INTERNAL MEDICINE

Practice Pearls

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The Art of Diagnosis

• To make the correct diagnosis, we need the right choices.
• To consider the right choices, we need the right information.
• To obtain the right information, we need to ask the right questions.
• Asking the right questions is the hallmark of clinical expertise.
  ~ R. Kreisburg, MD

After 25 years of practice, most clinicians come to the conclusion that the practice of medicine is both an art and a science. The main objective of this article is to share some of the lessons I have learned over the years, with the hope that this knowledge will benefit the readers’ patients.

For the sake of simplicity, thoughts have been categorized according to:
• Patient evaluation and care
• Fluid administration and medications
• Diseases by organ system.

GENERAL CLINICAL SIGNS

FLUID ACCUMULATION: CHEST AND ABDOMEN
Commonly indicates a serious disease, such as neoplasia, heart failure, diffuse inflammation, or hypoproteinemia

HIGH TEMPERATURE
Temperature > 109.4°F = heat stroke; beware of disseminated intravascular coagulation
• Fever + immune-mediated disease = appetite can persist
• Fever + sepsis = anorexia

HYPERVERVENTILATION
Various causes include cardiorespiratory distress, pyrexia, brain disease, Cushing’s disease, metabolic acidosis, anxiety, pain, shock, and anemia

PALLOR & ICTERUS
Pallor can be caused by hypoxia, shock, anemia, or peripheral vasoconstriction.
• Anemic pallor + icterus = yellow mucous membrane color
• Pink mucous membranes + icterus = orange mucous membrane color

SEPTIC SHOCK
Patient typically has hypothermia, thrombocytopenia, and hypotension refractory to intravenous fluid treatment.
**PATIENT EVALUATION & MANAGEMENT**

### PATIENT EVALUATION

#### History
- It is all in the history.

#### Physical Examination
- Skin turgor is difficult to assess with cachexia and obesity.
- Look under the tongue for a linear foreign body in any vomiting cat or dog.
- Palpation: “Touch but don’t squeeze the Charmin.”
- Have you been palpating each mammary gland for early detection of mammary tumors?
- If something “just ain’t right,” consider neurologic disorders.
- To detect early signs of weakness, look at the rear limbs for splaying or crossing.
- Circumlinear ulcer in frenulum: Consider linear foreign body.
- Sudden mental depression 2 to 3 days post enterotomy: Rule out dehiscence and sepsis.

#### Diagnostics
**The big 6 preliminary tests for assessing ill animals when client funds are limited:**
1. Packed cell volume
2. Total protein
3. Blood urea nitrogen
4. Glucose
5. Urinalysis
6. Chest/abdominal radiographs

#### Imaging
- Every sick or trauma patient should have chest and abdominal radiographs performed on initial evaluation.
- Performing abdominal ultrasound without abdominal radiographs will eventually lead to missed information.


#### Advanced Diagnostics
- Don’t just look at a lump—stick it! A lump is a lump until you do so.
- Traumatic ear flush can cause inner ear and vestibular disease.

### PATIENT MANAGEMENT

#### Feline
- A clean cat is a happy cat.
- Cats hate atropine eye drops, which cause marked salivation; use ointment instead.
- Do not forget to evaluate cats for thiamine deficiency.
- Body bandages in cats cause pseudoparalysis.

#### Pediatrics
- Don’t forget glucose for neonates.
- A heparinized syringe may contain as much as 200 U heparin—too much for puppies and kittens (best not to exceed 150 U or 0.15 U/g).

#### Sedation
- Senior dogs and cats poorly tolerate tranquilization.
- Avoid sedating acutely ill patients unless absolutely necessary.
- Don’t sedate at the end of the day unless IV fluid support is provided, especially in senior patients; it is an invitation for renal failure.

#### Therapeutics
- After therapeutic paracentesis, repeat abdominal palpation so you do not pass the mass.
- Rapid abdominocentesis is effective and safe for chronic ascites, except when ascites is caused by chronic liver disease; in these cases simultaneous IV plasma or albumin infusion is recommended.
- A heat lamp and rubbing alcohol can ignite the patient.

