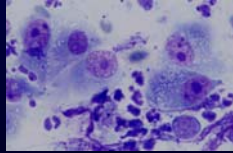


"This Case Just Doesn't Make Sense!"

Some fun medicine case challenges



Richard A. Squires,
James Cook University,
Australia.

What do I stand to gain by participating in this "Case challenges" webinar?



What do I stand to gain?

1. Have some fun, challenging myself by reviewing some fairly 'tricky' cases...



What do I stand to gain?

2. A chance, perhaps, to discover some small animal internal medicine 'secrets' that are new to me...



<http://www.amazon.co.uk/Feline-Internal-Medicine-Secrets-Michael/dp/1560534613>

http://www.amazon.co.uk/s/ref=nb_sb_noss?url=search-alias%3Dstripbooks&field-keywords=canine+internal+medicine+secrets&x=0&y=0

http://www.amazon.co.uk/Feline-Medicine-Self-assessment-Colour-Review/dp/1840760478/ref=sr_1_1?s=books&ie=UTF8&qid=1314736659&sr=1-1

What do I stand to gain?

3. A chance to 'benchmark' my knowledge and understanding against that of my friends and other colleagues in a friendly, non-threatening environment...



<http://www.dynamicbusiness.com.au/growing/benchmark-to-grow-your-business.htm>

What do I stand to gain?

4. Most importantly (in this presenter's view), a chance to analyse your own diagnostic 'way of thinking'.

What happens in your brain when you are working through a 'confusing' case?

What do I stand to gain?

4. Most importantly (in this presenter's view), a chance to analyse your own diagnostic 'way of thinking'.

Do you have a systematic approach to 'the confusing case', just as you have a systematic approach to interpretation of your radiographs?

If not, would you like to begin to develop one tonight?

Socrates

γνῶθι σεαυτόν, *gnōthi seauton*

"Know thyself"

- The aphorism has actually been attributed to at least the following [ancient Greek sages](#):
- [Bias of Priene](#)
- [Chilon of Sparta](#)
- [Cleobulus of Lindus](#)
- [Heracitus](#)
- [Mylon of Cheanae](#)
- [Periander](#)
- [Pittacus of Mytilene](#)
- [Pythagoras](#)
- [Socrates](#)
- [Solon of Athens](#)
- [Thales of Miletus](#)

http://en.wikipedia.org/wiki/Know_thyself

DIAGNOSIS AND TREATMENT

Diagnostic Reasoning

Jerome P. Kassirer, MD

Great paper!

Research in cognitive science, decision sciences, and artificial intelligence has yielded substantial insights into the nature of diagnostic reasoning. Many elements of the diagnostic process have been identified, and many principles of effective clinical reasoning have been formulated. Three reasoning strategies are considered here: probabilistic, causal, and deterministic. Probabilistic reasoning relies on the statistical relations between clinical variables and is frequently used in formal calculations of disease likelihoods. Probabilistic reasoning is especially useful in evoking diagnostic hypotheses and in assessing the significance of clinical findings and test results. Causal reasoning builds a physiologic model and assesses a patient's findings for coherency and completeness against the model; it functions especially effectively in verification of diagnostic hypotheses. Deterministic reasoning consists of sets of compiled rules generated from routine, well-defined practices. Much human problem solving may derive from activation and implementation of such rules. A deeper understanding of clinical cognition should enhance clinical teaching and patient care.

Annals of Internal Medicine. 1989;110:893-900.

probabilistic, causal, and deterministic reasoning strategies. Finally, we consider the interrelationships between reasoning strategies and the circumstances in which one strategy may be preferable to another. The discussion centers on the cognitive aspects of diagnosis, not on the other aspects of the patient encounter (social and psychological factors, interviewing techniques, or precision of information).

Elements of the Diagnostic Process

In the diagnostic process, the clinician makes a series of inferences about the nature of malfunctions of the body. These inferences are derived from existing observations (historical data, physical findings, and routine tests) as well as from invasive tests and responses to various manipulations. Inferential reasoning proceeds until the clinician has discovered a diagnostic category sufficiently acceptable to either establish a prognosis, yield a therapeutic action, or both (1). When making diagnostic inferences from clinical data, the clinician uses many strategies to combine, integrate, and interpret the data (2, 3). Clinicians make extensive use of rules of thumb, or shortcuts (heuris-

Diagnostic Reasoning

Jerome P. Kassirer, MD

Annals of Internal Medicine
1989 110: 893-900

Richard.Squires@jcu.edu.au

Forms of diagnostic reasoning

- Probabilistic
- Causal
- Deterministic

diagnostic error

Diagnostic error and clinical reasoning

Geoffrey R Norman & Kevin W Eas

CONTEXT There is a growing literature on diagnostic errors. The consensus of this literature is that most errors are cognitive and result from the application of one or more cognitive biases. Such biased reasoning is usually associated with 'System 1' (non-analytic,

are attempting to be systematic and analytical. We then examine the effectiveness of various approaches to reducing errors. We point out that educational strategies aimed at explaining cognitive biases are unlikely to succeed because of limited transfer. Conversely, there is an

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"...the 'microscope' that can enable detection of mental processes in live time has yet to be invented."

ORIGINAL INVESTIGATION

Diagnostic Error in Internal Medicine

Mark L. Graber, MD, Nancy Franklin, PhD, Ruthanna Gordon, PhD

Background: The goal of this study was to determine the relative contribution of system-related and cognitive components to diagnostic error and to develop a comprehensive working taxonomy.

Methods: One hundred cases of diagnostic error involving internists were identified through autopsy discrepancies, quality assurance activities, and voluntary reports. Each case was evaluated to identify system-related and cognitive factors underlying error using record reviews and, if possible, provider interviews.

Results: Ninety cases involved injury, including 33 deaths. The underlying contributions to error fell into 3 natural categories: "no fault," system-related, and cognitive. Seven cases reflected no-fault errors alone. In the remaining 93 cases, we identified 548 different system-related or cognitive factors (5.9 per case). System-related factors contributed to the diagnostic error in 69% of the cases and cognitive factors in 74%. The most common system-related factors involved problems with poli-

cies and procedures, inefficient processes, teamwork, and communication. The most common cognitive problems involved faulty synthesis. Premature closure, ie, the failure to continue considering reasonable alternatives after an initial diagnosis was reached, was the single most common cause. Other common causes included faulty context generation, misjudging the salience of findings, faulty perception, and errors arising from the use of heuristics. Faulty or inadequate knowledge was uncommon.

Conclusions: Diagnostic error is commonly multifactorial in origin, typically involving both system-related and cognitive factors. The results identify the dominant problems that should be targeted for additional research and early reduction; they also further the development of a comprehensive taxonomy for classifying diagnostic errors.

Arch Intern Med. 2005;165:1493-1499

Once we realize that imperfect understanding is the human condition, there is no shame in being wrong; only in failing to correct our mistakes.
George Soros

Diagnostic error is viewed as a cognitive failing.^{1,10} Diagnosis reflects the clinician's knowledge, clinical acumen, and problem-solving skills.¹⁰ In everyday practice, cli-

Cognitive errors: Faulty knowledge (11 occasions); faulty data gathering (45); faulty information processing (159) and faulty verification (106).

Some well-recognised sources of diagnostic error

- Jumping to conclusions, narrowing down too soon, i.e., reaching 'closure' too quickly

(i.e., we stop thinking as we go on through the case management process when we must continue)

Some well-recognised sources of diagnostic error

- Not considering enough differential diagnoses (and therefore missing the right one).

If the correct diagnosis is not in our 'basket' at the end of generating differential diagnoses, we are likely to neglect it for the rest of the diagnostic process and thus make a misdiagnosis.

