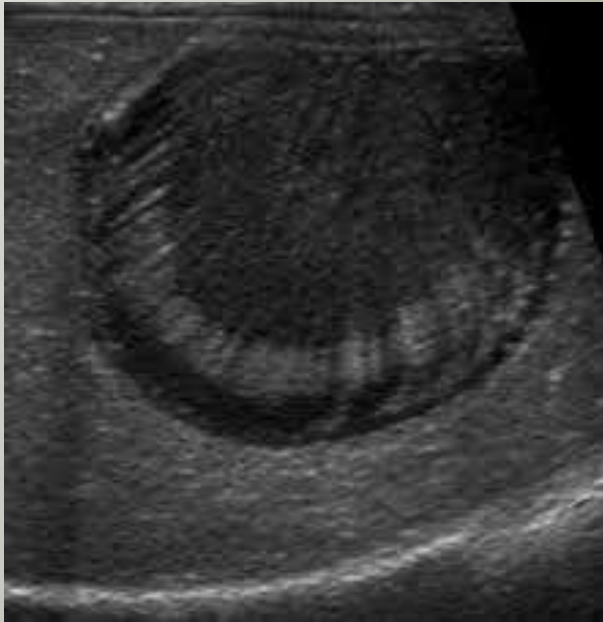
..and some cases!

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Mucocoele: emerging syndrome?



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Biliary Sludge – normal in dogs, less so in cats



..but if immobile?

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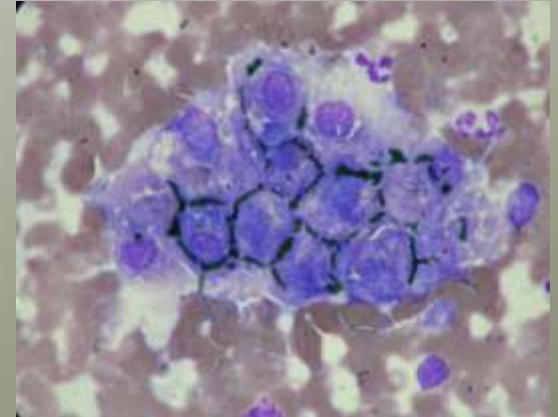


..immobile sludge strong marker for infection



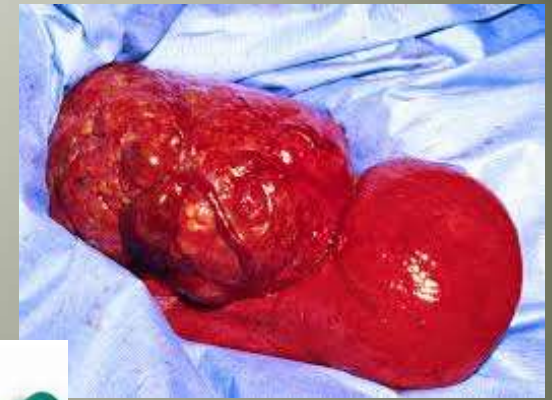
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- Anatomy revision
- Signs
- Clinical exam
- Bloods/urine
- Xray
- Ultrasound
- **Aspirate**
- **Biopsy**
- Therapeutics
- Surgery tips

..and some cases!



Don't forget copper! ? Take fresh tissue, or biopsy for stain



Always culture the bile!

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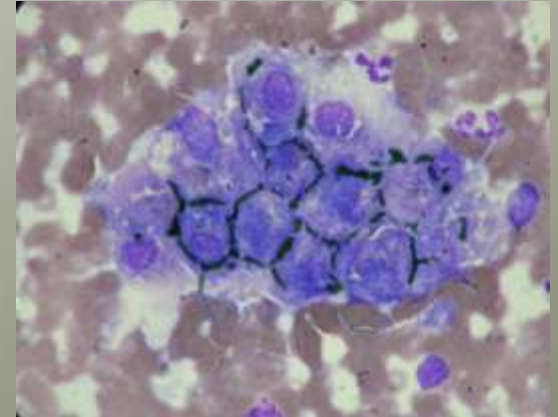
Keyhole Biopsy

- Fast
- Safe – even in ascites
- Low morbidity
- Day procedure
- Client acceptability even in aged pets
- **Allows repeat comparison monitoring: *need request pathologist compares***



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- Anatomy revision
- Signs
- Clinical exam
- Bloods/urine
- Xray
- Ultrasound
- Aspirate
- Biopsy
- Therapeutics
- Surgery tips

..and some cases!

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A middle aged Boxer with reducing appetite and lethargy

- ◇ Species Canine
- ◇ Breed Boxer
- ◇ Age 7 years
- ◇ Sex Male
neutered
- ◇ 4 week history of
lethargy
- ◇ Weakness
- ◇ Icterus
- ◇ ALP 2000, Bile
acids 150
- ◇ Abdo ultrasound
normal



