COMPLETE ELECTROLYTES PANEL

INTERPRETATION GUIDE

Scroll down or click on the following parameters to quickly access content

Lyte 4 CLIP:

Na

Cl

Na:K

K

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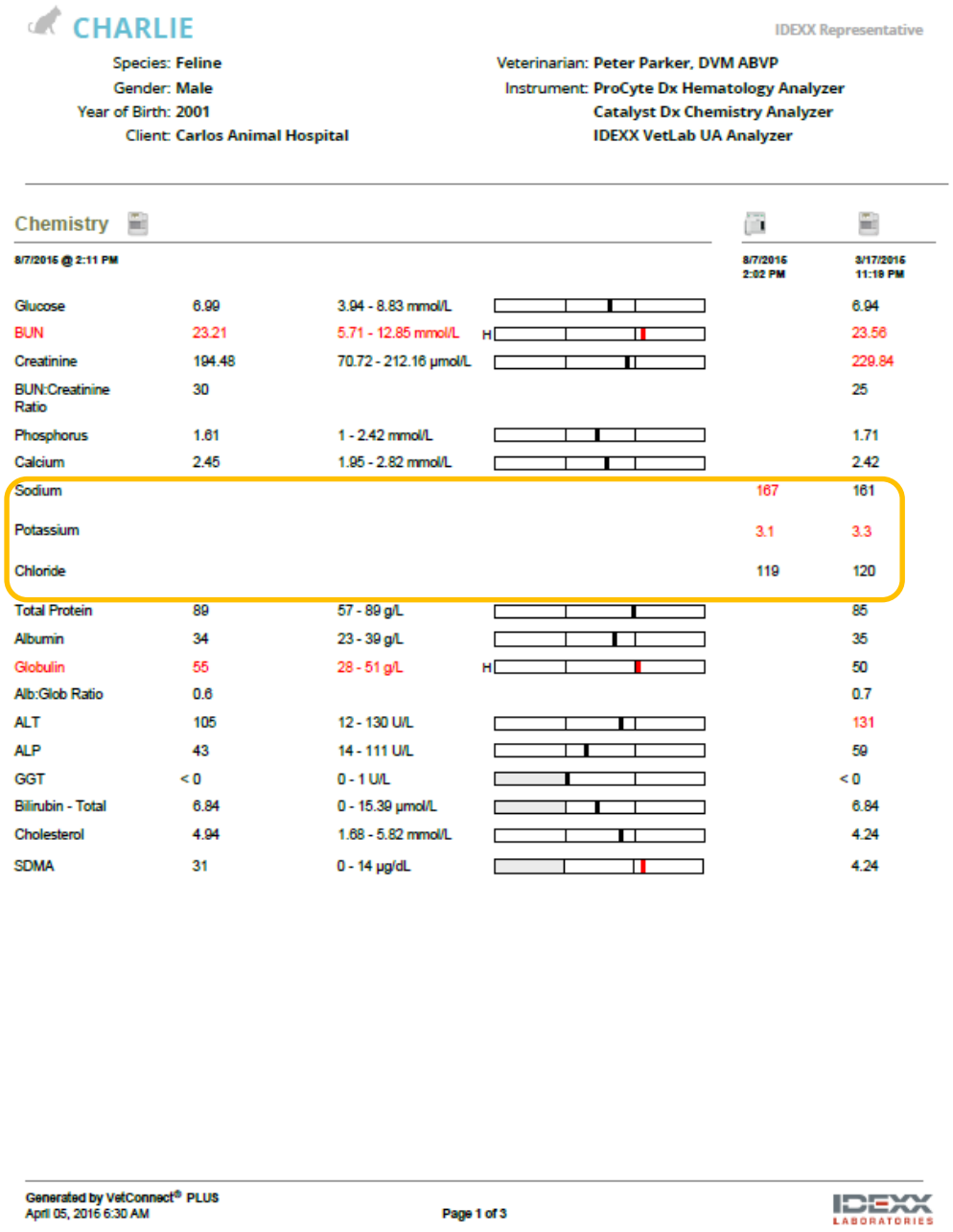
Osmolality