Some well-recognised sources of diagnostic error

- Adhering with remarkable tenacity to one or more diagnostic misconceptions in the face of growing evidence that we are on the wrong track! (*Why?*)

Some well-recognised sources of diagnostic error

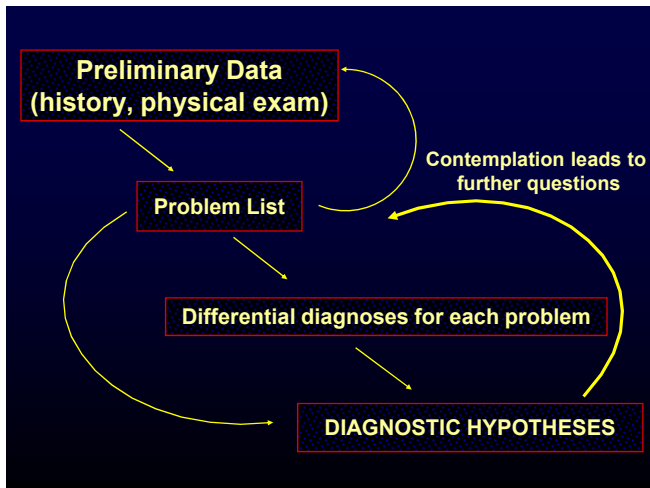
- Not taking advantage of the easy opportunity to check things for a second time (i.e., double checking things) while thinking hard about the case

Always be second guessing ourselves (while remaining decisive and not developing 'analysis paralysis')

The Diagnostic Process



- SIGNALMENT (species, age, breed, sex)
- **HISTORY** (general and problem-specific)
- **PHYSICAL EXAMINATION**
- GENERATION OF A PROBLEM LIST
- CONTEMPLATION / FURTHER QUESTIONS
- DIFFERENTIAL DIAGNOSES
- PLAN (diagnostic, therapeutic, client education)
- EXECUTION OF THE PLAN
- PROBLEM LIST REFINEMENT
- FINAL DIAGNOSIS / DIAGNOSES



Some well-recognised sources of diagnostic error

- Not taking sufficient advantage of what we already know or can easily get:
 - Problem-based reasoning
 - DAMNIT-V scheme (a handle on the drawer)
 - Mechanisms of disease algorithms
 - ‘6th sense’ etc

Some well-recognised sources of diagnostic error

- Not taking sufficient advantage of:
 - our capacity for ‘probabilistic’ reasoning
Remembering that ‘common things occur commonly’
 - our capacity for cause-and-effect reasoning (a chance to grow!)
- Not thinking enough about ‘**diagnostic parsimony**’

Law of Parsimony

“...the assertion that no more causes or forces should be assumed than are necessary to account for the facts”

Etymology

ME f. L parsimonia, parcimonia f. parcere, pars - spare

Some well-recognised sources of diagnostic error

- Not considering that a clinical finding might be normal for this particular patient
- Not recognising, or failing to consider the possibility of, artifacts in diagnostic test results
- Missing, misidentifying or failing to consider the possibility of ‘human error’ in other people (or in self – v. difficult)

Some well-recognised sources of diagnostic error

- Gaps in knowledge and skills
[recognised or unrecognised]
- Problem with attitude or attention
[esp. overconfidence. 94% of doctors think they perform in the top half of their profession]
- ‘Panicking’ or ‘going blank’ (i.e. not having a systematic approach to a confusing situation to fall back upon [CPR metaphor])
-



The most beautiful colour in this bird's plumage is the:

- a) Turquoise
- b) Yellow-Orange
- c) Cinnamon
- d) Russet
- e) Puce

<http://www.wildaboutbritain.co.uk/pictures/showphoto.php/photo/34411>

Try it out: Your demographics...

1. I graduated within the last 3 years
2. I graduated 3 - 5 years ago
3. I graduated 5 - 10 years ago
4. I graduated 10 - 20 years ago
5. I graduated >20 years ago



Based on probabilistic reasoning and pattern recognition, this 10-year-old FS DSH cat most likely has:

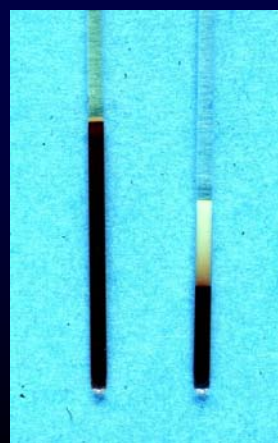
- a) Hyponatraemia
- b) Hypocalcaemia
- c) Hyperphosphataemia
- d) Hypercalcaemia
- e) Hypokalaemia

A trick question?



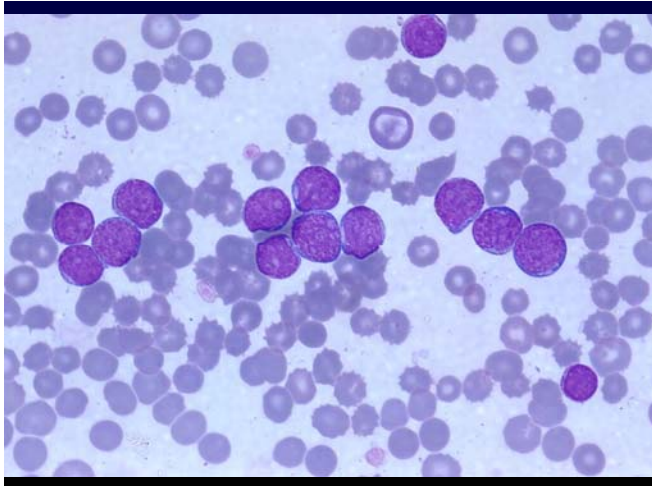
The microhaematocrit tube on the left was from a normal dog. The one on the right was from an anorexic, depressed 6-year-old male German shepherd dog. It had a PCV of 13. What does the image reveal to you?

- a) Lipaemia, maybe pancreatitis
- b) Most likely lymphoid leukaemia
- c) I need to look at a buffy coat smear
- d) I need to test for IgA deficiency
- e) Most likely extreme neutrophilia



The microhaematocrit tube on the left was from a normal dog. The one on the right was from an anorexic, depressed 6-year-old male German shepherd dog. It had a PCV of 13. What does the image reveal to you?

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- d) I need to test for IgA deficiency
- e) Most likely extreme neutrophilia



A colleague is seeking your opinion on the radiographs of this 8-month-old male DSH cat with acute onset of hindlimb lameness.

No reported possibility of trauma.

Vaccination and diet reportedly normal.



Vet Pathol 40:530-539 (2003)

Osteogenesis Imperfecta in Two Litters of Dachshunds

F. SEELIGER, T. LEEB, M. PETERS, M. BRÜGMANN, M. FEHR, AND M. HEWICKER-TRAUTWEIN

Department of Pathology (FS, MP, MB, MH), Clinic for Small Domestic Animals (MF), and Department of Animal Breeding and Genetics (TL), School of Veterinary Medicine Hannover, Hannover, Germany

Abstract. A clinical, morphologic, ultrastructural, and genetic study was performed on five rough-coated dachshund semi-siblings with osteogenesis imperfecta (OI). Clinical signs consisted of pain, spontaneous bone and teeth fractures, joint hyperlaxity, and reduced bone density on radiography. Primary teeth were extremely thin-walled and brittle. The hallmark of the disease was a severe osteopenia characterized by impairment of lamellar bone formation in the long bones, skull, and vertebral column. No deformity or dwarfism was present. The columns of chondrocytes and primary trabeculae in the epiphyses and metaphyses were histologically normal. An abrupt failure of secondary spongiosa and lamellar bone formation was evident in the medullary and cortical zones in all animals. The few existing trabeculae consisted of woven bone. There was no increase in the number and size of osteoclasts or lacunae. In the teeth, the dentine layers were thin and lacked a tubular pattern. Ultrastructurally, osteoid apposition on bone surfaces was reduced, and small numbers of large cytoplasmic vacuoles were present in a few osteoblasts. Molecular analyses of the collagen type I-encoding genes *COL1A1* and *COL1A2* revealed several nucleotide differences compared with the published canine sequences but were not significant for OI. Therefore, OI in these Dachshund litters was characterized by a severe, generalized osteopenia and dentinopenia. This pattern of reduced bone formation is suggestive of defective production of collagen type I.