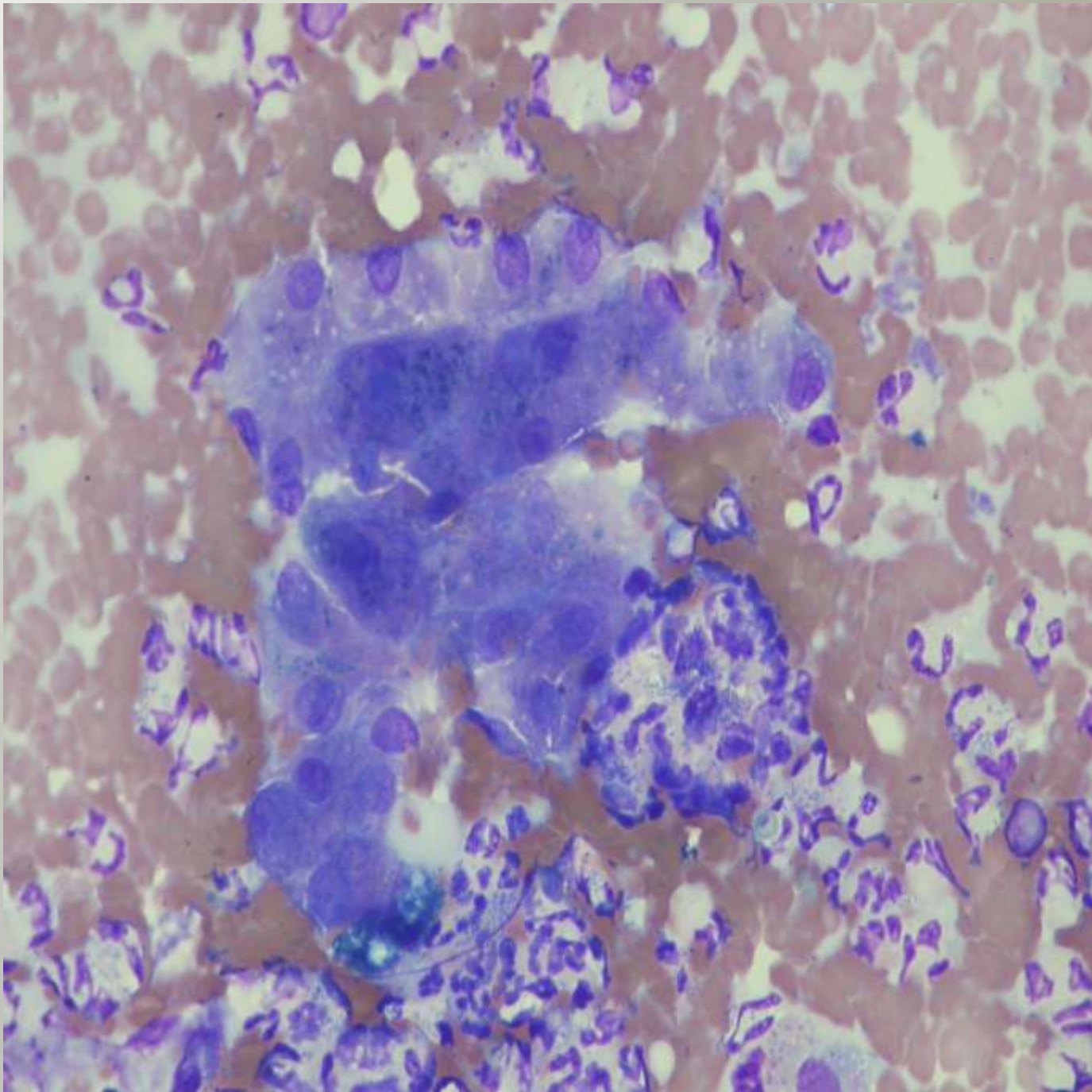
Haematology – blood film review

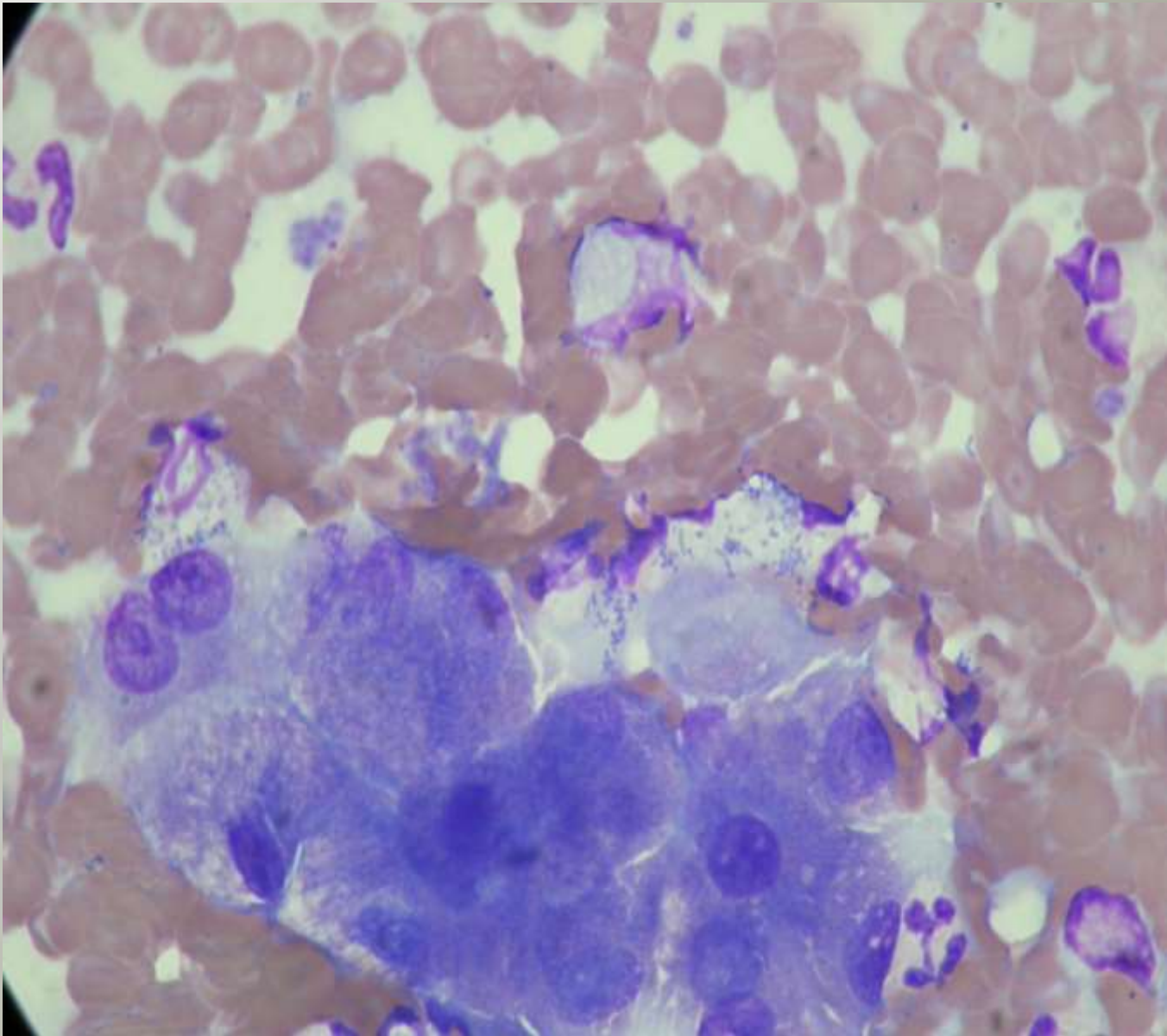
◇ RBC	WNL		
◇ Platelets	WNL		
◇ WBC	14.31		6.0-15.0
◇ Neutrophils	11.88	Hi	3.0-11.5
◇ Bands	0.29		0.0-0.3
◇ Lymphocytes	0.57	Lo	1.0-4.8
◇ Monocytes	1.43	Hi	0.0-1.3
◇ Eosinophils	0.14		0.0-1.25

◇ Leukocyte morphology - No significant left shift and no obvious toxic signs, low numbers of reactive lymphocytes

◇ Erythrocyte morphology - + polychromasia, low numbers of target cells, acanthocytes and occasional spherocytes

◇ Platelets – normal numbers and morphology





Heavy growth of E.coli – sens to amoxicillin, cephalixin, marbofloxacin

An aged Pointer with polyuria and polydipsia

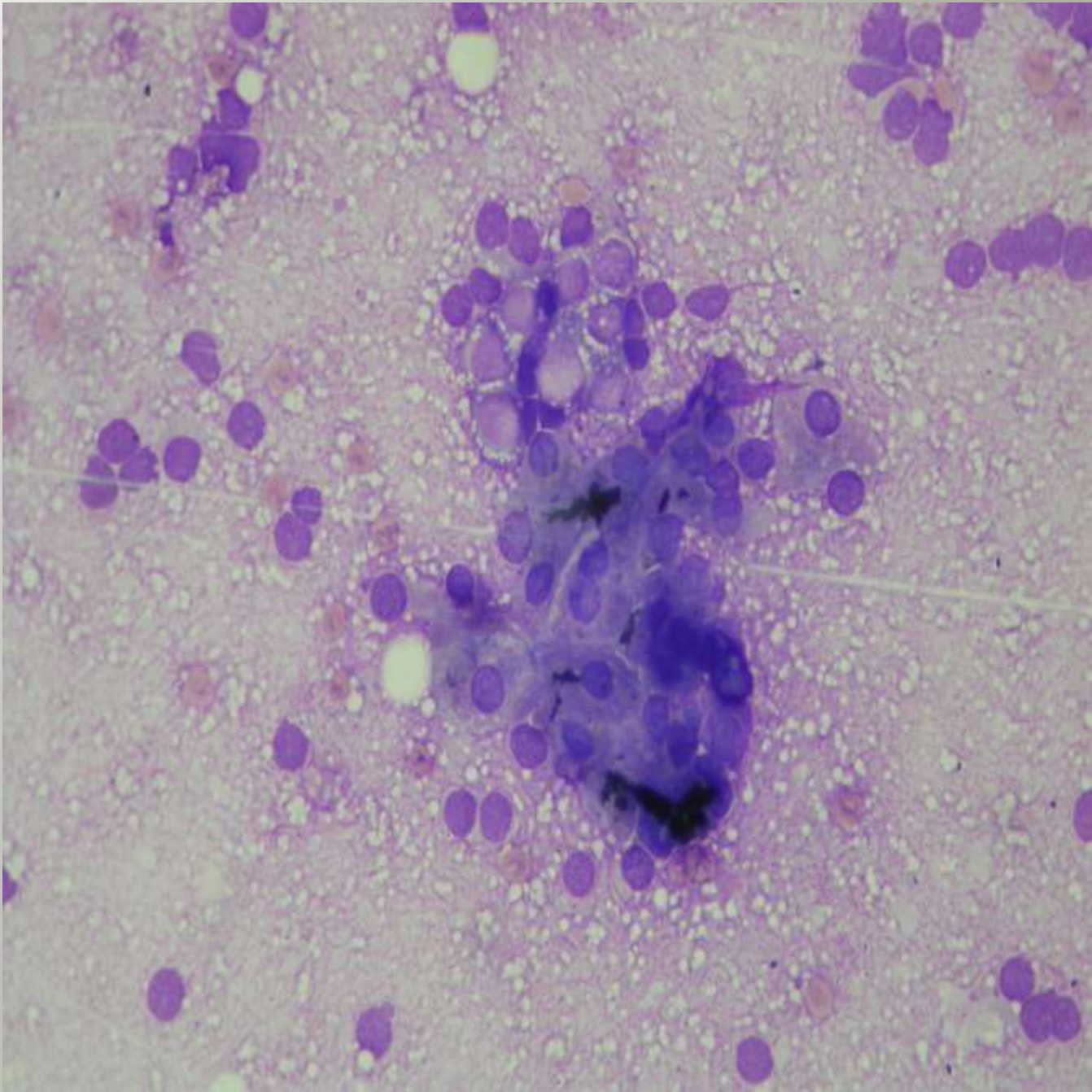
- ◇ Species Canine
- ◇ Breed Pointer
- ◇ Age 11 years
- ◇ Sex Female
- ◇ PU/PD
- ◇ ALP 3000, ALT 513
- ◇ US – highly abnormal liver with multiple hyperechoic masses
- ◇ Large left adrenal mass

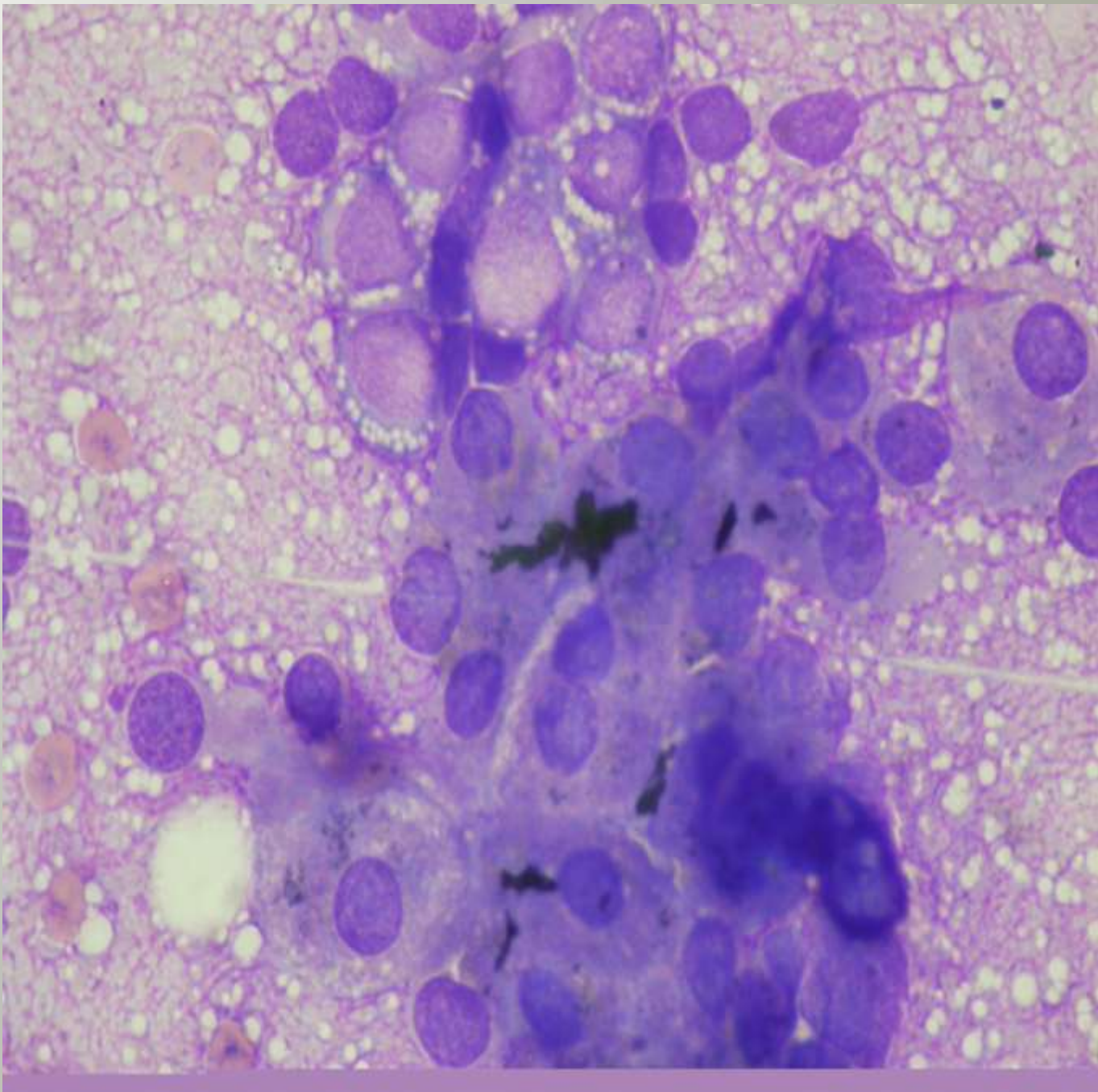




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A young cat with anorexia, pyrexia and a peritoneal effusion