CHARLIE

IDEXX Representative

Species: Feline
Gender: Male
Year of Birth: 2001
Client: Carlos Animal Hospital

Veterinarian: Peter Parker, DVM ABVP
Instrument: ProCyte Dx Hematology Analyzer
Catalyst Dx Chemistry Analyzer
IDEXX VetLab UA Analyzer

Chemistry

	8/7/2016 @ 2:11 PM			8/7/2016 2:02 PM	3/17/2016 11:18 PM
Glucose	6.99	3.94 - 8.83 mmol/L			6.94
BUN	23.21	5.71 - 12.85 mmol/L	H		23.56
Creatinine	194.48	70.72 - 212.16 µmol/L			229.84
BUN:Creatinine Ratio	30				25
Phosphorus	1.61	1 - 2.42 mmol/L			1.71
Calcium	2.45	1.95 - 2.82 mmol/L			2.42
Sodium				167	161
Potassium				3.1	3.3
Chloride				119	120
Total Protein	89	57 - 89 g/L			85
Albumin	34	23 - 39 g/L			35
Globulin	55	28 - 51 g/L	H		50
Alb:Glob Ratio	0.6				0.7
ALT	105	12 - 130 U/L			131
ALP	43	14 - 111 U/L			59
GGT	< 0	0 - 1 U/L			< 0
Bilirubin - Total	6.84	0 - 15.39 µmol/L			6.84
Cholesterol	4.94	1.68 - 5.82 mmol/L			4.24
SDMA	31	0 - 14 µg/dL			4.24

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IDEXX LABORATORIES

Sodium

Description

- Sodium (Na+) is a cation and is abundant in the extracellular fluid (including blood).
- Osmalality of the blood and extracellular fluid is due in large part to sodium. Extracellular fluid volume (EDF) and distribution in the body is therefore largely controlled by sodium. Depletion of body sodium results in decreased ECF and may be reflected in the blood as hyponatremia. Excess sodium (due to increased intake or retention) leads to ECF expansion and may be reflected in the blood as hypernatremia.
  NOTE: Whether hyponatremia or hpernatremia develops depends on the degree of sodium loss or retention relative to the amount of water loss or retention. Disturbances of some organ systems (particularly GI tract) may lead to either hypernatremia or hyponatremia, depending on how much sodium is lost relative to the amount of water lost.

Values Below Reference Range

Hyponatremia

Common Causes
Hyponatremia may be due to: (1) increased loss of sodium, (2) the result of water excess (dilutional) or (3) decreased intake of sodium.

- Sodium loss (depletion) may be the result of:
  - Diarrhea
  - Vomiting
  - Sequestration in the GI tract as with ileus or obstruction or in the abdomen in cases of ruptured urinary bladder
  - Renal disease (e.g., renal tubular acidosis)
  - Diabetes mellitus (due to ketoacidosis and sodium loss in association with organic ions)
  - Diuretic use
  - Hypoadrenocorticism
  - Hypoaldosteronism
- Dilutional hypontremia is due to an excess of water retention or intake (total body sodium may be normal, but is diluted, resulting in measured hyponatremia). This is seen with:
  - Congestive heart failure
  - Nephrotic syndrome and effusion
  - Ascites
  - Hepatic cirrhosis
  - Inappropriate anitdiuretic hormone secretion syndrome
  - Inappropriate fluid therapy (e.g., excess dextrose or use of hypotonic fluids)
  - Psychogenic polydipsia
- Decreased sodium intake is usually the result of severe dietary restriction and is uncommon in animals on good commercial diets.

