What's All the Phys About?

What is the Meaning of an Abnormal Anion Gap, Low Ionized Calcium and Elevated Cardiac Enzymes?

If metabolic acidosis is present, calculate the anion gap as follows:

- $[(Na)] – [Cl + HCO_3)]$[44-46]
  - ✧ Use the serum CO_2 on the electrolyte panel for the HCO_3.
- Normal values for the neonate are 5 to 15 mEq/L.[47,48]
  - ✧ **High anion gap**[49,50]
    - ◇ Lactic acidosis – produced by anaerobic metabolism; shock, sepsis
    - ◇ Ketoacidosis – inborn error of organic acid or amino acid metabolism
    - ◇ Renal failure
    - ◇ Late metabolic acidosis
    - ◇ Toxins
  - ✧ **Normal anion gap**
    - ◇ Loss of bicarbonate (HCO_3–), usually from gastrointestinal (small bowel drainage, diarrhea) or renal losses (bicarbonate wasting secondary to immaturity, renal tubular acidosis, diuretic treatment with carbonic anhydrase inhibitors)[44,47,49]
    - ◇ Excessive chloride in IV fluid
    - ◇ Aldosterone deficiency
    - ◇ Hyperchloremia is a compensatory mechanism[49]
  - ✧ **Low anion gap**
    - ◇ Caused by hypoalbuminemia[47,51]

Ionized calcium is the measure of 'free calcium' and the best indicator of physiologic blood calcium activity

- Hypocalcemia in term and late preterm infants is defined as an ionized calcium concentration < 4.4 mg/dL (1.1 mmol/L)[52,53]
- Calcium acts as a second messenger in myocardial contractility
- If there is insufficient calcium available for myocardial contraction, other inotropes will be significantly less effective

Elevated Cardiac enzymes can be due to myocardial tissue injury

- *BNP – B-type natriuretic peptide* is synthesized and released by the ventricles of the heart in response to excessive stretching of cardiac myocytes or ventricular stress[54-57]
  - ✧ Ranges Elevated in:[57-60]
    - ◇ Congestive heart failure
    - ◇ Pulmonary hypertension
    - ◇ Various congenital heart diseases
    - ◇ Septic shock

Values in Preterm infants*	
Median values of 31 to 833[54] were obtained in 24- to 31-week gestation infants with patent ductus arteriosus (PDA)	Values increased as grade of PDA increased If also intubated and ventilated, the BNP values were in the higher range[54]

Values in Healthy Term Infants*

Mean BNP starts at 231.6 and declines to 48.4 in first week[57]

Values are highest in the first 3 days of life[61]

**Interpret in the context of clinical events and physical exam.*

- *Troponin I (cardiac Troponin)* is released in response to myocardial injury
  - ✧ Newborns have slightly higher levels than adults and increase these levels when asphyxiated[62]
- Creatine phosphokinase (CPK) is an enzyme found mainly in the heart (MB fraction), brain (BB fraction), and skeletal muscle (BB fraction)
  - ✧ CPK-MB rises 4 – 6 hours after myocardial injury and peaks at 24 hours
  - ✧ Less reliable marker than Troponin I

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