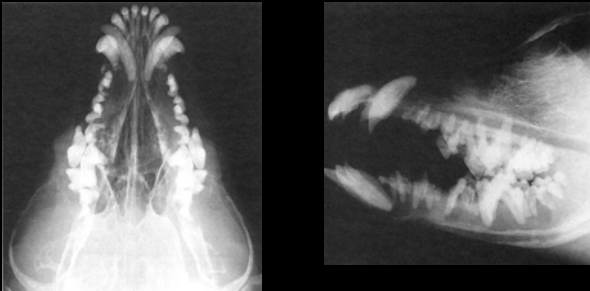
Key words: Bone; collagen; Dachshunds; histopathology; osteogenesis imperfecta; reverse transcription-polymerase chain reaction.

This case is about double checking...

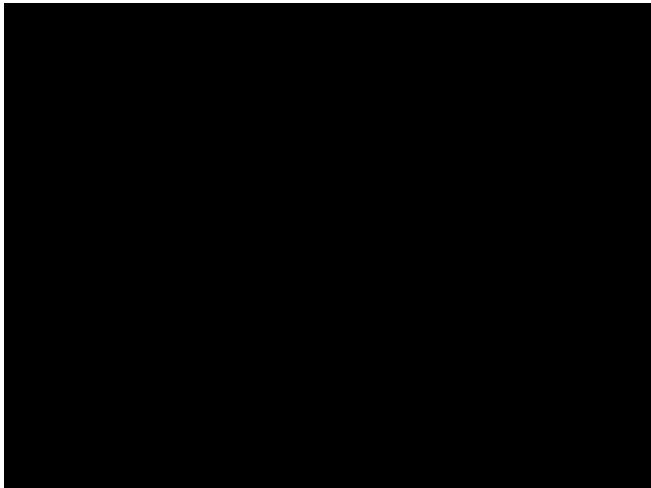
This case is about double checking...

The kitten has actually been fed nothing but kidneys since a very early age!!!

Renal secondary hyperparathyroidism



Nutritional secondary hyperparathyroidism



A Quickie...



Based on probabilistic reasoning and pattern recognition, this 10-year-old FS Labrador retriever most likely has:

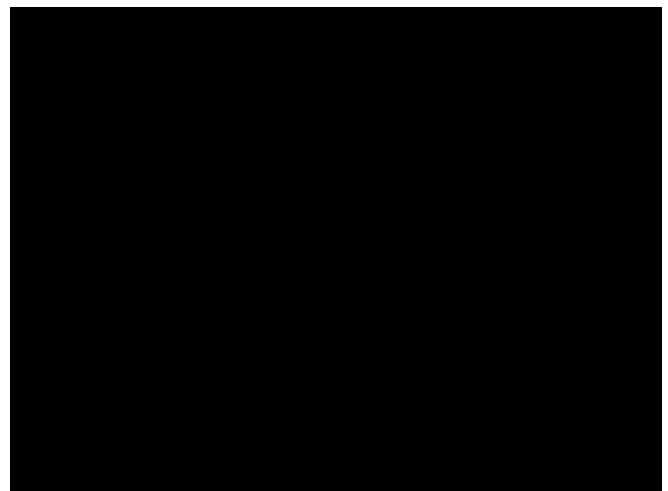
- a) Mitral endocardiosis with pulmonary oedema
- b) A large pleural effusion
- c) A nasopharyngeal foreign body
- d) Laryngeal paralysis
- e) Tetanus

Another Quickie...

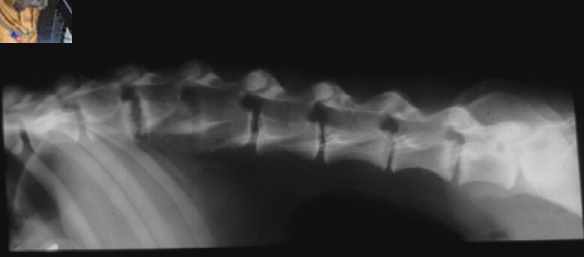


Based on pattern recognition, this little dog most likely has:

- a) A nasopharyngeal tumour
- b) Reverse sneezing
- c) Nasal mite infestation
- d) Eversion of the laryngeal sacculles
- e) Chronic bronchitis

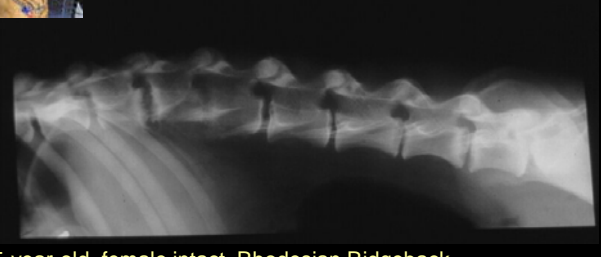


Not sufficiently considering the possible Dx errors of others...



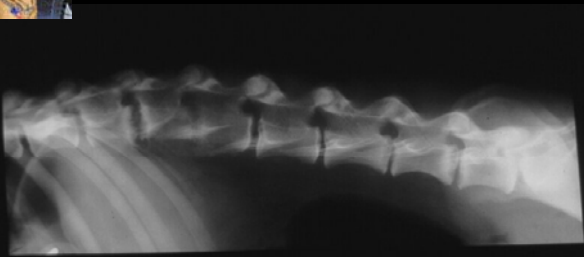
5-year-old, female intact, Rhodesian Ridgeback

Chronic back pain, vomiting once daily for two weeks. Had her last litter of puppies two years ago, no signs of oestrus since then.



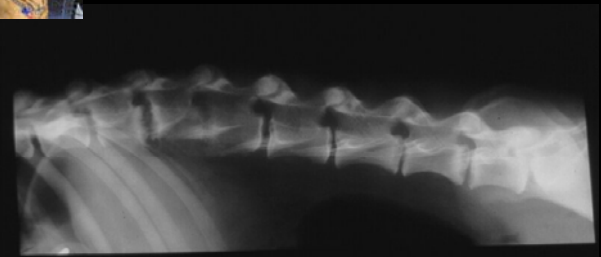
5-year-old, female intact, Rhodesian Ridgeback
Possible back trauma 2 to 3 years ago.

15 months ago, exploratory laparotomy for suspected pyometra. No abnormalities found, OVH not done. PCV/TPP: 43/100. WBCC: $28.27 \times 10^9/L$ 18.9 neutrophils, 7.6 lymphocytes.



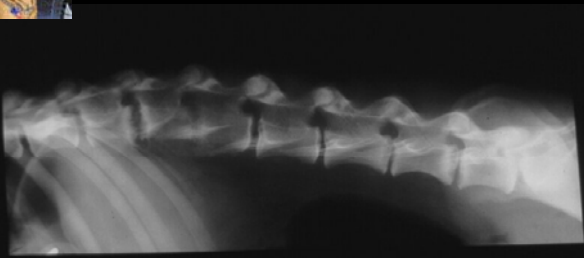
5-year-old, female intact, Rhodesian Ridgeback

10 months ago, referred to a surgeon because was not willing to go upstairs, was manifesting back pain and exercise intolerance.



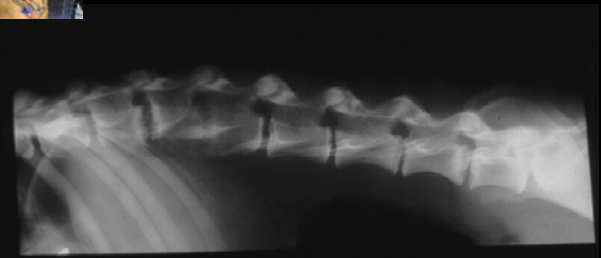
5-year-old, female intact, Rhodesian Ridgeback

10 months ago, diagnosed with discospondylitis. Brucella titre negative. Disc spaces curetted. No bacteria cultured, *Aspergillus flavus* contaminant cultured. Antibiotic prescribed.