Related Findings

- Chloride is often decreased with excessive GI tract loss (vomiting, diarrhea).
- Total protein, albumin and globulins may be increased if the animal is dehydrated due to diarrhea, etc. They may be decreased if nephritic syndrome or hepatic cirrhosis is present.
- Potassium is often increased with hypoadrenocorticism, hypoaldosteronism or acidosis. It may be decreased in cases of vomiting or diarrhea.
- BUN and creatine may be increased if sodium depletion is related to renal dysfunction.

- Glucose levels in blood and urine are increased with diabetes mellitus.
- Ketones may be observed in urine.

Other Laboratory Tests

- Serum electrolytes (sodium, chloride, potassium)
- Total protein, albumin, globulin
- Blood urea nitrogen (BUN) and creatinine
- Glucose
- Urinalysis
- ACTH stimulation test for suspected hypoadrenocorticism

Values Above Reference Range

Hypernatremia

Common Causes
Hypernatremia may be due to: (1) excess loss of water, (2) increased sodium retention, or (3) increased intake of sodium (salt).

- Excess loss of water results in dehydration and may be due to:
  - Restricted or no access to water
  - Decreased intake due to oropharyngeal or esophageal disease
  - High environment temperatures
  - Sweating (some species)
  - Strenuous exercise
  - Polyuria
  - Vomiting or diarrhea in which water loss exceeds sodium loss
  - Osmotic diuresis
  - Decreased production of or response to antidiuretic hormone
  - Severe burns
- Increased sodium retention may be seen with:
  - Hyperaldosteronism
  - Some cases of Cushing's disease
- Increased sodium intake
  - Excessive consumption of salt (e.g., misformulatd diets)
  - Inappropriate fluid therapy

Related Findings

- Total protein, albumin and globulin may be increased if the animal is dehydrated.
- Potassium may be decreased in cases of hyperaldosteronism.
- Chloride may be concurrently increased with sodium.
- Urine specific gravity is usually increased with dehydration.

Other Laboratory Tests

- Total protein, albumin, globulin
- Urinalysis
- Serum electrolytes (sodium, chloride, potassium)

- ACTH stimulation test if hyperaldosteronism is detected

References

Duncan JR, et al. *Veterinary Laboratory Medicine; Clinical Pathology*. 3rd ed. Iowa State University Press: Ames, Ia; 1994.

Tilley LP, et al. *The 5-Minute Veterinary Consult: Canine and Feline*. Williams & Wilkins: Baltimore, Md;1997.

Willard MD, et al. *Small Animal Clinical Diagnosis by Laboratory Methods*. 3rd ed. WB Saunders: Philadelphia, Pa; 1999.

Potassium

Description

- Major intracellular cation
- Serum concentration does not accurately reflect total body concentration
- Responsible for maintenance of intracellular volume and determining cellular membrane potential

Values Below Reference Range

Hypokalemia

Common Causes

- Increased loss
  - Diuretics (e.g., furosemide)
  - Gastrointestinal loss, diarrhea and/or vomiting
- Potassium-poor fluids
- Renal diseases
  - Postobstructive diuresis
  - Diet-induced hypokalemic nephropathy in cats
  - Renal failure (chronic; especially cats)
- Potassium translocation from ECF to ICF
  - Insulin and glucose therapy

Other Diagnoses

- Insufficient intake
  - Anorexia (rarely the primary cause)
  - Deficient diets
  - Potassium-free fluids
- Drugs
  - Amphotericin B, penicillins
- Factitious
  - Hyperlipidemia, improper sample handling
- Hyperaldosteronism
  - Mineralocorticoid excess
- Hypokalemic periodic paralysis
- Renal disease
  - Renal tubular acidosis
- Sodium bicarbonate therapy
- Sweating
  - Horse
- Potassium translocation from ECF to ICF

- Alkalemia
- Rapid correction of metabolic acidosis

Other Laboratory Tests

- Aldosterone measurement
- ACTH stimulation or low-dexamethasone suppression test
- Blood pH/gas analysis
- CBC
- Urinalysis
- Urine potassium concentration and urinary fractional excretion

