Avoiding Lab Errors: Trusting Your Diagnostics

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Common Acronyms

ASVCP: Am. Soc. Vet. Clin. Path.

DKA: Diabetic Ketoacidosis

EDTA: Ethylenediaminetetraacetic Acid

GGT: Gamma-Glutamyl Transferase

IMHA: Immune-Mediated Hemolytic Anemia

i-STAT: Point-of-care Analyzer

NRBC: Nucleated Red Blood Cell

Part I: Foundations of Error

Overview

Understanding where errors originate in the diagnostic process.

Diagnostic errors are often blamed on the lab, but statistics show the vast majority occur before the sample even reaches the analyzer. Understanding the three phases of error is critical for troubleshooting.

> **Key Statistic: 70–80%** of errors are **Pre-analytical** across human and veterinary studies.

1. PRE-ANALYTICAL

Occurs **before** analysis.

- Sample collection (hemolysis, clots)
- Labeling errors (one of the most dangerous errors)
- Delayed processing
- Wrong tube type

2. ANALYTICAL

Occurs **during** analysis.

- Instrument malfunction
- Reagent issues
- Interfering substances (Lipemia, Icterus)

3. POST-ANALYTICAL

Occurs **after** analysis.

- Transcription errors
- Reporting wrong patient
- Misinterpretation of data

Part II: Case Studies in Error

Clinical Application

Real-world examples of diagnostic pitfalls and how to solve them.

Case 01: Chase (The Pseudo-Addisonian)

PRESENTATION

5mo Corgi. Bloody diarrhea, dull.

Labs:

- **K+: 6.4** (High)
- Na+: Low
- Na:K Ratio: < 27
- Platelets: > 1,000,000

The Error: Pseudohyperkalemia

The constellation of signs suggested Addison's, but the age (5mo) was atypical. The culprit was the massive **Thrombocytosis**.

Mechanism A: Platelet Release

Platelets release Potassium (K+) when they clot. In extreme thrombocytosis (>1M), this release is significant enough to cause artificial hyperkalemia in serum.

Mechanism B: EDTA Contamination

EDTA contains Potassium (K-EDTA). Even minute contamination from a purple top into a red top can spike K+ and chelate Calcium (though Ca was normal here).

Suggested order of draw (to reduce EDTA carryover)

While purple tops are often drawn first to prevent clotting, this risks EDTA carryover. If possible, draw **Red Top (Serum)** first, or use a "waste" tube between draws to clear the needle of contaminants.

Solution: Run a heparinized whole blood sample (e.g., i-STAT) or redraw carefully. In this case, i-STAT K+ was normal.

Case 02: Rocky (The Lipemic Sample)

Scenario: Dog with pancreatitis. Initial CBC normal. Repeat CBC 1 hour later showed anemia (Hct 39%) and massive platelets (3M).

ISSUE 1: IN-VITRO HEMOLYSIS

Lipemia lyses red blood cells over time. The sample sat for an hour, causing RBCs to rupture, falsely lowering the Hematocrit.

Fix: Run PCV immediately on lipemic samples.

ISSUE 2: PSEUDO-THROMBOCYTOSIS

Analyzers count particles by size. **Lipid particles (chylomicrons)** and RBC fragments mimic the size of platelets, leading to falsely elevated counts.

Fix: Verify with a blood film.

Case 03: Charlie (The NRBC Confusion)

PRESENTATION

14yo Golden. Splenic Hemangiosarcoma (Splenectomy 3mo prior).

Automated CBC:

- WBC: 16,000 (Normal)
- Lymphs: 5,600 (High)

The Error: NRBC Misclassification

Manual diff revealed WBC was actually low (3,000). The "Lymphocytes" were actually **Nucleated Red Blood Cells (NRBCs)**.

> **Why?** The spleen removes NRBCs. Post-splenectomy, NRBCs circulate freely. Analyzers confuse these nucleated cells for Lymphocytes or Monocytes because they still have a nucleus.