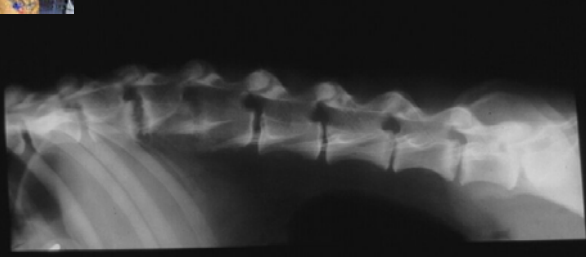
5-year-old, female intact, Rhodesian Ridgeback

8 months ago: recheck, no better. 6 months ago: carprofen started. Discussed referral. Owner thinks PU/PD may have developed in the weeks prior to referral to VTH.



5-year-old, female intact, Rhodesian Ridgeback

Physical exam: arched back, tense abdomen, very painful spine. Stiff hindlimb gait, reduced epaxial muscle mass, no neurological deficits.



5-year-old, female intact, Rhodesian Ridgeback

Problem list, differential diagnoses, plan

Selected lab. results

Mature neutrophilia ($31.3 \times 10^9/L$)

TOTAL PROTEIN	105 gm/L
ALBUMIN	30 gm/L

Urine analysis

Light yellow, slightly hazy

S.G. 1.009

pH 6.5

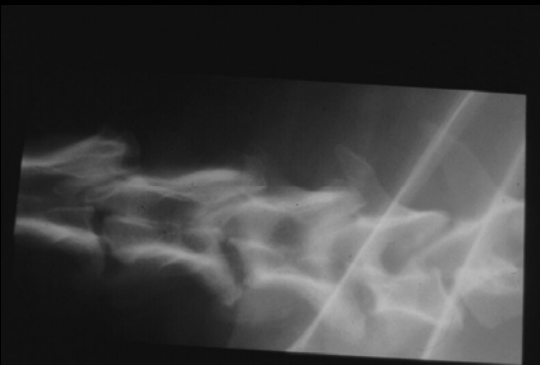
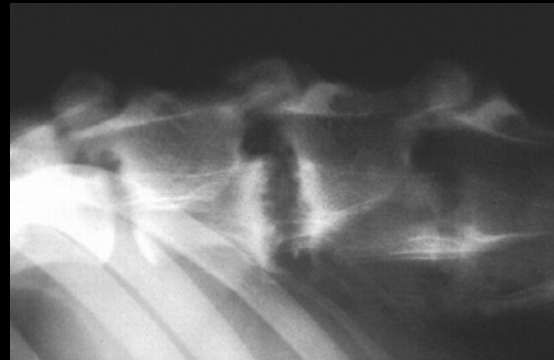
Hb 2+

Urobilinogen 0.2

Few transitional / squamous cells

Rare granular casts

15-20 RBCs / hpf, 0-2 WBCs / hpf



Serology

Aspergillus titre: *negative*



Aspergillus terreus



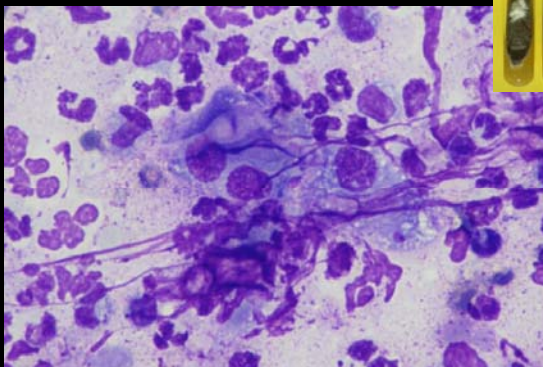
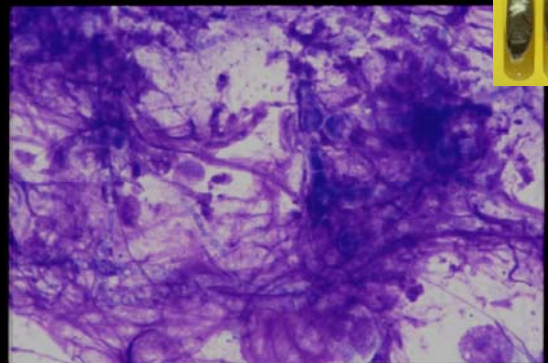
- The major cause of disseminated aspergillosis in dogs (also *A. deflexus*)
- Mainly GSDs
- Mainly in hot climates (but...)
- Poor humoral immune response (low IgA, high, nonspecific IgG)

Aspergillus terreus



Update

- Seen in cooler climates
- Affects several breeds
- Favours bone, kidneys, eyes
- Vasculotropic (aneurysms)

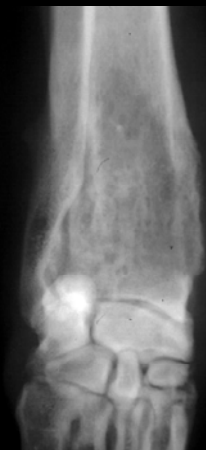


Osteosarcoma?

6-year-old female spayed black Labrador retriever

6-week history of left forelimb lameness

Biopsy: osteosarcoma with "osteochondrous dysplasia"



Osteosarcoma?

6-year-old female spayed
black Labrador retriever

6-week history of left
forelimb lameness

Biopsy: osteosarcoma with
"osteochondrous dysplasia"

Silver stain: the bone
was full of branching,
septate, fungal
hyphae



Quickie – thinking mechanistically (causal reasoning)

- 11-year-old FS Terrier X with acute onset dyspnoea (9 kg)
- Too ill and unstable to manipulate very much
- Grade 4/6 holosystolic heart murmur radiating widely from the left apex. Tachycardic (200 bpm)



Your interpretation?



An 8-year-old female
Fox Terrier



An 8-year-old female
Fox Terrier

- Presented this morning for acute depression and anorexia of 24 hours' duration
- T° 39.3°C, tense abdomen
- Haemorrhagic diarrhoea began six hours after admission.

Problem list, Differential diagnoses, Plan



An 8-year-old female
Fox Terrier

- PCV 41
- WBCC $143 \times 10^9/L$ (bands 11.4, Segs 124, Lymphs 2.86, Eos 4.29)
- Platelets adequate
- \uparrow serum amylase & lipase
- Positive cPLI



What do you want to do now?



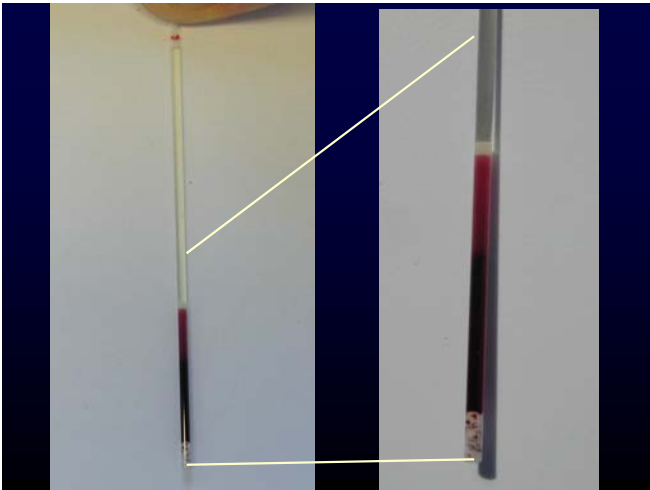
An 8-year-old female Fox Terrier

- 48 hours later: muffled lung sounds
- PCV 33, TPP 52.1, retics 9.1 x 10⁹/L
- WBCC 252 x 10⁹/L (bands 22.68, segs 214.2, lymphs 7.56, monos 5.04, eos 2.52)



An 8 year-old female Fox Terrier

- Many neutrophils show toxic changes, some lymphs look active
- ALP 232, amylase 1976, lipase 3538, bilirubin 11.4, albumin 22.1
- Urinalysis non-remarkable



What does the presence of 'toxic changes' in PMNs indicate to you?





Your interpretation?