Values Above Reference Range

Hyperkalemia

Common Causes

- Decreased urinary excretion
  - Renal diseases
  - Renal failure (anuric or oliguric)
  - Urethral obstruction/rupture
  - Uroperitoneum
- Potassium translocation from ICF to ECF or additions to ECF
  - Hyperkalemic periodic paralysis (horse)

Other Diagnoses

- Decreased urinary excretion
- Drainage of chylothorax
- Drugs
  - ACE inhibitors
  - Heparin
  - Nonsteroidal anti-inflammatory drugs
  - Potassium-sparing diuretics
  - Prostaglandin inhibitors
- Potassium translocation from ICF to ECF or additions to ECF
- Acidemia
- Collection from IV tube where potassium administered
- Diabetes mellitus (insulin deficiency)
- Drugs (e.g. propranolol)
- Pseudohyperkalemia (factitious)
  - Hemolysis
  - Delayed serum separation
  - Akitas
  - English springer spaniels

    - Herbivore
    - Leukocytosis (>100,000/µL)
    - Neonates
    - Thrombocytosis
- Tissue injury/necrosis
    - Chemotherapy
    - Ischemia
    - Shock
    - Rhabdomyolysis
    - Trauma
    - Tumor lysis syndrome

Other Laboratory Tests

- ACTH stimulation test
- Aldosterone measurement
- Blood pH/gas analysis
- CBC
- Urinalysis
- Urine myoglobin and hemoglobin tests

References

Duncan JR, et al. *Veterinary Laboratory Medicine; Clinical Pathology*. 3rd ed. Iowa State University Press: Ames, Ia; 1994.

Tilley LP, et al. *The 5-Minute Veterinary Consult; Canine and Feline*. Williams & Wilkins: Baltimore, Md; 1997.

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Sodium Potassium Ratio (Na:K)

Description

The ratio of sodium to potassium in the peripheral blood.

Values Below Reference Range

Common Causes

- Hypoadrenocorticism (often, but not always; ACTH stimulation test to verify)
- Gastroenteritis (e.g., whipworms and other GI disorders)
- Chylothorax drainage
- Urinary tract disease (e.g., anuric or oliguric renal failure, urinary bladder rupture or obstruction, urethral obstruction)

Other Laboratory Tests

- ACTH stimulation test: to rule out Hypoadrenocorticism (Addison's Disease)
- Body fluid: cytologic, fluid analysis, culture, and sensitivity
- CBC: often normochromic, normocytic, nonregenative anemia with Addison's plus lymphocytosis, eosinophilia
- Urinalysis: USG usually between 1.015 and 1.030 with Addison's
- Glucose: +/- hypoglycemia with Addison's
- BUN/Creatinine: often moderate to severe prerenal azotemia with Addison's

Reference

Duncan JR et al. *Duncan and Prasse's Veterinary Laboratory Medicine: Clinical Pathology,* 4th ed. Ames, Ia: Iowa State University Press; 2003.

Kaneko JJ et al. *Clinical Biochemistry of Domestic Animals,* 5th ed. San Diego, Ca: Academic Press; 1997.

Stockham SL et al. *Fundamentals of Veterinary Clinical Pathology,* 1st ed. Ames, Ia: Iowa State University Press; 2002.

Willard, MD et al. *Small Animal Clinical Diagnosis by Laboratory Methods,* 4th ed. St. Louis, Mo: Elsevier; 2004.

Tilley LP et al. *Blackwell's Five-Minute Veterinary Consult: Canine and Feline*. Baltimore, Md: Lipincott Williams and Wilkins; 1997.

Chloride

Description

- Chloride is the most abundant anion in the extracellular fluid. It maintains cellular integrity through its influence on osmotic pressure. It is also significant in monitoring acidbase balance and water balance. In metabolic acidosis, there is a reciprocal rise in chloride concentration when the bicarbonate concentration drops.