- ◇ Species Feline
- ◇ Breed DSH
- ◇ Age 4 years
- ◇ Sex Female
neutered
- ◇ Pyrexia
- ◇ Jaundice
- ◇ Anorexia
- ◇ Treated with
synulox and
baytril



BIOCHEMISTRY AND HAEMATOLOGY

◇ Total protein	42	Lo	54-80
◇ Albumin	18	Lo	26-42
◇ Globulin	24	Lo	25-45
◇ Sodium	145		125-160
◇ Potassium	3.1	Lo	3.6-6.0
◇ Chloride	111		110-140
◇ Total calcium	1.54	Lo	2.0-3.0
◇ Phosphate	1.3		1.2-2.6
◇ Urea	2.5	Lo	4.0-12.0
◇ Creatinine	50	Lo	80-180
◇ Alb. Phos	30	Hi	0.0-25
◇ ALT	193	Hi	0.0-40.0
◇ GGT	2		0.0-10
◇ Total bill	72	Hi	0.0-10
◇ Bile acids	139	Hi	0.0-10
◇ Glucose	8.7	Hi	3.5-5.6
◇ CH	1476		0.0-152
◇ Serum icteric			

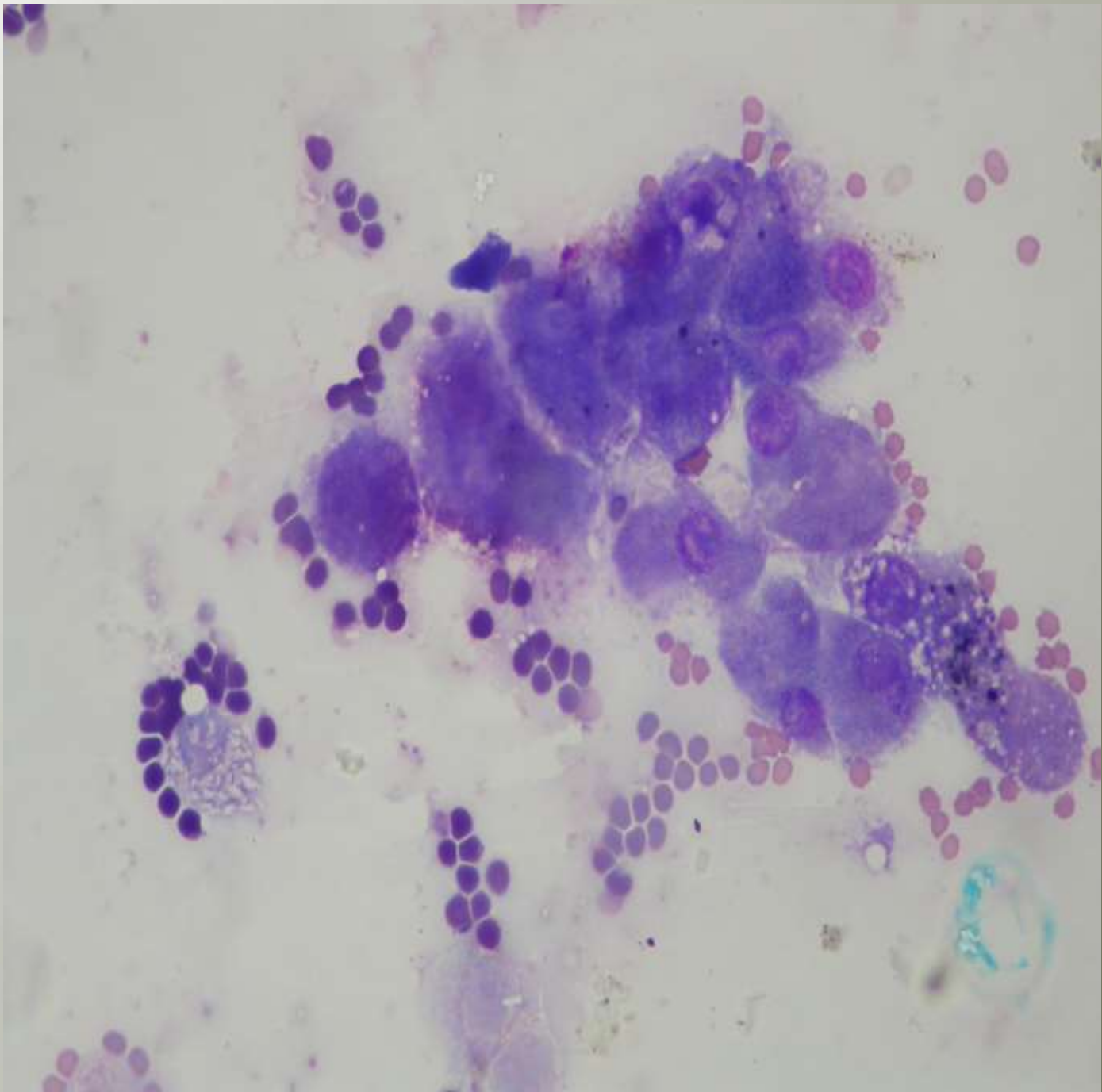
Fluid TP 21, Albumin 10,
Globulin 11, Alb:glob 0.91,
WBC 60, RBC +

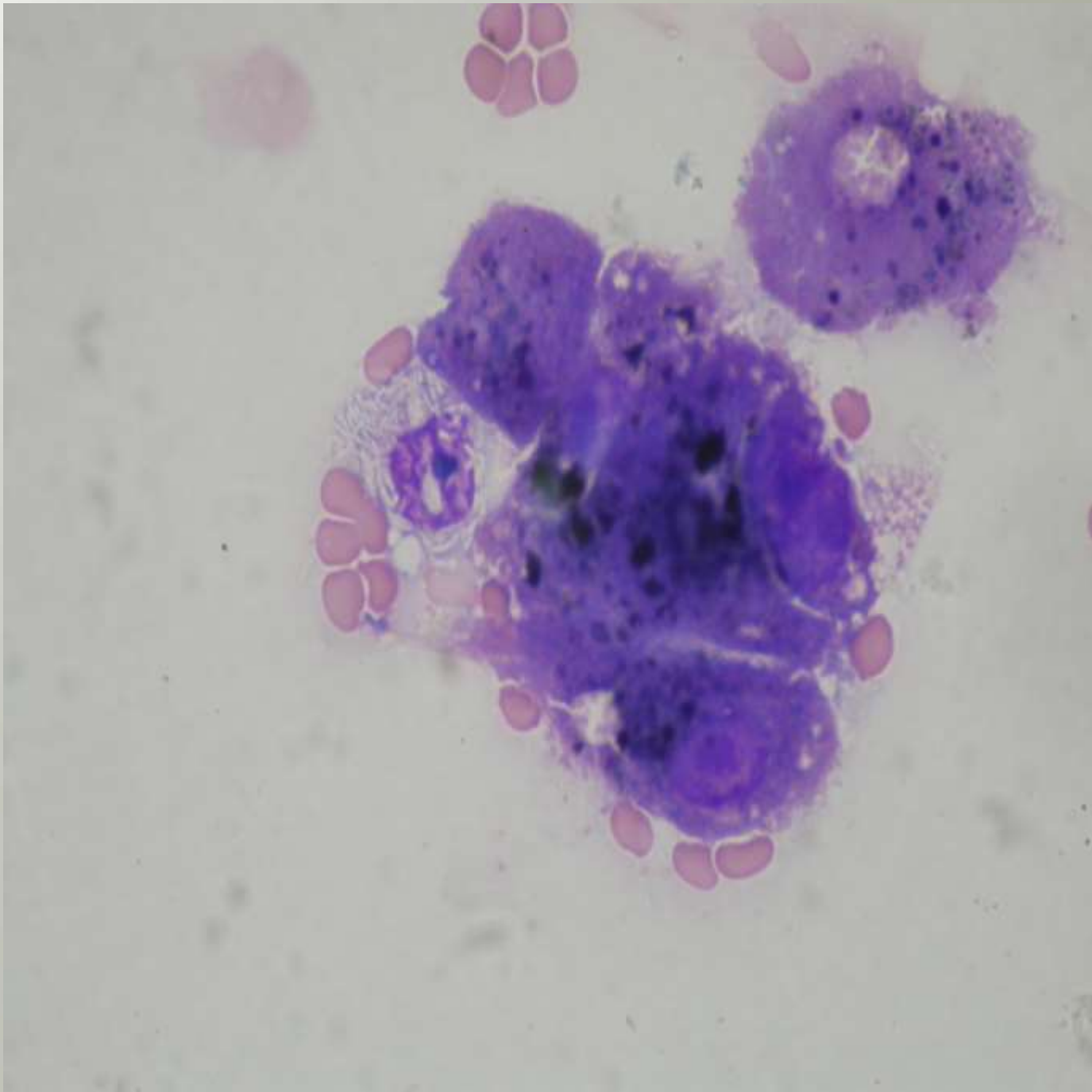
Modified transudate with
haemorrhage

◇ RBC	3.05	Lo	5.5-10.0
◇ HB	4.8	Lo	9.0-17.0
◇ HCT	16.8	Lo	27-50
◇ MCV	55		40-55
◇ MCH	15.8		13.0-21
◇ MCHC	28.8	Lo	31.0-36
◇ Platelets	See comment		
◇ WBC	1.85	Lo	4.0-15.0
◇ Neutrophils	0.52	Lo	2.5-12.5
◇ Bands	0.42	Hi	0.0-0.3
◇ Lymphocytes	0.21	Lo	1.5-7.0
◇ Monocytes	0.35		0.0-0.8
◇ Eosinophils	0.0		0.0-1.5