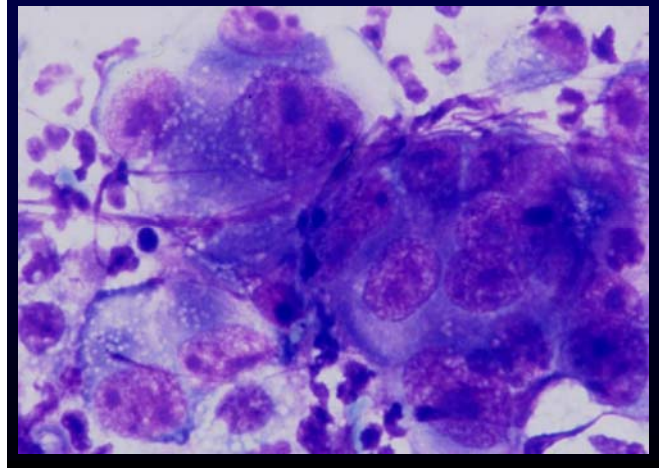
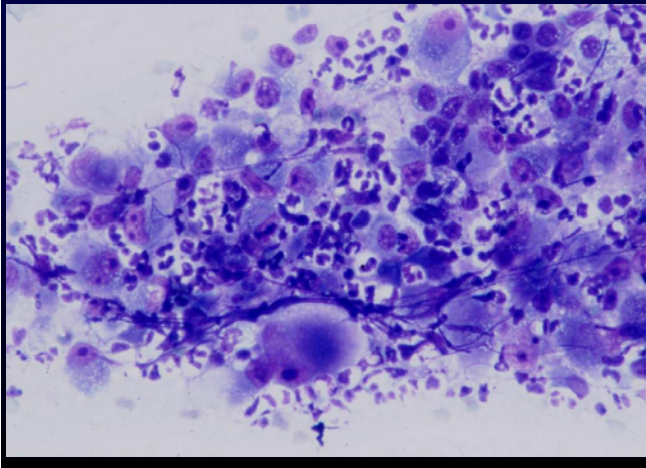
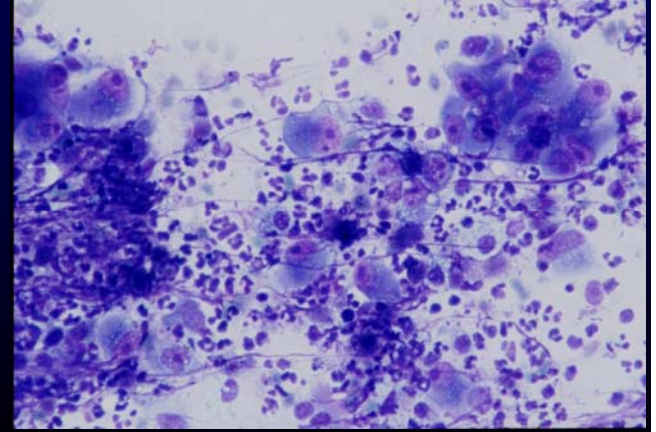
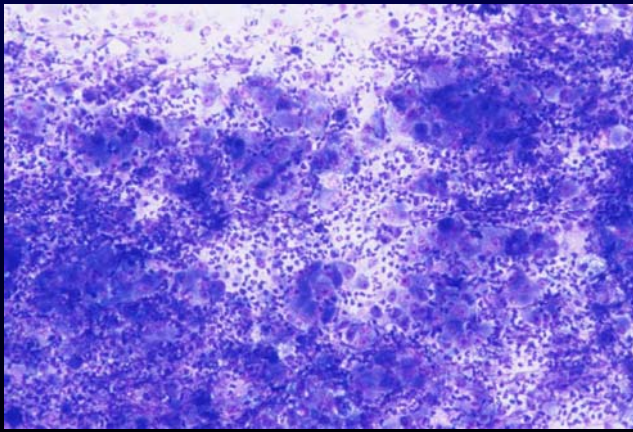
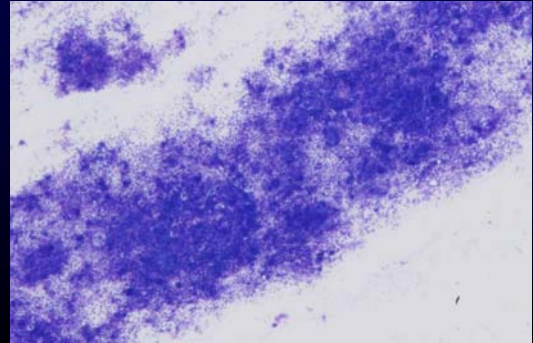
Cytology of pleural fluid

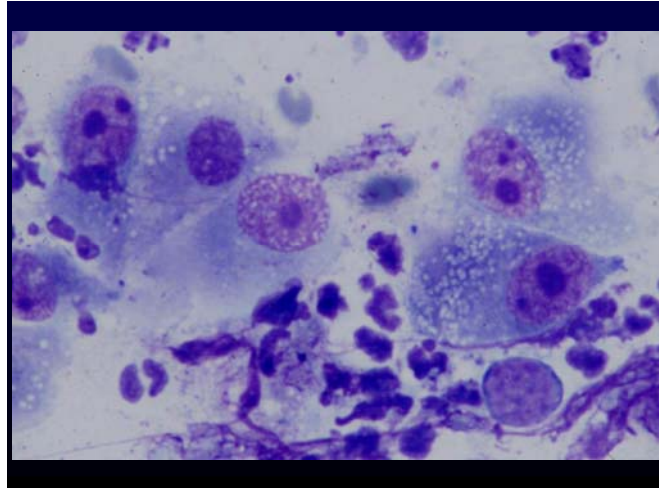
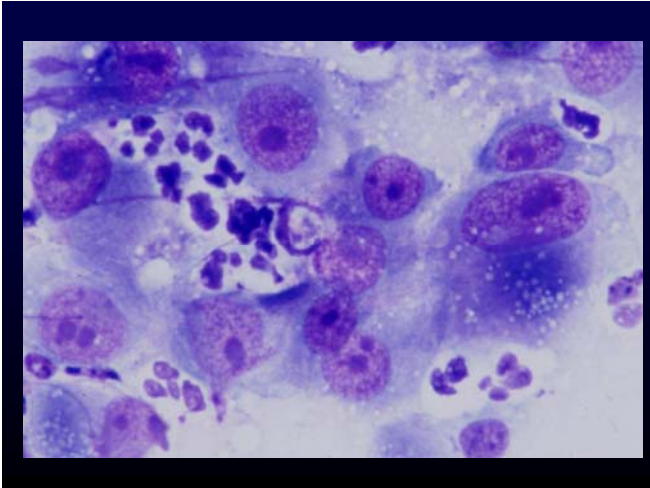
- “*Suppurative inflammation with toxic changes in PMNs. Recommend bacterial culture.*”

Faecal culture

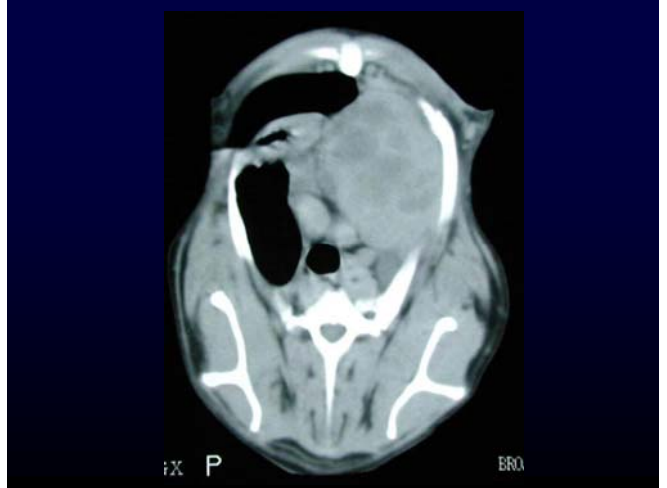
- Negative for Salmonella, Campylobacter and parasites

Ultrasound-guided aspirate of the cranial mediastinal mass





Your thoughts at this stage?