#### Digestive System
- Postoperative patients or those with pelvic fractures will appreciate glycerine suppositories.
- No Fleet enemas (fleetlabs.com) for obstipation, unless you want to treat a case of hypocalcemia.

#### Urinary System
- Manually expressing a male dog’s bladder may result in rupture.
- Some pathologic bladders can leak after cystocentesis.
- Ketamine (3 mg IV) can adequately restrain an ill cat with urethral obstruction.

#### End-of-Life Considerations
- Many terminal patients will show a burst of movement prior to dying.
- Never euthanize based on cytology results because cytologic errors may be as high as 50%.

SC = subcutaneous; IM = intramuscular; IV = intravenous; U = units
## FLUID ADMINISTRATION & MEDICATIONS

### FLUID & ELECTROLYTES

**Administration**
- If the patient is eating and drinking without excess fluid loss, IV fluids are not needed.
- SC fluid administration: Isotonic, 18-gauge needle, gravity flow without positive pressure; 50 mL/site in adult cats
- Volume load with isotonic crystalloid.
- Rehydrate before inducing diuresis; however, check urine specific gravity first.
- Intraosseous cannulas can be life saving.

**Specific Recommendations**
- All IV maintenance fluids should contain KCl (7–10 mEq/250 mL); exceptions are cases of oliguria and untreated Addison’s disease.
- To make 2.5% dextrose solution increments, add:
  - D-50-W (12.5 mL) to fluids (LRS, NaCl; 250 mL) or
  - D-50-W (50 mL) to isotonic crystalloid (1 L).
- Adult cats:
  - When IV administration is not an option, manage hypocalcemia by adding 10% calcium gluconate (2.5 mL/kg) to 0.9% NaCl (150 mL); administer SC Q 12 H
  - Avoid hypokalemia when administering SC fluids by adding KCl (7 mEq) to LRS (250 mL)

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**Physiologic Conditions**
- **Metabolic alkalosis** (usually with hypokalemia) = TCO\(_2\) > 40 mEq/L
- **Severe metabolic acidosis** = TCO\(_2\) < 10 mEq/L (usually)

**Cautions**
- Be careful with SC fluids: Dogs are not cats; they are prone to sloughing.
- Potassium penicillin contains 1.7 mEq K\(+\)/million U; take heed when bolusing.
- Avoid tissue edema by restricting excess fluids in cases of severe pulmonary, brain, and general trauma.

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**Adverse Effects**
- Consider adverse drug effects when unexpected signs appear following treatment with a new medication.
- Prevent anaphylactoid reactions by avoiding IV administration of:
  - Thiamine (administer IM)
  - Vitamin K\(_4\) (administer SC)
  - Vitamin B\(_1\) (administer SC)
  - Vitamin preparations
- Panmycin (oral tetracycline) can cause fever in cats.

**Interactions**
- Theophylline & ciprofloxacin: Use together will result in theophylline overdose.
- Cimetidine & metronidazole: Cimetidine, a cytochrome P450 inhibitor, enhances metronidazole-induced neurotoxicity.

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D-50-W = dextrose in water (50%); GI = gastrointestinal; IV = intravenous; KCl = potassium chloride; LRS = lactated Ringer’s solution; NaCl = sodium chloride; SC = subcutaneous; TCO\(_2\) = total carbon dioxide; U = units

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### MEDICATIONS

**Specific Recommendations**
- **Aminoglycosides** should only be administered after rehydration.
- **Doxycycline & clindamycin** tablet administration should be followed by a syringe of water to encourage swallowing and prevent esophageal stricture in cats.
- **Imipenem** should be considered for life threatening infections.
- **Prednisone** will arrest the progression of craniomandibular osteopathy if caught early; extended treatment with alternate day therapy will reverse early changes and impede disease progression.