◇ Platelets clumped in film, actual count appears normal.
Metamyelocytes, occ myelocyte, neutrophils show slight toxicity, occ dohle body, no polychromasia

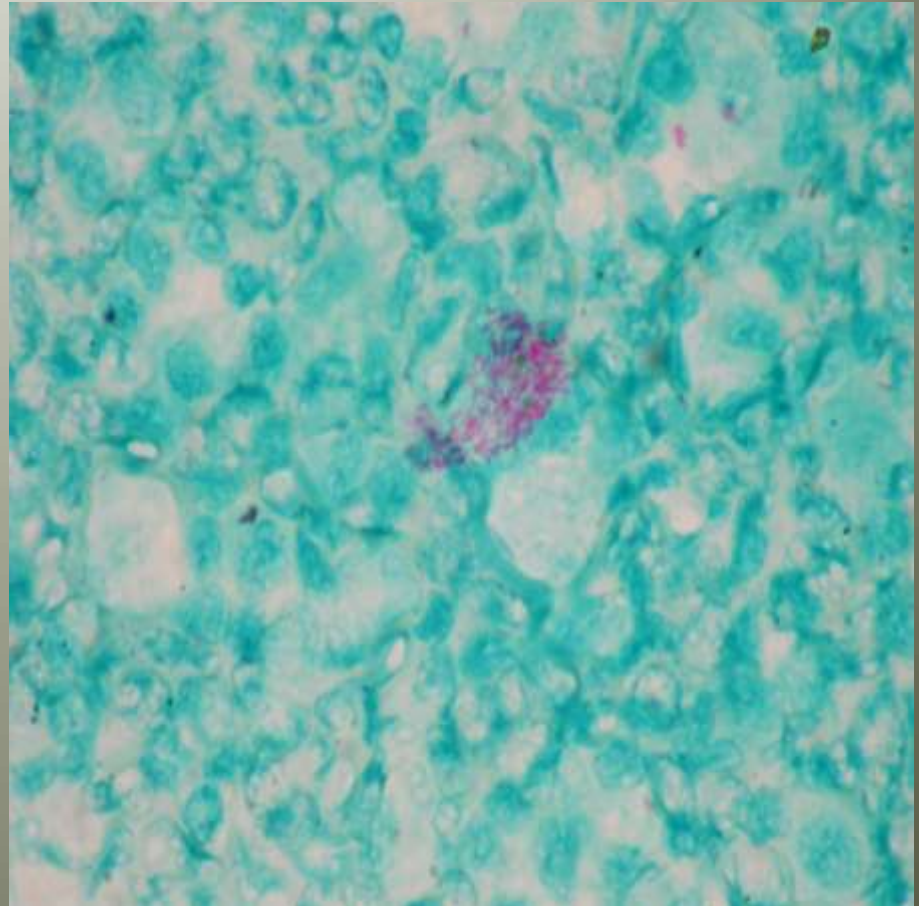
◇ FELV	Negative
◇ FIV	Negative
◇ Coronavirus	Negative <10





Blood Test for Suspect Feline TB

The interferon gamma test is intended to assist in the diagnosis of suspected feline TB cases. The interferon gamma test can be useful in categorising cats with suggestive lesions appropriately. This in turn can inform decisions as to whether treatment is appropriate and whether it is necessary to report the case to AHVLA (Suspected Bovine TB is a notifiable disease in all mammals). There is also some evidence that the test can be used to monitor treatment, with responses falling in cats in remission



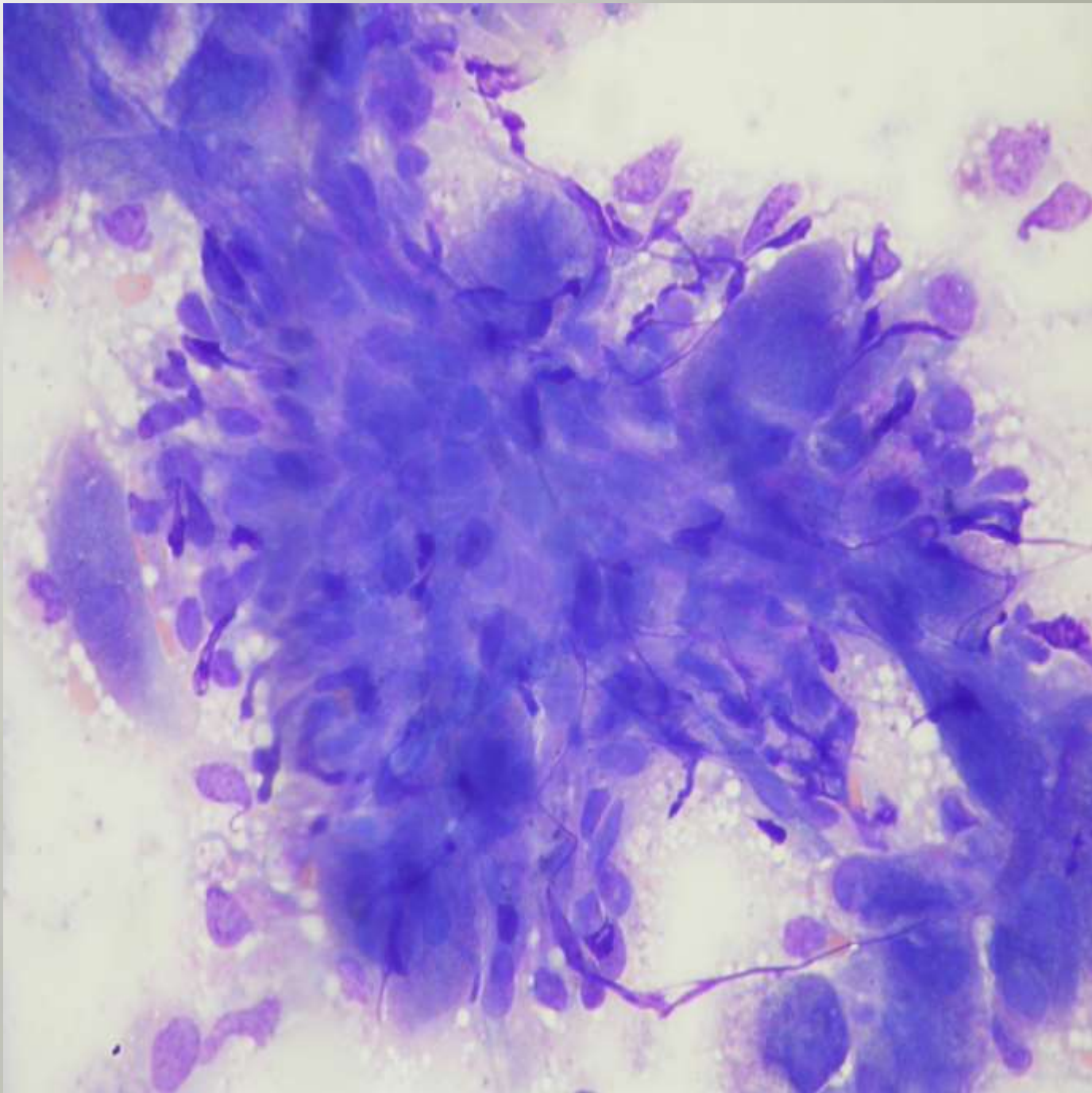
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A young bitch with ascites

