

Spurious Results in Mineral and Electrolyte Analysis



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KEYWORDS

• Analytical error • Artifact • Electrolyte • Mineral • Spurious

KEY POINTS

- Errors in mineral and electrolyte reporting are common.
- Errors are broken into 3 categories: preanalytical, analytical, and postanalytical.
- Most of these errors can be eliminated by careful sample acquisition, handling, and equipment monitoring, and by appropriate interpretation of results.
- Because no rigid quality control standards are in place for preanalytical, analytical, or especially postanalytical testing in veterinary medicine, it is up to clinicians to understand how to appropriately obtain samples and to realize the limitations of both the mechanical and human constituents of their laboratories.

It has been estimated that 60% to 70% of clinical decisions are based on laboratory results. Thus, accurate results are critical for evaluation of laboratory data for the appropriate interpretation of abnormalities as indicators of disease states. Erroneous results can have a variety of causes that can interfere with biochemical and hematological testing and interpretation. According to human studies, approximately 4% to 32% of errors occur during the analytical phase or testing of the sample, whereas most errors (32%–75%) occur before the sample is analyzed; for example, during collection, labeling, transport, or processing. The remainder of errors occur during report generation or interpretation of the results.¹ Minerals and electrolytes can be influenced by many environmental, physiologic, and iatrogenic conditions, making them prone to error and, therefore, abnormal results. Because of these inherent problems, guidelines have been established for veterinary laboratories to assist in obtaining quality samples, establish standards for processing and analyzing these samples, and for proper equipment maintenance.² The goal is to decrease the incidence of accruing and reporting errors that could be detrimental in determining the health statuses of patients. This article describes many of the causes and mechanisms of

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spurious electrolyte and mineral abnormalities as well as recommendations to minimize those factors (**Box 1**).

Errors can be broken down by general cause:

1. Preanalytical error, including error caused by physiologic conditions
2. Analytical error
3. Postanalytical error

PREANALYTICAL FACTORS

These errors can be generally classified into 2 categories: (1) technical effects caused by the sampling technique and specimen management before analysis, and (2) biological factors inherent to the patient sampled.³

In the first category, errors are related to the collection, handling, and submission of specimens to the laboratory before analysis. This category includes insufficient

Box 1			
Principal causes of spurious electrolyte disorders in dogs and cats			
Interfering Substance	Analyte	Result	Cause
Hemolysis	Potassium	↑	Cellular release
	Phosphorus	↑	
	Calcium	↑	Interference: spectrophotometry
	Phosphorus	↓	
	Tco ₂	↓	
	Sodium	↓	Dilution
	Chloride	↓	
Icterus	Phosphorus	↓	Interference: spectrophotometry
Lipemia	Potassium	↓	Ion exclusion effect (↓ aqueous phase): indirect potentiometry or flame photometry
	Sodium	↓	
Hyperproteinemia/ hyperglobulinemia	Potassium	↓	Ion exclusion effect (see above)
	Sodium	↓	
	Phosphorus	↑	Interference: spectrophotometry (phosphomolybdate)
Hypoproteinemia/ hypoalbuminemia	Calcium	↓	Decreased bound fraction
	Magnesium	↓	
Thrombocytosis/platelet clumping	Potassium	↑	Cellular release
Leukemia	Potassium	↑	Cellular release
	Phosphorus	↑	Cellular release: some assays
Halides (eg, bromide)	Chloride	↑	Assay interference: all assays
EDTA	Potassium	↑	Contamination (K-EDTA)
	Sodium	↑	Contamination (Na-EDTA)
	Calcium	↓	Contamination and complexing
	Magnesium	↓	
Heparin	Calcium	↓	Dilution and complexing of analytes
	Magnesium	↓	
	Phosphorus	↓	
Citrate	Calcium	↓	Contamination and complexing
	Phosphorus	↓	

Abbreviation: EDTA, ethylenediaminetetraacetic acid.

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