Glucose

Interpretive Summary

Description: Glucose is the basic energy source for the body.

Decreased Glucose

Common Causes

- Artifact
  - Failure to spin and separate a blood sample within 30-60 minutes of collection
- Neonatal or juvenile hypoglycemia
- Liver failure/severe liver disease
- Sepsis/endotoxemia
- Insulinoma
- Addison's disease
- Drugs/toxins
  - Insulin
  - Sulfonylureas (e.g. glipizide)
  - Xylitol

Uncommon Causes.

- Congenital
  - Growth hormone deficiency
  - Hypopituitarism
- Exercise induced hypoglycemia (hunting dogs, endurance horses)
- Other cancers
  - Leiomyoma/leiomyosarcoma
  - Hepatoma/hepatocellular carcinoma
  - Renal carcinoma
- Starvation (mild decrease only)
- Pregnancy (late gestation in the dog)
- Extremely high white blood cell counts/leukemia
  - May increase glucose consumption
  - Usually only occurs in the sample after collection
- Drugs
  - Antihistamines
  - Spironolactone
  - Ethanol
  - Anabolic steroids

Related Findings

- Severe liver disease/failure
  - Increased liver enzymes (ALT, AST, ALP, GGT) and/or bilirubin
  - Abnormal liver function tests (e.g. bile acid stimulation test)
  - May see decreased albumin, BUN, cholesterol
  - Abnormalities on liver biopsy
- Insulinoma
  - Normal or increased serum insulin with concurrent decreased blood glucose
  - Increased insulin:glucose ratio
  - Pancreatic mass may be seen on ultrasound (cats >dogs)

    - Abnormal cells on cytology or biopsy of a pancreatic mass
- Sepsis/endotoxemia
    - Increased neutrophil counts and band neutrophil
    - Low neutrophil counts due to increased tissue demand
    - Positive blood culture, urine culture
- Addison's disease
    - Absence of a stress leukogram (normal or increased lymphocytes and eosinophils)
    - May have decreased sodium and increased potassium; decreased Na:K ratio
    - May have decreased albumin, cholesterol
    - Decreased resting serum cortisol; failure to stimulate on an ACTH stimulation test

Increased Glucose

Common Causes

- Diabetes mellitus
- Physiologic response (mild increase)
    - Stress (especially cats)
    - After eating
    - Diestrus (dogs)
- Pancreatitis
- Cushing's disease
    - Increased glucose production
    - Insulin resistance
- Drugs
    - Glucose/dextrose
    - Glucocorticoids
    - Megestrol acetate
    - Progesterone
    - Epinepherine

Uncommon Causes

- Acromegaly (especially cats)
- Hepatocutaneous syndrome (dogs)
- Hyperammonemia (horses)
- Thyroid disease
    - Hyperthyroidism (cats)
    - Hypothyroidism (dogs)
- Cancer
    - Glucagonoma
    - Pheochromocytoma
    - Pancreatic carcinoma
- Kidney failure
- Drugs
    - Glucagon
    - Insulin (Somogyi effect secondary to overdose)
    - Ethylene glycol
    - Propranolol
    - Thyroxine
    - Sedatives/analgesics/anesthetics
        - Ketamine
        - Detomidine
        - Xylazine
        - Morphine

Related Findings

- Diabetes mellitus
  - Increased serum fructosamine
  - Glucose in urine +/- ketones
- Pancreatitis
  - Increased neutrophils, often with band neutrophils
  - Decreased neutrophils in severe, acute cases
  - Increased amylase and/or lipase
  - Increased Spec cPL®, Spec fPL®
- Cushing's disease
  - Increased ALP
  - Decreased urine specific gravity
  - Mild to moderately increased platelets
  - Adrenal tests consistent with Cushing's

Additional Information

Physiology

- Glucose is produced from digestion of carbohydrates in the gastrointestinal tract. It is also released via breakdown of glycogen stores in the liver (glycogenolysis). The liver manufactures glucose from products of protein and fat metabolism (gluconeogenesis).
- Glucose is tightly regulated by various endocrine hormones, especially insulin and glucagon.
- Insulin stimulates uptake of glucose into most cells, including adipocytes (fat cells) and myocytes (muscle).
- Neurons, blood cells, and hepatocytes do not require insulin for glucose uptake.
- Glucagon increases blood glucose by stimulating glycogenolysis and gluconeogenesis.

Diagnostic Methodology

- Most glucose assays are photometric and are influenced to varying degrees by lipemia, hemolysis, and icterus. Nonphotometric assays have fewer chemical and photometric interferences.

References

- Latimer KS, Mahaffey EA, Prasse KW, eds. *Duncan and Prasse's Veterinary Laboratory Medicine: Clinical Pathology,* 4th ed. Ames, IA: Blackwell; 2003.
- Stockham SL, Scott MA. *Fundamentals of Veterinary Clinical Pathology,* 2nd ed. Ames, IA: Blackwell; 2008.

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