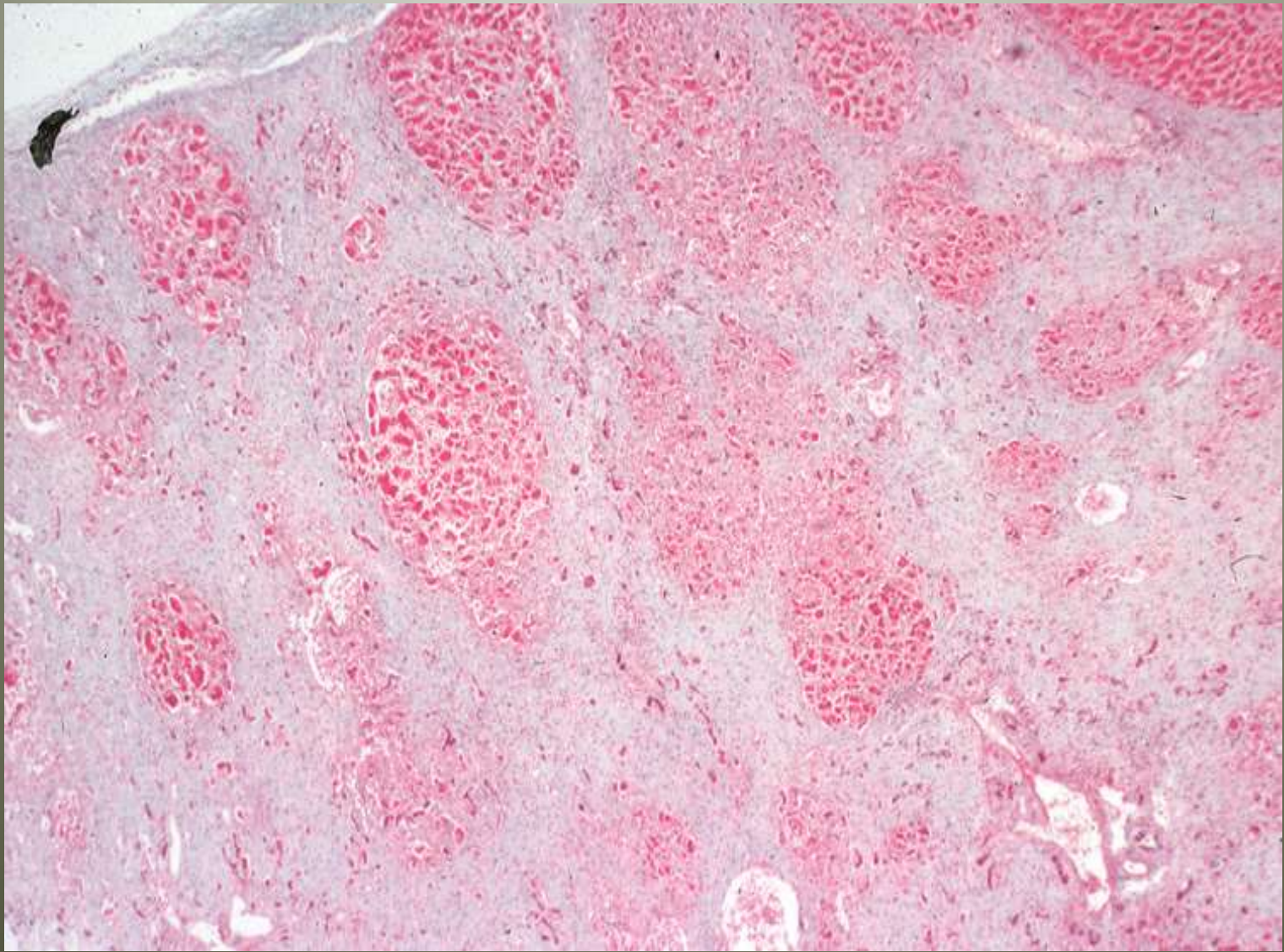
- ◇ Species Canine
- ◇ Breed Springer
Spaniel
- ◇ Age 1 years
- ◇ Sex Female
- ◇ Weight loss
- ◇ Reduced appetite
- ◇ Ascites – low protein modified transudate
- ◇ Low albumin, elevated ALT and ALP
- ◇ Bile acids pre 202, post 243

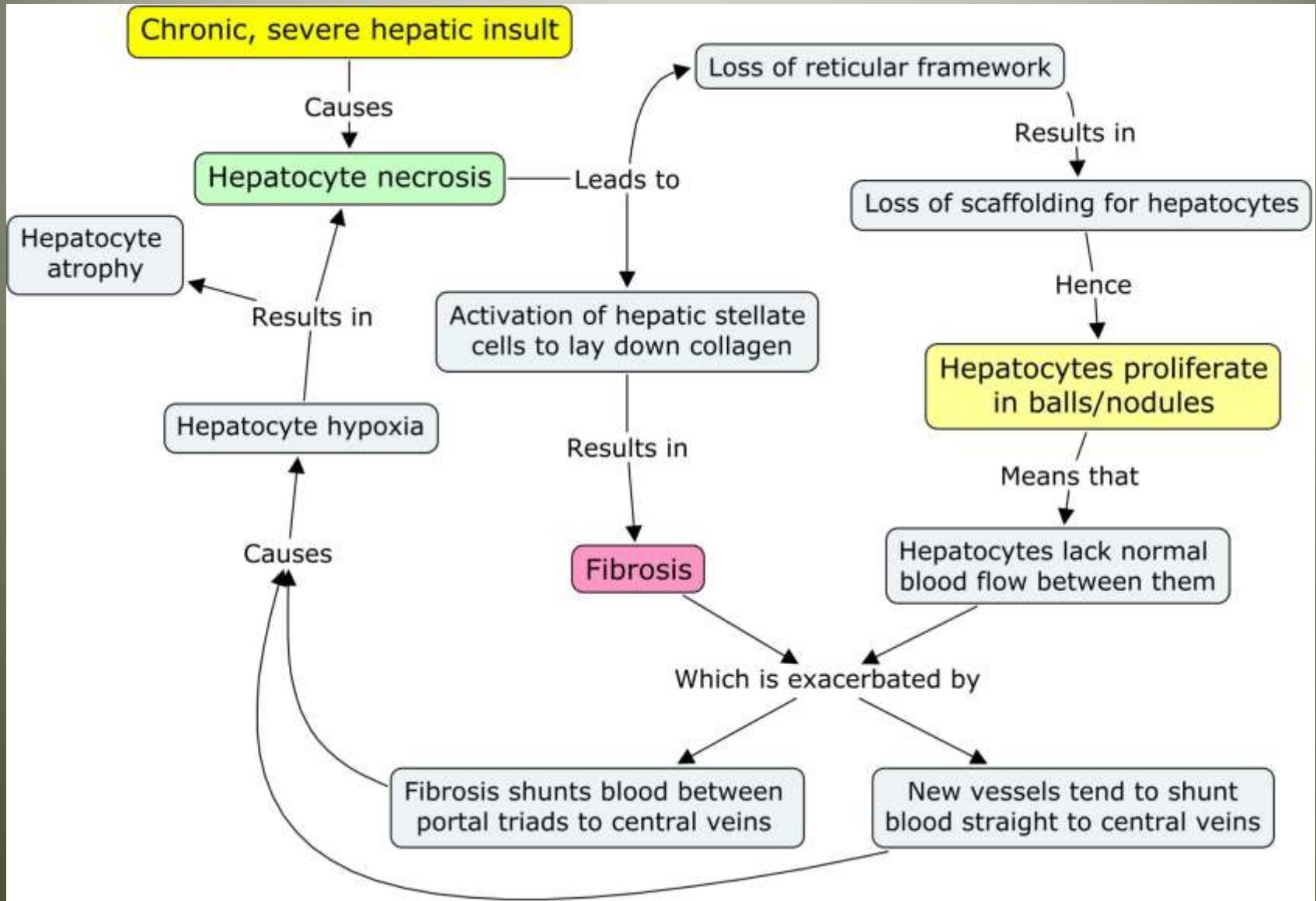


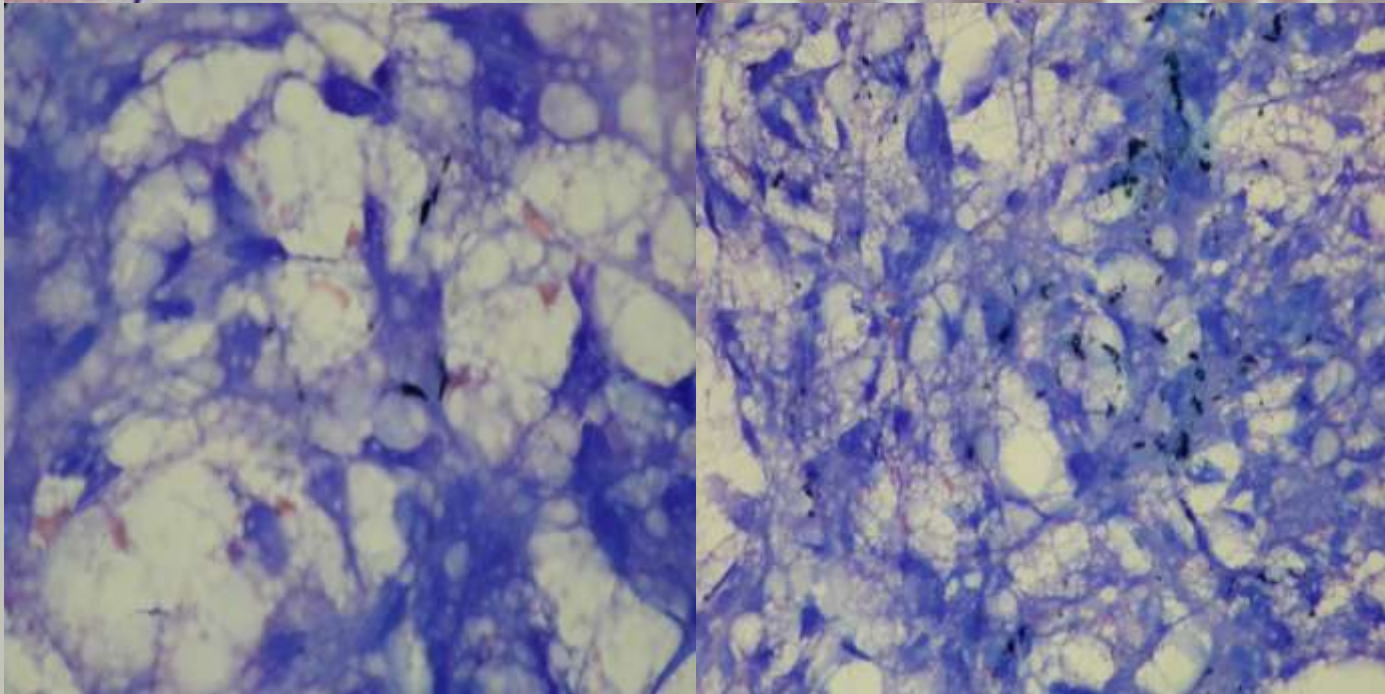
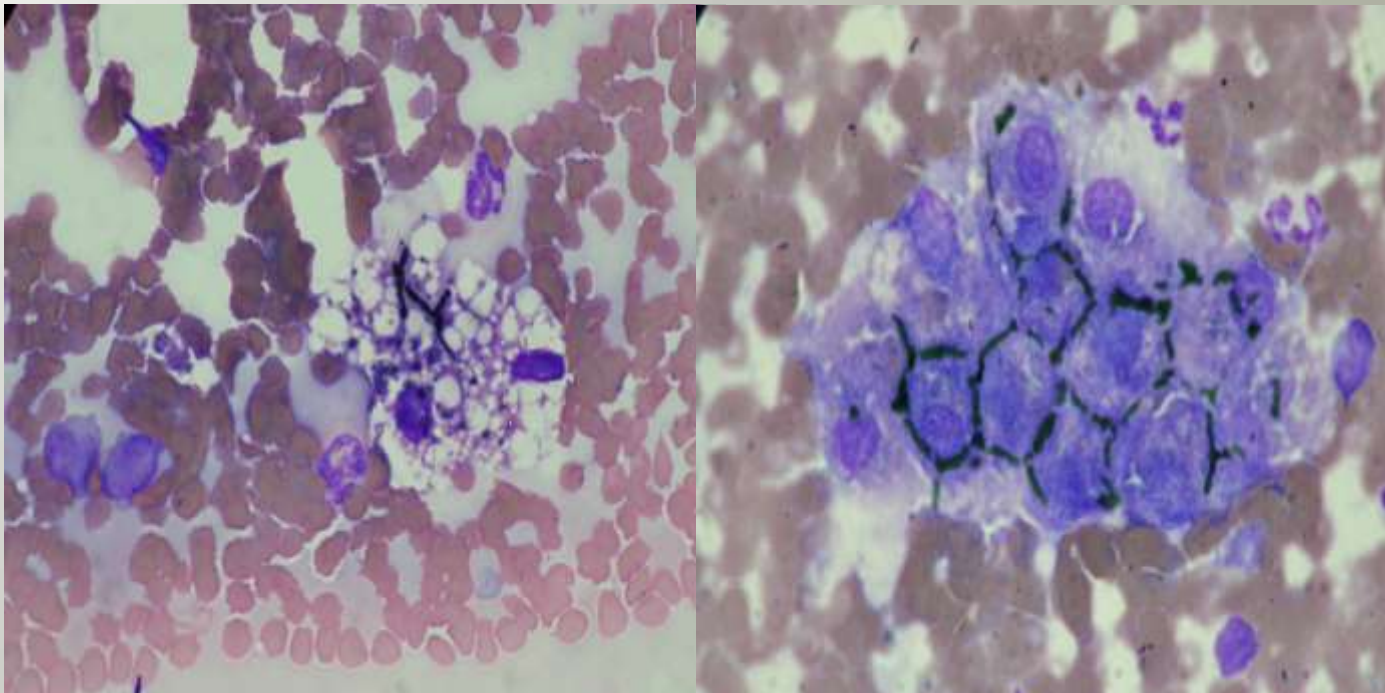