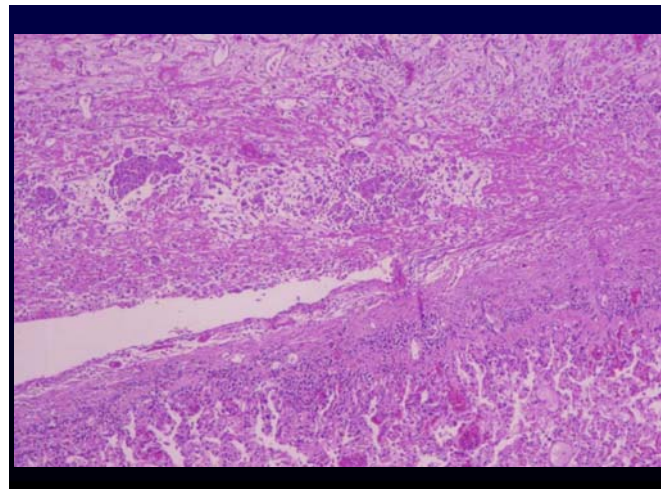
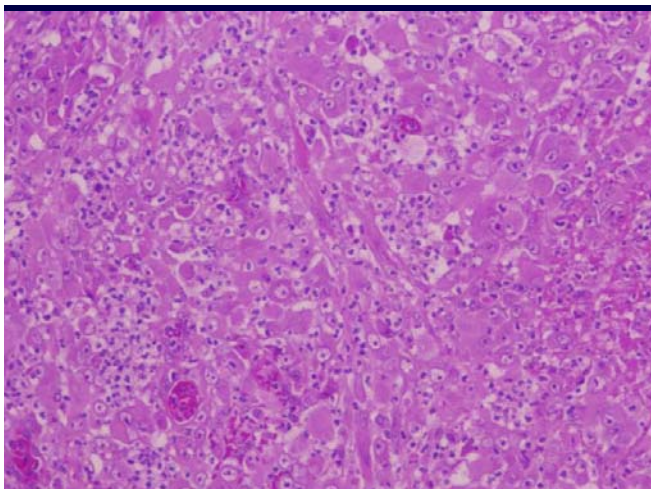
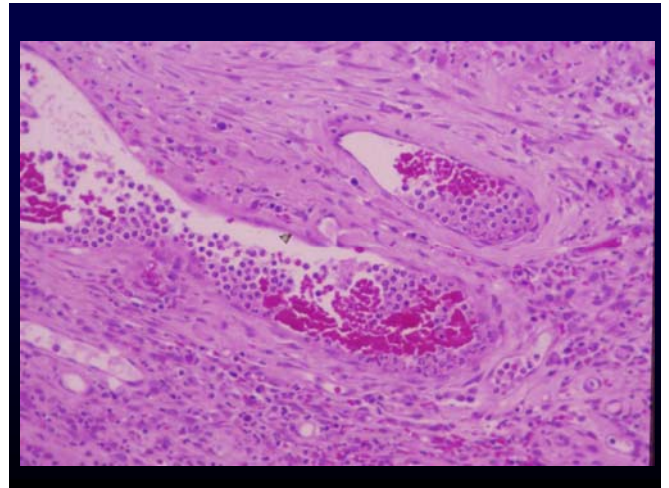


Your interpretation?



Most plausible mechanism of the extreme neutrophilia?

1. Tumour necrosis
2. Pancreatitis
3. Acute myelogenous leukaemia
4. Paraneoplastic
5. Infectious



Neutrophil chemotactic factors produced by malignant fibrous histiocytoma cell lines.

British Journal of Cancer
67(3):508-13, 1993

Inflammatory fibrous histiocytoma presenting leukemoid reaction.

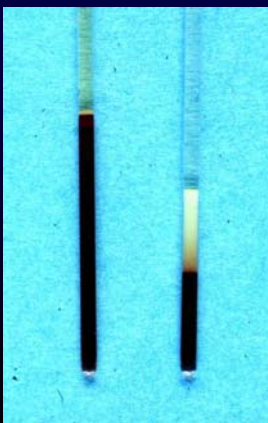
Pathology, Research & Practice.
184(5):498-506, 1989

Inflammatory fibrous histiocytoma: an important variant of malignant fibrous histiocytoma highly responsive to chemotherapy.

Annals of Internal Medicine
97(6):858-63, 1982

Malignant fibrous inflammatory histiocytosis

Extreme leukocytosis



- Usually a neutrophilia, with or without a left shift
- Usually no fever
- ~60-330 x 10⁹/L PMNs
- Synthesis of haematopoietic growth factors by the tumour e.g., G-CSF, GM-CSF, IL-3
- Need to remove the underlying cause

Veterinary Clinical Pathology ISSN 0275-6382

CASE REPORT

Paraneoplastic leukocytosis in a dog with a renal carcinoma

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Key Words

Chromophobic cystic papillary renal carcinoma, GM-CSF, hematuria, neutrophilia

Correspondence

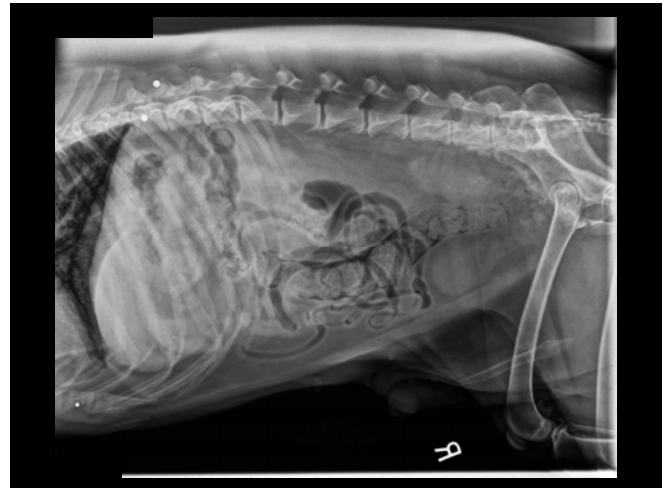
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Abstract: A 7-year-old male German Shepherd dog in poor body condition had a 3-month history of intermittent hematuria. Nonregenerative anemia, mild leukocytosis, marked hypoalbuminemia, and hematuria were observed. Subsequently, marked neutrophilia and moderate monocytosis were noted; anemia, hypoalbuminemia, and hematuria persisted; and the dog developed disseminated intravascular coagulation. Ultrasonographic examination of the abdomen revealed the presence of an enlarged and irregularly shaped right kidney with a large area of cavitation, and a nephrectomy was performed 30 days after initial examination. Cytologic examination of fine-needle aspirates and imprints of the right kidney revealed a neoplastic cell population suggestive of renal carcinoma. The

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Quickie...

- 11-year-old male neutered Boxer with a history of persistent haematuria despite several weeks of antibiotic therapy.



Your interpretation?

- Benign prostatic hypertrophy
- Prostatic adenocarcinoma
- Paraprostatic cyst
- Cystic calculi
- Transitional cell carcinoma of bladder apex

George

A 10 year-old MC black
Labrador Retriever



- It is 9:00am. He seized at 7:30 this morning, apparently for the first time in his life. It lasted for about 2 minutes, says the owner.
- Now he's a bit quieter than usual, but otherwise normal.

George

A 10 year-old MC black
Labrador Retriever



- No previously detected illnesses apart from a low grade elbow lameness that has been present for several years
- He receives carprofen whenever he is thought to be uncomfortable

George

A 10 year-old MC black
Labrador Retriever



- T° 39.4 °C, pulse 110, RR 24 (intermittently panting)
- Normal skin turgor
- Warm, moist, 'very' red mucous membranes



Not George, of course

George

A 10 year-old MC black
Labrador Retriever



- Large palpable mass or masses in the cranial, dorsal abdomen

George

A 10 year-old MC black
Labrador Retriever



Your next step(s)



Least appropriate next step at this stage?