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### CARDIORESPIRATORY DISEASE

#### Clinical Signs & Disease Identification
- Watch for the exaggerated abdominal component of respiration.
- **Cardiac arrhythmias:** Consider digoxin intoxication
- **Cough in cats:** Consider allergic bronchitis, tracheobronchial disorders, flukes, lungworms, heartworms, hair or foreign body in trachea, tumors
- **Diffuse muffling:** Usually caused by chest fluid
- **Dorsal muffling:** Caused by air or mass in chest
- **Lack of coughing in dyspneic cats:** Usually indicates heart disease
- **Muffled chest sounds:** Causes include fluid, air, or mass in chest; obesity; deep-chested conformation; and even the clinician’s plugged ears
- Many patients die without ever showing open-mouth breathing.

#### Diagnostics
- **Electrocardiography:**
  - Cardiomegaly does not always cause tall ECG complexes.
  - A standing lead 2 ECG is satisfactory for rate, rhythm, and interval measurements.
- **Echocardiography:** Can be used to diagnose vegetative endocarditis
- **Imaging:**
  - For dyspneic patients, keep the unaffected side “up” (away from the table) when taking radiographs.
  - Ketamine (3–5 mg IV, total dose) can allow “survival” radiographs in a dyspneic cat.
  - Minimal radiographic infiltrates: Consider bacterial pneumonia + leukopenia (myelosuppression)
  - Sudden-onset diffuse pulmonary infiltrates: Consider ARDS

#### Therapeutics
- Dispense **prednisone** and **furosemide** for the earliest signs of pulmonary thromboembolism in dogs treated for heartworms.
- **H₂-blockers** alter stomach microbial population, which worsens aspiration pneumonia.
- Do not use **beta blockers** until pulmonary edema resolves.

ARDS = acute respiratory distress syndrome; ECG = electrocardiography

### NEOPLASIA

#### Clinical Signs & Disease Identification
- **Bloody, suppurative, mucoid nasal discharge:** Produced by nasal cancer
- **Copious mucoid nasal discharge:** Consider nasal adenocarcinoma.
- **Firm mammary nodule:** Assume carcinoma until proven otherwise.
- **Massive generalized lymphadenopathy:** Usually indicates lymphoma.
- Cutaneous mast cell tumors can mimic any type of skin growth.
- Don’t miss lymphangitic inflammatory mammary carcinoma.

#### Diagnostics
- Cancer can cause elevated total WBC count and fever.
- Mammary tumors: Don’t stick them; remove them.
- Try gastric biopsy forceps for nasal biopsy.
- Closed-mouth nasal cavity radiographs are useless.

WBC = white blood cell

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“Take the patient out of the cage and look at it!”
ENDOCRINE DISEASE

General
- The hypocalcemic cat may not exhibit early signs of tetany; it may simply be dazed and weak.
- Keep an eye out for the atypical Addisonian patient.

Diagnostics
- Blood glucose meters: Not very accurate at the high/low ends of scale
- Tears: May help detect hyperglycemia
- Soiled litter: Can be used to detect glycosuria
- Assess toy/miniature breed dogs with eclampsia for hypoglycemia.

Laboratory Analysis
- Glycosuria: Can occur with diabetes, Fanconi’s syndrome, proximal renal tubular disease, stress, and IV dextrose
- Hypercholesterolemia + elevated CK: Can occur with hypothyroidism
- Hypocholesterolemia: Can occur in some patients with Addison’s disease
- Marked hyperglycemia: Present in oliguric diabetics
- Marked hyperglycemia + minimal glycosuria: Consider oliguria/anuria
- Morning marked glycosuria + afternoon diminished glycosuria: Typifies transient insulin response (requires split dose)

Therapeutics
- U-100 syringe (or TB syringe) must be used for U-100 insulin.
- When treating diabetic ketoacidosis, do not forget adequate K+.
- If patient initially hypokalemic, delay insulin for several hours, but begin crystalloid supplemented with potassium.
- During the correction of hypokalemia, IV fluids alone can lower blood glucose by as much as 50% to 60%.
- For severe hypoglycemic encephalopathy, try mannitol.
- When fludrocortisone (Florinef, pfizer.com/kingpharmaceuticals) is not effective, use DOCP (Percorten-V, norvartis.us) and prednisone.
- If you have a dog with Cushing’s disease and diabetes that becomes weak and depressed and is receiving both insulin and opDDD, remember:
  - If dog is opDDD toxic, its appetite will be absent that day and vomiting may have occurred.
  - If dog has been overdosed with insulin, it very likely will have eaten that morning; coma and seizures may be present.
  - If dog has both hypoglycemia and opDDD toxicity, any combination of the above can occur. In this situation, treat for the treatable if laboratory tests are unavailable, which would indicate dextrose and glucocorticoid administration.