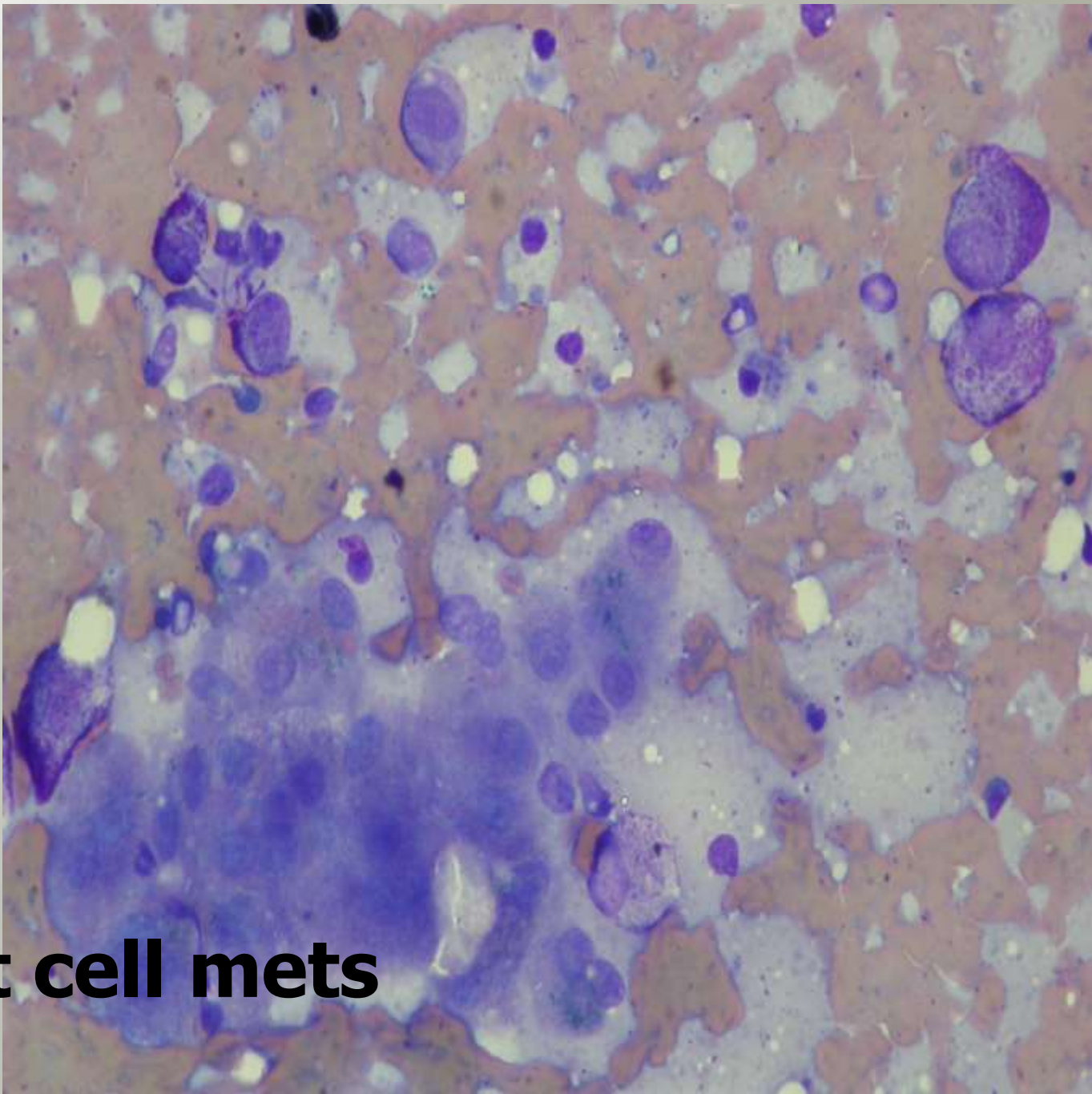
Cirrhosis = fibrosis + nodular regeneration + loss of hepatocytes