1. Routine haemogram, serum chemistry profile, urinalysis
2. PCV / TPP / Glucose (in-house)
3. Abdominal imaging
4. Thoracic imaging
5. Serum erythropoietin



Well-recognised sources of diagnostic error in 'human' medicine

“Narrowing down too soon”

George

A 10 year-old MC black Labrador Retriever



- PCV 75 TPP 78
- Glucose normal

Does this look like a relative or an absolute erythrocytosis to you?

- A. Relative
- B. Absolute
- C. What does that mean?
- D. Neither
- E. I'm just taking the Micky by pressing "E".



High PCV

High TPP

Normal TPP

relative erythrocytosis
(dehydration)

absolute erythrocytosis



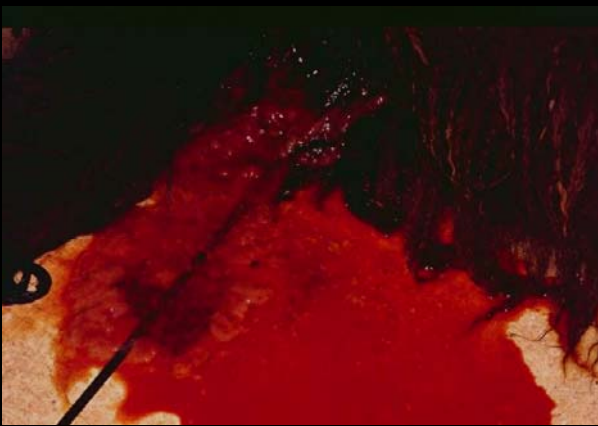
George

A 10 year-old MC black Labrador Retriever



- PCV 75 TPP 78

In another animal, could figures like these ever reflect a 'relative' erythrocytosis?



Haemorrhagic gastroenteritis

Updated problem list

- History of lameness / carprofen
- 'Seizured' this morning
- Palpable abdominal mass(es)
- Absolute erythrocytosis

Differential diagnoses for absolute erythrocytosis

- Relative erythrocytosis (dehydration + hypoproteinaemia)
- Breed variation
- Hyperadrenocorticism
- Some longstanding cardiovascular and pulmonary diseases

Differential diagnoses for absolute erythrocytosis

- Some non-neoplastic renal diseases (cysts, hydronephrosis)
- Polycythaemia vera (primary erythrocytosis)
- Paraneoplastic causes

Paraneoplastic erythrocytosis

Pathogenesis

- Tumour itself produces erythropoietin
- Tumour causes renal ischaemia / tissue hypoxia, leading to an increase in release of erythropoietin by the kidney(s)

Tumour-associated erythrocytosis

Pathogenesis

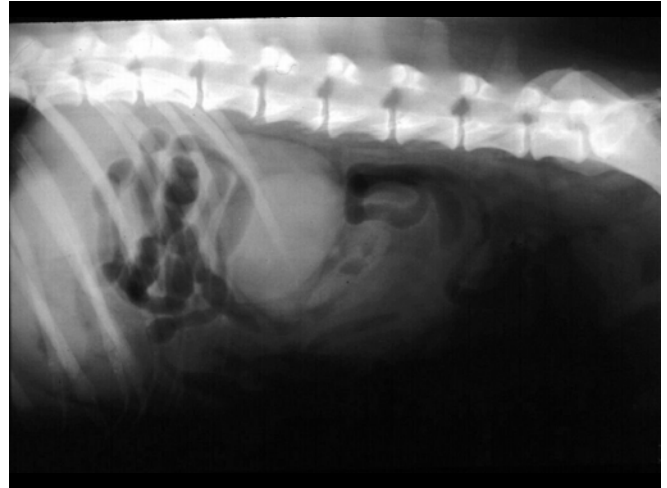
- Tumour causes arterial hypoxaemia (lung? heart? airways?), the kidneys respond 'appropriately' by releasing more erythropoietin.

George

A 10 year-old MC black
Labrador Retriever



Your updated plan?



Abdominal imaging

- Bilaterally symmetrical, marked renomegaly
- Kidneys are diffusely and severely infiltrated
- Lymphoma is considered a likely diagnosis

Thoracic radiography

- No abnormalities detected

Routine haemogram, serum biochemistry and urine analysis

- USG 1.019
- Creatine kinase 1209
- Otherwise, normal

What would you most like to do now?



What would you most like to do now?

- A. Refer him **BUT OWNER SAYS NO!**
- B. Hit the books and read about approaches to absolute erythrocytosis
- C. Remove a unit or two of blood, replace with crystalloid, and think again

- D. Trucut biopsy one or both kidneys

Updated Plan...

- Admit and monitor
- Lower his HCT so he is in better shape for further investigations (could save the blood?)
- FNAB kidney
- Check haemostatic status, blood pressure; then biopsy kidney
- ± Serum EPO measurement

Paraneoplastic erythrocytosis

Kinds of tumours previously associated

- Renal tumours
- Liver tumours
- Nasal fibrosarcoma *How?*
- T.V.T.
- Others

Paraneoplastic erythrocytosis

Typical clinical features

- Lethargy, depression, inappetence
- PU/PD
- Red mucous membranes
- ± Seizures

Paraneoplastic erythrocytosis

Typical clinical features

- Lethargy, depression, inappetence
- PU/PD
- Red mucous membranes
- ± **Seizures**

So why did George seizure?

Choose the least plausible reason

1. Cerebrovascular accident
2. Cerebral hyperoxygenation (essentially, oxygen toxicity)
3. Increased blood viscosity
4. Poor cerebral blood flow
5. Idiopathic epilepsy

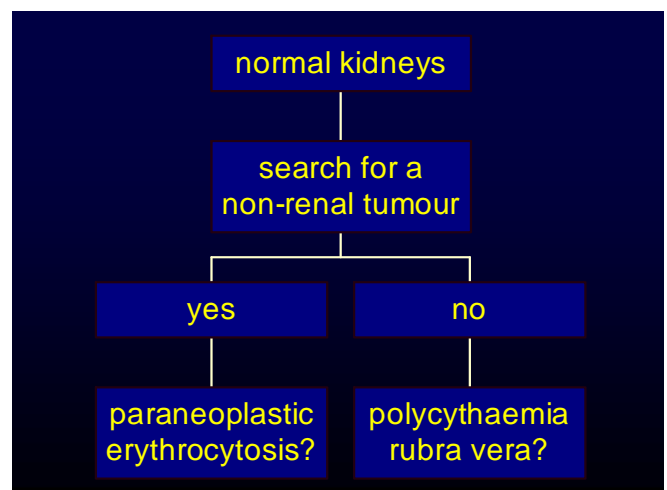
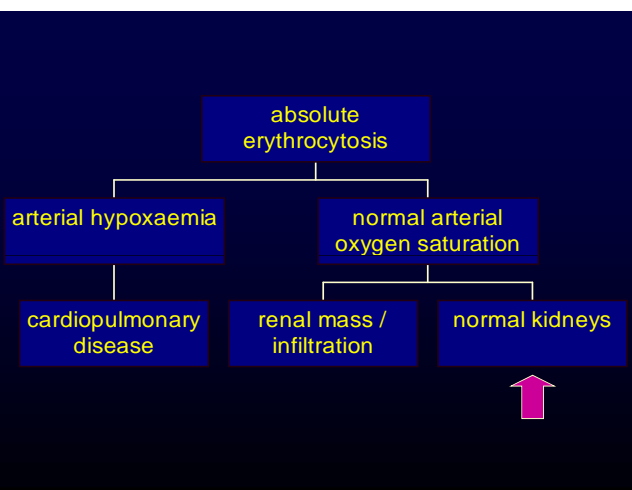
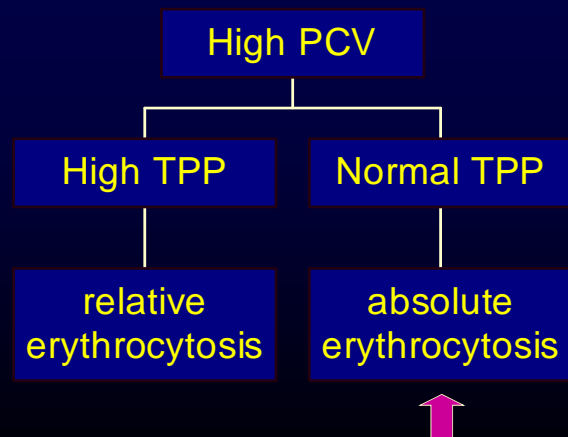
So why did George seizure?