Decreased levels of chloride are found in severe vomiting, severe diarrhea, ulcerative colitis, pyloric obstruction, severe burns, heat exhaustion, diabetic acidosis, Addison's disease, fever and acute infections such as pneumonia. Increased levels are found in dehydration, Cushing's syndrome, hyperventilation, eclampsia, anemia and cardiac decompensation.

- Chloride concentration is directly proportional to sodium and inversely proportional to bicarbonate concentration.

Values Below Reference Range

Hypochloremia

Common Causes

- Diuretics (e.g., furosemide or thiazide)
- Gastric vomiting
- Hypoadrenocorticism
- Metabolic alkalosis
- Respiratory acidosis
- Salt-losing nephropathy

Other Laboratory Tests

- ACTH stimulation test
- Blood gas analysis
- CBC
- Urinalysis
- Urine chloride and sodium concentration

Values Above Reference Range

Hyperchloremia

Common Causes

- Dehydration
- Diabetes insipidus
- Diabetes mellitus
- Fluid therapy (hypertonic saline)
- Metabolic acidosis

- Respiratory alkalosis
- Potassium bromide therapy causing pseudohyperchloremia
- Renal tubular acidosis
- Small bowel diarrhea

Other Laboratory Tests

- CBC
- Osmolality
- Urinalysis
- Urine chloride and sodium concentration

References

Duncan JR, et al. *Veterinary Laboratory Medicine: Clinical Pathology*. 3rd ed. Iowa State University Press: Ames, Ia; 1994.

Tilley LP, et al. *The 5 Minute Veterinary Consult; Canine and Feline*. Williams & Wilkins: Baltimore, Md; 1997.

Willard MD, et al. *Small Animal Clinical Diagnosis by Laboratory Methods*. 3rd ed. WB Saunders: Philadelphia, Pa; 1999.

Recommended Reading

DiBartola SP. Fluid, *Electrolyte and Acid-Base Disorders in Small Animal Practice*. 3rd ed. Philadelphia, PA: Elsevier; 2006.

Kaneko JJ, ed. *Clinical Biochemistry of Domestic Animals*. 4th ed. San Diego, CA: Academic Press; 1989.

Thrall MA, et al. *Veterinary Hematology and Clinical Chemistry*. Baltimore, MD: Lippincott, Williams and Wilkins; 2004.

Pagana KD, Pagana TJ. *Mosby's Manual of Diagnostic and Laboratory Tests*. Boston, MA: Mosby; 1998:133–135.

Willard MD, et al. *Small Animal Clinical Diagnosis by Laboratory Methods*. 3rd ed. Philadelphia, PA: WB Saunders; 1999.

Osmolality

Description

- The number of particles dissolved in 1 kg of solvent irrespective of type, charge and molecular weight of the particles
- Sodium, potassium, glucose and BUN are the largest contibutors to serum osmolality
- Osmolality (calculated) (mOsm/kg) = 2 ({Na+} + {K+}) + {glucose}/18 + {BUN}/2.8
- Dogs (normal range) 292–308 mOsm/kg
- Cats (normal range) 280–300 mOsm/kg

Values Above Reference Range

Common Causes

- Diabetic ketoacidosis with severe hyperglycemia
- Severe dehydration
- Ethylene glycol, ethanol and other toxicities
- Sepsis, cardiac disease, acute pancreatitis

Other Laboratory Tests

- Measured serum osmolality
- Osmolal gap
- CBC
- Chemistry
- Complete urinalysis

References

DiBartola SP. *Fluid, Electrolyte and Acid-Base Disorders in Small Animal Practice,* 3rd ed. New York, NY: Elsevier; 2006.

Duncan JR et al. *Duncan and Prasse's Veterinary Laboratory Medicine: Clinical Pathology,* 4th ed. Ames, Ia: Iowa State University Press; 2003.

Hess RS. Hyperosmolar Syndrome. Proceedings from: International Veterinary Emergency and Critical Care Symposium; September 17-21, 2006; San Antonio, Tx.

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