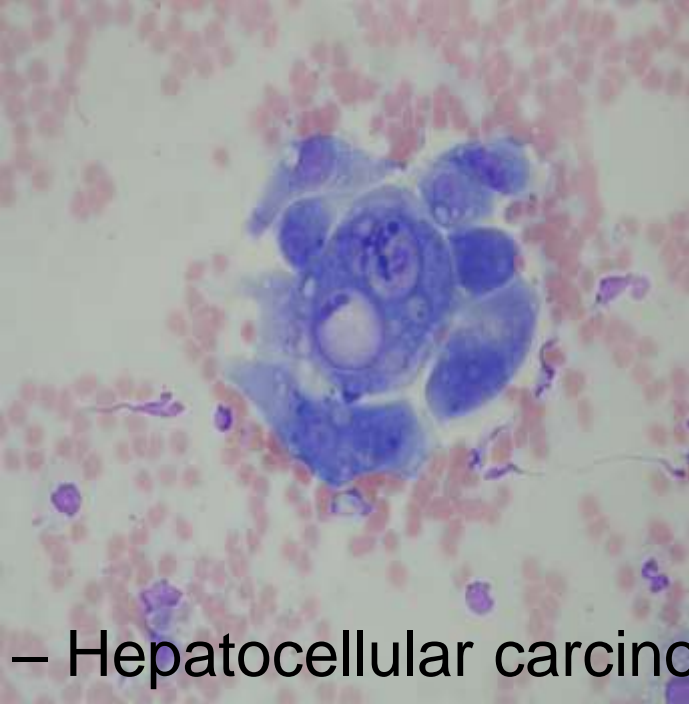
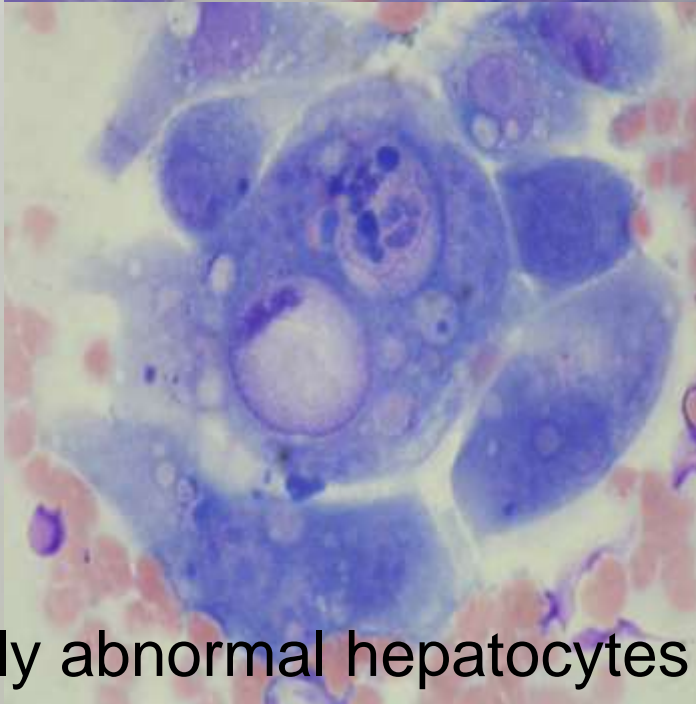
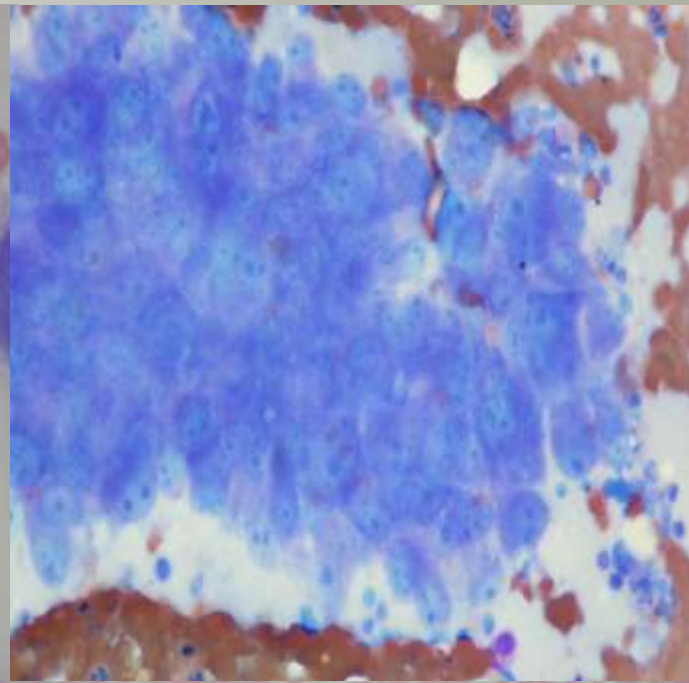
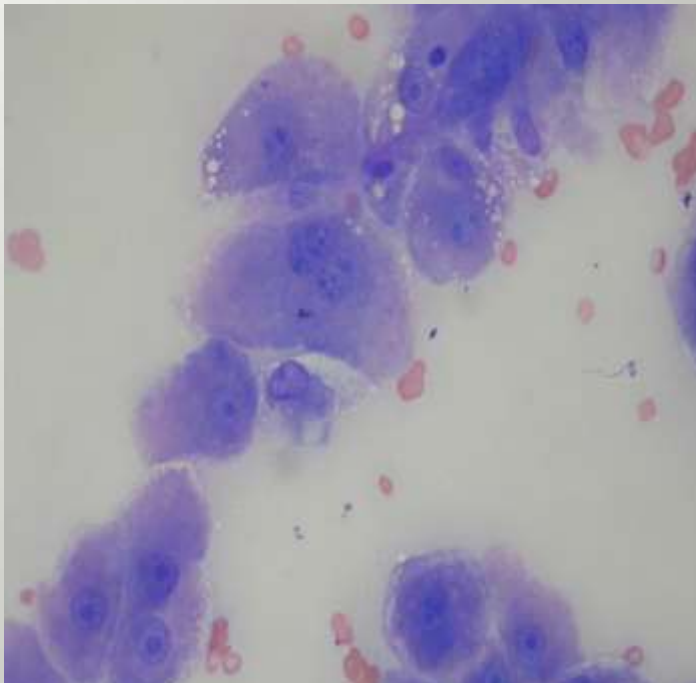




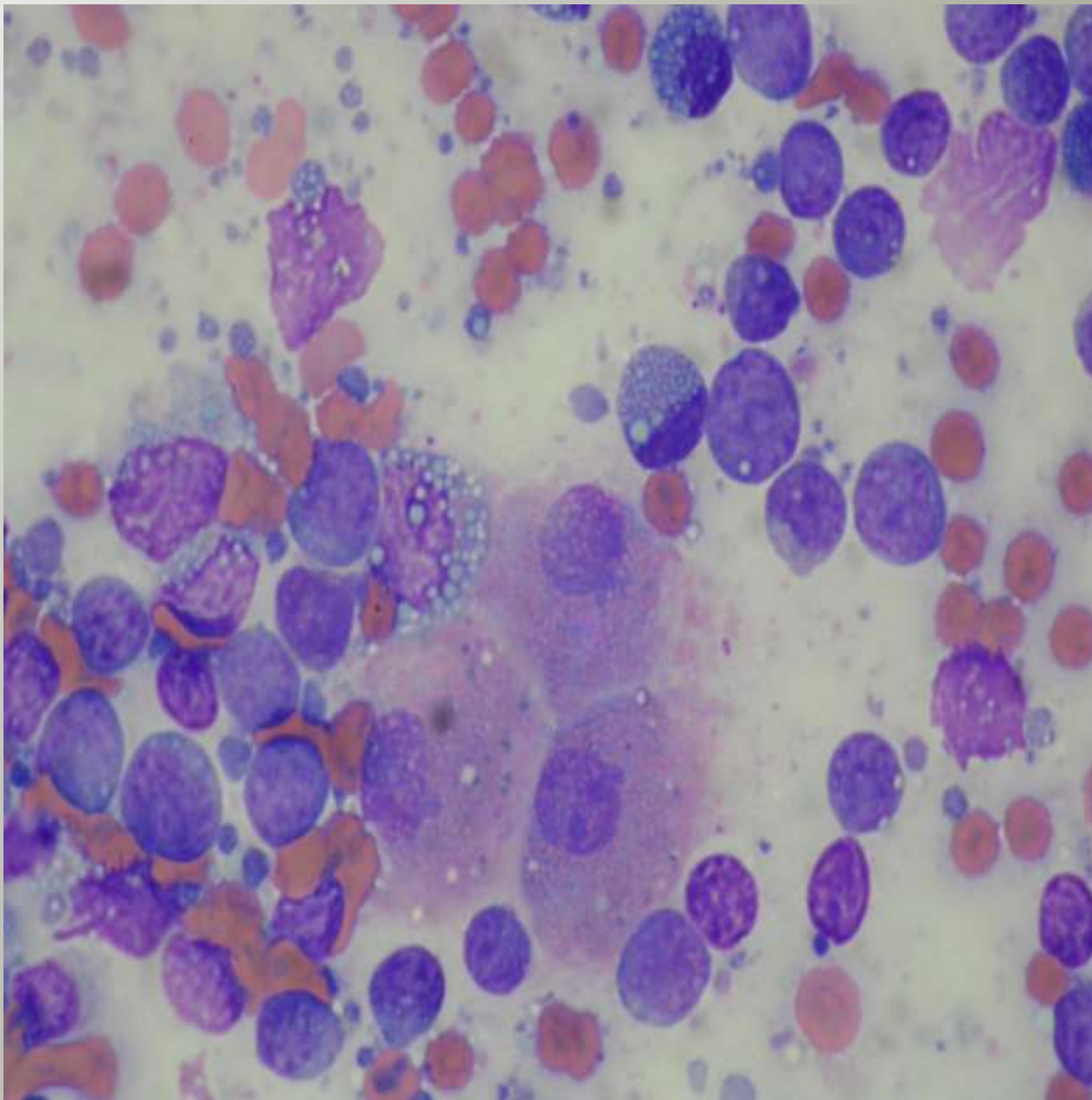




Mast cell mets



Severely abnormal hepatocytes – Hepatocellular carcinoma



Lymphoma with Mott cell differentiation in the liver

Therapy for liver disease

Diagnosis is vital - without it you are shooting in the dark!

Table 1: The commonest causes of chronic liver disease in dogs and cats

DOGS:

- Breed-related hepatitis: e.g. cocker hepatitis; doberman hepatitis; Westie hepatitis (some copper associated and some not copper associates)
- Copper toxicosis: Bedlington terriers
- Congenital or early developmental disease: e.g. lobular dissecting hepatitis in standard poodles; idiopathic non-inflammatory hepatic fibrosis in GSDs and others
- Chronic cholangiohepatitis: less common than in cats - cause unknown - ? relationship to pancreatitis and/or inflammatory bowel disease?
- Suppurative hepatitis ± cholestasis secondary to local or distant infection
- Chronic progression of acute hepatopathy e.g. toxic, idiosyncratic drug reaction, infectious, ischaemic, obstructive
- Neoplasia: lymphoma, hepatocellular carcinoma, metastases, others

CATS:

- Suppurative (acute) cholangitis: likely primary infection - ? extending up bile duct from GI tract?
- Chronic (lymphoplasmacytic) cholangiohepatitis complex: various histological forms. May be immune-mediated disease and/or some unknown cause (e.g. viral or hepatic helicobacter??).
Divided in to:
 - Chronic lymphocytic cholangitis (periportal + bile duct)
 - Lymphocytic portal hepatitis (not involving bile duct)
 - Lymphocytic cholangitis (mainly UK. High protein ascites)
 - Sclerosing cholangitis: rare - severe fibrosis. May be end stage of chronic biliary obstruction
 - Hepatic lipidosis: primary or secondary. Common in USA. Uncommon in UK but does occur - particularly the secondary form
 - Infections: particularly FIP - associated hepatitis (major differential diagnosis for some forms of chronic cholangiohepatitis)
 - Neoplasia: especially lymphosarcoma (- may be more acute liver failure)

Therapy Chronic Liver Disease

- Diet diet, diet! (avoid renal diets – v high fat!)...then drugs – targeted therapy based on accurate diagnosis
- Dogs have anaerobes in liver – empirical antibiotic to cover those