Correction Formula:

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Corrected WBC = (Uncorrected WBC × 100) ÷ (NRBC per 100 WBC + 100)
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Case 04: Sven (The Leukemia Masquerade)

Scenario: German Shepherd with fever. Automated CBC showed **Monocytosis** and "Stars" (Error flags) on the differential.

The Error: Blasts as Monocytes

The analyzer saw large, complex cells and dumped them into the "Monocyte" bucket.

Blood Film Reality: Cells were **Myeloblasts** (Acute Myeloid Leukemia). Large nuclei, prominent nucleoli.

Scatter Plot Clue: Look for "sharp lines" or "walls" where cell populations collide. Real populations look like distinct clouds; errors look like forced geometric cuts.

Rule of Thumb: Always review a blood film for any unexplained Monocytosis.

Case 05: Emma (The Mystery GGT)

Scenario: Dog on Azathioprine. Routine labs showed a massive spike in **GGT (70)** while all other liver enzymes were normal.

THE CAUSE

Red Cell Contamination. The serum was not separated carefully, leaving a pellet of red blood cells in the tube. RBCs contain GGT. As they sat, they leached GGT into the serum.

THE FIX

Pre-analytical Technique.

- Pipette serum carefully; do not disturb the buffy coat or RBC pellet.
- Transfer serum to a clean, plain tube immediately after centrifugation.
- Don't trust serum separator gels blindly; they can fail.

Case 06: August (The Species Swap)

Scenario: Cat wellness check. Analyzer called **Neutropenia** and **81% Lymphocytes**. Blood film showed normal Neutrophils and many Eosinophils.

The Error: Wrong Species Selected

The sample was run as "Cat" but was actually "Dog" (or vice versa in some error modes). Analyzers use species-specific algorithms to identify cells.

Dog Eosinophils
Round granules. Often faint.

Cat Eosinophils
Rod/Rice-shaped granules.

***Tip:** PCV and Hemoglobin should match (Hgb × 3 ≈ Hct). If they are wildly discordant, suspect species entry error.*

Case 07: Finley (Incompatible with Life)

Scenario: IMHA dog. Labs showed K+ of 26, Creatinine of 57, Phos of 23. Values compatible with a deceased patient, yet the dog was alert.

THE CONTAMINANT: URINE

Someone poured serum into a tube that previously contained urine (or mixed them). Urine is massively high in K+, Creatinine, and Phosphorus.

Lesson: Use distinct tubes (e.g., sterile white top) for urine. If results are impossible, smell the sample!

Case 08: David

The Catheter Clot

Issue: Horse with 28k platelets. No clumps seen.

Cause: Sample drawn from a jugular catheter. Micro-clots formed in the catheter/syringe but didn't transfer to the tube.

Generic Clinical Example
A healthy cat presents with marked thrombocytopenia (e.g., 8,000/µL) but no clots are visible in the tube.
Cause: Clotting occurred in the vessel or syringe during a slow draw, consuming platelets before they reached the tube.

Fix: Avoid catheter draws for CBCs.

Case 09: Marlin

The Gray Eosinophil

Issue: Greyhound/Golden with "Monocytosis."

Cause: "Gray Eosinophils." Some breeds have Eos that don't stain pink (vacuolated/gray). Analyzers call them Monocytes.

Fix: Know breed predispositions (Sighthounds).

My Notes:

Part III: Positive Interference

Advanced

When an error flag is actually a diagnostic clue.

The "False Lipemia" Alert

Sometimes an analyzer flags "Lipemia" but the sample looks clear to the naked eye.

MECHANISM
High levels of **Globulins** (Monoclonal Gammopathy) can precipitate when the analyzer adds diluent/saline. This cloudiness mimics lipemia.

Clinical Value: A false lipemia flag is a screening test for Multiple Myeloma or other gammopathies. Check Total Protein and Globulins immediately.

"The curious incident of the false lipemia index."