CK = creatine kinase; DOCP = desoxycorticosterone; IV = intravenous; K+ = potassium ion; opDDD = 1,1-dichloro-2-(o-chlorophenyl)-2-(p-chlorophenyl) ethane; TB = tuberculin

TOXICITIES

Clinical Signs & Disease Identification
- Newly acquired bleeding: Consider anticoagulant rodenticide intoxication.
- Sudden facial hemorrhagic lymphedema, hemorrhagic oral mucosa, subdued mentation: Consider Eastern diamondback rattlesnake envenomation.

Diagnostics
- If identified early, ethylene glycol in urine sometimes fluoresces under a Wood’s lamp.
- Unexplainable radiodense particles in bowel: Consider lead.

Therapeutics
- DMSA: An oral chelator for lead poisoning
- 4-methylpyrazole: Use for antifreeze intoxication; avoids grogginess (currently unavailable).
- Vodka does work for ethylene glycol intoxication when ethanol is unavailable.
- Oral vitamin K1 (4–6 weeks): Use for newer anticoagulant rodenticides


DMSA = dimercaptosuccinic acid
**GASTROINTESTINAL DISEASE**

| Clinical Signs & Disease Identification | • Acute excruciating abdominal pain: Consider bowel infarction or intestinal volvulus.  
• Bile in vomitus: Signifies pyloric patency  
• Black stools: Consider upper GI bleed, thrombocytopenia, blood in mouth, bismuth subsalicylate ("Pepto"), or iron or charcoal ingestion.  
• Co-existing vomiting/diarrhea: Rarely associated with GI obstructions  
• Coffee ground vomitus: Consider gastric ulcers (primary/secondary) or uremic gastritis.  
• Melena: Consider upper GI lesions or thrombocytopenia.  
• Occult blood loss: Consider GI disease, especially if accompanied by hypoproteinemia and anemia.  
• Vomiting: Main sign of GI obstruction; the lower the obstruction, the more feculent the vomitus |
| Diagnostics | • Physical examination:  
» Melena detection: “Let your finger do the walking”  
• Laboratory analysis:  
» Bilirubinuria in cats: Signifies liver disease  
» Elevated BUN + normal creatinine: Consider upper GI bleed, especially if kidney can concentrate urine  
» Metabolic alkalosis + hypokalemia: Common with upper GI obstructions  
• Imaging:  
» Right kidney easily visible on radiograph: Consider acute pancreatitis (Figure 1).  
» Cholangiostasis: Consider sepsis.  
» Diffuse inflammatory bowel disease: Can often be diagnosed with distal colon biopsy  
» Gas in the gall bladder is a surgical emergency |
| Therapeutics | • 0.9% NaCl + KCl is best for upper GI obstructions.  
• Never let the sun set on a linear foreign body intestinal obstruction.  
• J-tube feeding: Beneficial for the prolonged period of NPO in patients with pancreatitis |

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Figure 1. Ventral-dorsal abdominal radiograph of a dog with acute pancreatitis; note the visibility of the right kidney