DRUG	DOGS	CATS	Main contraindications and notes
Prednisolone	1-2mg/kg/day po. Taper to 0.5mg/kg/day or eod	2-4 mg/kg/day po Taper to 0.5mg/kg/day or eod	Avoid in suppurative inflammation. Avoid in portal hypertension: ascites, potential GI ulceration. Avoid use of dexamethasone if possible as very ulcerogenic
Metronidazole	7.5 mg/kg po or slowly iv bid	7.5 mg/kg po bid	Avoid in severe hepatic insufficiency as hepatic metabolism
Ampicillin	15-20 mg/kg po or iv tid	15-20 mg/kg po or iv tid	Avoid in penicillin sensitivity
Neomycin	20 mg/kg tid to qid po or as retention enema	5.5-10 mg/kg bid po or as retention enema	Systemic absorption and oto- and nephrotoxicity may occur if GI ulceration - esp cats
Lactulose	5-15mls po tid	0.25-1ml po tid	Not licensed for use in small animals. Overdose results in diarrhoea - titrate to effect
Urso-deoxycholic acid	4 - 15 mg/kg total po daily - preferably divided bid	15 mg/kg po sid	Not licensed for use in small animals. Avoid in biliary obstruction. Not indicated in congenital PSS
SAM-e	20 mg/kg po sid or higher	20mg /kg or 200 to 400 mg total sid (<i>different sources of advice</i>)	Tablets must be given unbroken on empty stomach. 2 sizes available: 90mg and 225mg
Zinc acetate or sulphate	1-20 mg/kg/day of elemental zinc	7mg/cat/day elemental zinc	Not licensed for use in animals. Monitor blood levels every 1-2 weeks and keep 200-300 microg/dl
Colchicine	0.03 mg/kg/day po	Not recommended	Not licensed for use in animals. Monitor for bone marrow suppression. GI side-effects common
Penicillamine	10-15 mg/kg po bid	Not recommended	Not licensed for use in animals. Vomiting common. Immune-mediated disease possible
Spironolactone	2-4 mg/kg/day in divided doses	2-4 mg/kg/day in divided doses	Gradual onset of action over 2-3 days.
Sucralfate	1g per 30kg qid	250mg/cat tid	Not licensed for use in animals
Ranitidine	2 mg/kg po bid	0.5-2 mg/kg po bid	May not be necessary if gastric pH high

50mg pills from Summit

CARE – quality!

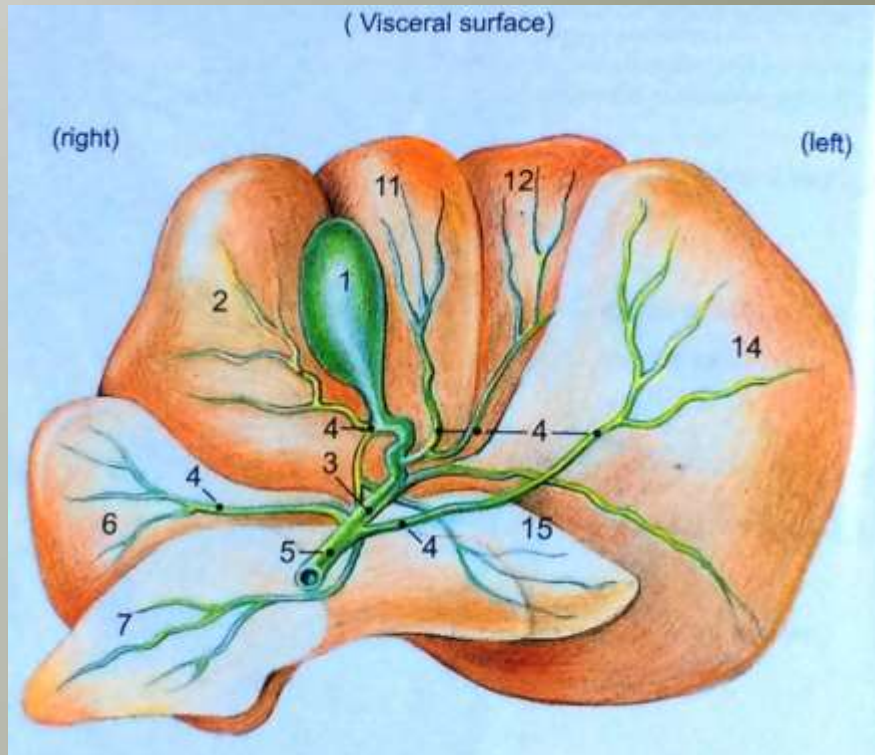
Not cimetidine (consider omeprazole or famotidine)

Anti-fibrotic



Surgery top tips!

- Don't forget clotting (Vit K) 0.5-2.0mg/kg 12 hours before biopsy, rpt every 7-21 dd
- Don't be frightened to remove gall bladder



Cedarmount Veterinary Clinic, Bangor



Fracture hnikue?



Surgitie™ Ligating Loop



Description

The Surgitie™ ligating loop consists of a narrow nylon carrier (3.9 mm O.D.) through which is threaded a 53 cm (21") length of absorbable Polysorb™ suture size 0 or 2-0 (3.5 or 3 metric). The suture is anchored at the proximal end of the carrier (marked by a black band) and the carrier is scored. The suture extends from the distal end of the carrier in the form of a loop, having a sliding knot which secures itself when tightened. A delivery system may be used (5 mm O.D. x 15.24 cm long) for the introduction of the loop and carrier into any appropriately sized trocar sleeve or larger sized trocar sleeve with the use of a converter.

Polysorb™ sutures are composed of Lactomer™ glycolide/lactide copolymer, which is a synthetic polyester derived from glycolic and lactic acids. Polysorb™ sutures are prepared by coating the suture with a caprolactone/glycolide copolymer mixture of caprolactone/glycolide copolymer and calcium stearoyl lactylate. Polysorb™ sutures are colored violet to increase

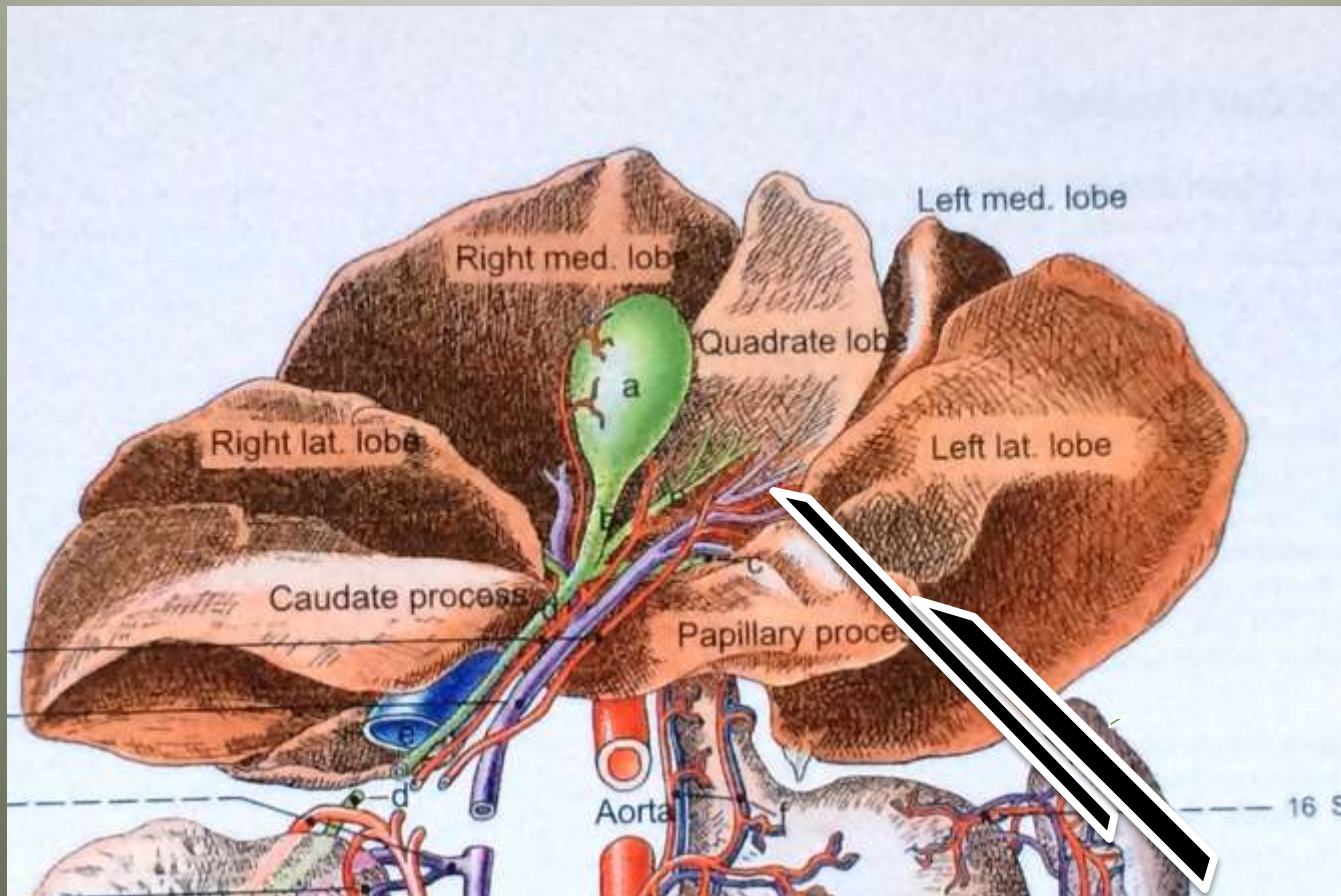
Surgitie™ Loop with Polysorb™ Suture

visibility. Polysorb™ sutures meet all requirements established by the United States Pharmacopeia and the European Pharmacopeia (EP) except for minor variations in suture diameter.

Such Variations Are:

Maximum Suture Oversize in Diameter (mm) from U.S.P.

U.S.P. Size	U.S.P. Size Overage (mm)	Maximum Designation (mm)
2-0	0.30-0.339	0.050
0	0.339-0.35	0.050



If lobe/mass too big for loop, use parallel bowel clamps (or tape loop) for temporary haemostasis and remove bulk before applying loop – **VERY EASY** and in my experience **VERY RELIABLE!!**

Cedarmount Veterinary Clinic, Bangor





Acknowledgements: TDDS for cases

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Happy to take advice calls

02891271364