- Poor blood flow, despite high O₂ carrying capacity, leads to poor tissue oxygenation (**becomes a vicious circle**)
- Mainly affects the brain, eyes, kidneys, heart
- May also see systemic hypertension or heart failure

Paraneoplastic erythrocytosis

Management

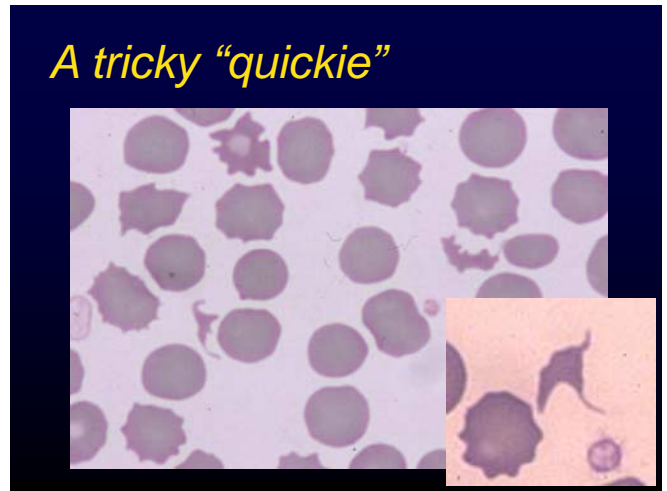
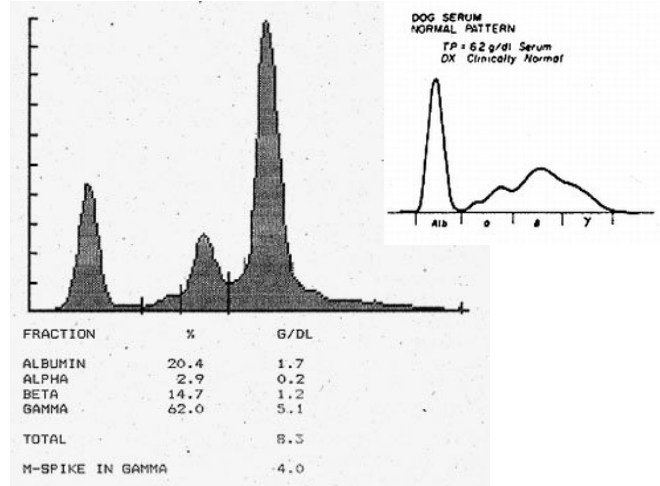
- Identify the underlying cause and remove it (if possible) or treat it
- Periodic phlebotomy
- ± Hydroxyurea
(40-50 mg/kg PO ÷ BID)



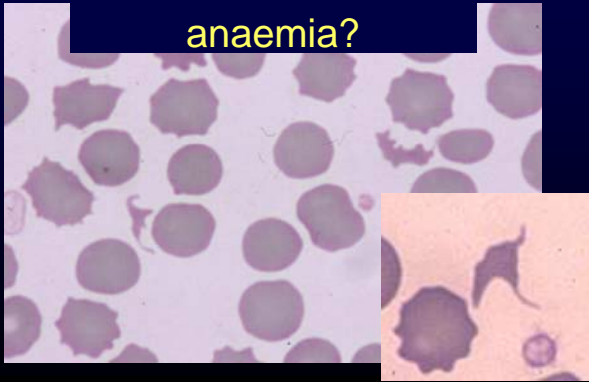


Other cause(s) of hyperviscosity?

1. Multiple myeloma
2. Lymphoma
3. Lymphoid leukaemia
4. "Benign" or primary gammopathy
5. All of the above



Most likely neoplastic cause of this kind of anaemia?



Most likely neoplastic cause of this kind of anaemia?



1. Sertoli cell tumour
2. Multiple myeloma
3. Large splenic haemangiosarcoma
4. Nasal fibrosarcoma
5. Bleeding caecal leiomyoma

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J Vet Intern Med. 1991 Jan-Feb;5(1):11-4.

Hemostatic abnormalities in dogs with hemangiosarcoma.

Hammer AS, Couto CG, Swardson C, Getzy D.

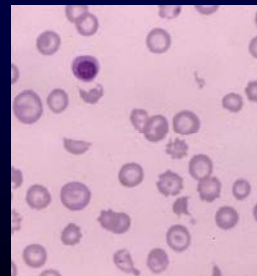
Department of Veterinary Clinical Sciences, Ohio State University, College of Veterinary Medicine, Columbus.

Abstract

The hemostasis profiles of 24 dogs with histologically confirmed hemangiosarcoma were prospectively evaluated. Microangiopathic hemolysis was defined as the presence of schistocytes, disseminated intravascular coagulation was defined as 1) thrombocytopenia, 2) fibrin(ogen) degradation products greater than 10 micrograms/mL, 3) prolongation of one or more coagulation times (activated partial thromboplastin time or one-stage prothrombin time) by greater than 25% of the control, 4) fragmented red blood cells (greater than or equal to 1+ based on a semi-quantitative grading scale), and 5) fibrinogen less than or equal to 80 mg/dL. Three of the five criteria listed above had to be met for disseminated intravascular coagulation to be diagnosed. Fifty percent of the dogs were considered to have disseminated intravascular coagulation at presentation. Thrombocytopenia was present in 75% of the dogs and was the most common abnormality. The mean platelet count was 137,800/microl. Twenty-five percent of the dogs died as a result of the hemostatic abnormalities. Only 12% of the dogs had microangiopathic hemolysis without other evidence of disseminated intravascular coagulation. Hemostatic abnormalities are present in many dogs with hemangiosarcoma at the initial clinical presentation and represent an important clinical finding.

PMID: 2020011 [PubMed - indexed for MEDLINE]

Another tricky "quickie"



A microcytic, hypochromic, mildly regenerative anaemia with a high platelet count



Most likely cause of this kind of anaemia



1. Large renal lymphoma
2. Multiple myeloma
3. Large splenic haemangiosarcoma
4. Nasal fibrosarcoma
5. Bleeding caecal leiomyoma

REVIEW ARTICLES

Iron Homeostasis and Disorders in Dogs and Cats: A Review

Jennifer L. McCown, DVM*, Andrew J. Specht, DVM, DACVM

ABSTRACT

Iron is an essential element for nearly all living organisms and disruption of iron homeostasis can lead to a number of clinical manifestations. Iron is used in the formation of both hemoglobin and myoglobin, as well as numerous enzyme systems of the body. Disorders of iron in the body include iron deficiency anemia, anemia of inflammatory disease, and iron overload. This article reviews normal iron metabolism, disease syndromes of iron imbalance, diagnostic testing, and treatment of either iron deficiency or excess. Recent advances in diagnosing iron deficiency using reticulocyte indices are reviewed. *J Am Anim Hosp Assoc* 2011; 47:151-160. DOI 10.5326/JAHA-MS-5553

Another tricky “quickie”

A 10 year-old MC Golden retriever presented for acute collapse with apparent abdominal enlargement, bilaterally symmetrical, non-pruritic truncal alopecia, white, warm, moist gums, good pulse quality, PCV 10, TPP 69.



Most likely cause of this kind of anaemia



1. Sertoli cell tumour
2. Multiple myeloma
3. Bleeding splenic haemangiosarcoma
4. Nasal fibrosarcoma
5. Bleeding gastric carcinoma