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**HEMATOLOGIC DISEASE**

| Clinical Signs & Disease Identification | • Newly acquired bleeding: Consider anticoagulant rodenticide intoxication  
• Lumbosacral petechia ("lots of it"): Consider fleas + thrombocytopenia  
• Pale petechia: Consider thrombocytopenia + anemia  
• Bone marrow derived leukopenic animals don’t produce pus. |
| Diagnostics | • Blood Analysis:  
» Unclotted blood in clot tube: Consider coagulopathy.  
» Low WBCs, low RBCs, low platelets: Rule out bone marrow suppression.  
» Fulminant hemolysis: Results in anemia, hemoglobinemia, hemoglobinuria, weakness, depression, +/- vomiting; then icterus  
» Observe for autoagglutination and spherocytes in IMHA.  
» A normal bleeding time assures that there is adequate platelet hemostasis; a normal platelet count does not.  
• Imaging:  
» Massive splenomegaly (Figure 2): Consider splenic torsion, hypersplenism, lymphoma, and myeloproliferative or mast cell splenic neoplastic infiltrate.  
• Owners can use urine dipsticks to detect hemeprotein, an early sign of recurrent hemolysis. |
| Therapeutics | • Keep IMHA and ITP patients on maintenance prednisone (Q 2 D) for 9 to 12 months to avoid relapse.  
• Try danazol, azathioprine, or cyclosporine with prednisone for refractory IMHA and ITP. |

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Figure 2. Radiograph (A) and surgical specimen (B) depicting splenomegaly caused by splenic torsion

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BUN = blood urea nitrogen; GI = gastrointestinal; KCl = potassium chloride; NaCl = sodium chloride; NPO = nil per os (no oral food or fluids)
**NEUROLOGIC DISEASE**

- **Clinical Signs & Disease Identification**
  - **Rapid onset LMN paralysis**: Consider tick-borne disease, organophosphate or metronidazole toxicity, botulism, polyradiculoneuropathy, and coral snake bite.
  - **Dilated pupils and blank stare (cats)**: Consider thiamine deficiency.
  - **Ventral cervical flexion with fixed dilated pupils**: Consider thiamine deficiency.
  - **Coma**: Consider diffuse cerebral and brainstem damage, metabolic abnormalities, and adverse drug effects.

**Figure 3.** Cat with thiamine deficiency; note dilated pupils that are fixed and nonresponsive to light

LMN = lower motor neuron

**UROGENITAL DISEASE**

- **Clinical Signs & Disease Identification**
  - **Cessation of PU in ill patient**: Consider oliguria/anuria, which are bad signs.
  - **Hematuria without stranguria**: Consider coagulopathy or primary renal bleed.
  - **Ill, intact female**: Rule out pyometra.
  - **Murky urine**: Can be caused by pus, chyle, crystals.
  - **Nasal crustiness, scleral injection, “muddy” mucous membranes**: May indicate uremia.
  - **Passive penile bleed, normal urination, normal dog**: Consider BPH.
  - **Prostate inflammation**: “prostatic shuffle” (gait characterized by short shuffling steps)
  - **Stranguria accompanying hematuria**: Consider recent renal bleed + clots in the bladder in addition to more common disorders, such as cystitis.

**Diagnostics**

- **Physical Examination**
  - **Prostate trends**: Carcinoma—asymmetrical, hard, mid- or caudal pelvis; BPH—symmetrical, firm, anterior displacement.
  - **Urethral pathology (female dog)**: Perform rectal examination.
  - **Scottish terriers** have very large BPH.

- **Laboratory Analysis**
  - **Emphysematous cystitis (Figure 4)**: Rule out diabetes mellitus.
  - **Hyperkalemia**: Common in oliguric renal failure.
  - **Normo- or hypokalemia**: Common in high-output chronic renal failure.
  - **PD + PU + isosthenuria**: Consider chronic renal disease, even if normal BUN/creatinine, but watch out for Cushing’s disease.

**Imaging**

- **Bilateral renomegaly (Figure 5)** means very serious disease: Lymphoma, hydronephrosis, pyonephrosis, granuloma, inflammation, subcapsular edema, polycystic kidneys.

**Figure 4.** Lateral abdominal radiograph depicting emphysematous cystitis in a diabetic dog

**Figure 5.** Abdominal radiographs of a cat with renal lymphosarcoma; note bilateral renomegaly (A and B)

**Therapeutics**

- **Never let the sun set on a sick pyometra patient.**
- **Empty urine line**: Consider anuria, recent emptying, obstruction.
- **Fluid therapy**: Always assess urine specific gravity first.
- **Oliguria**: Try administering dopamine (3–5 mcg/kg/min) before administering more fluids, furosemide, or mannitol.

BPH = benign prostatic hyperplasia; BUN = blood urea nitrogen; PD = polydipsia; PU = polyuria

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