

Arterial Blood Gas (ABG) Analyzer

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Abstract

This ABG analyzer calculator can assist in diagnosing or monitoring the status of respiratory, metabolic, and circulatory disorders.

I. HOW TO USE

When to Use

ABG analysis is useful when diagnosing or monitoring various respiratory, metabolic, and circulatory disorders. If a respiratory process is present, ABG analysis can help indicate if the process is acute or chronic.

Pearls / Pitfalls

While the analyzer can often help with analysis, the history of the patient is critical for accurate interpretation.

Why Use

The ABG analysis is a systematic approach that, when used in conjunction with patient history and clinical scenario, helps to determine the primary disease process and subsequently calculate any evidence of compensatory process. It also can aid in determining the chronicity of the acid-base disturbance along with any secondary or co-existing acid-base disturbances.

II. NEXT STEPS

Advice

Technique matters when it comes to collecting the blood specimen. Inaccurate results may be due to obtaining a venous sample instead of an arterial sample, the presence of air bubbles in the specimen (lowering PaCO₂), or a delay in analyzing the sample (lowering PaO₂).

Management

Management varies significantly depending on the ABG results along, with the clinical scenario.

Critical Actions

1. Ensure proper sampling of blood specimen.
2. Consider repeating ABG if results do not fit the patient history and clinical scenario.
3. A venous blood gas (VBG) can also be checked to see if it correlates with ABG results (only PaO₂ should be different).

III. EVIDENCE

Formula

This tool, developed by [Jonathan Chen, MD](#) first determines the primary process by looking at the pH and the PCO_2 . It then calculates compensations to determine chronicity, compensatory, and co-existing acid-base disturbances.

These calculations use the following normal values:

- Arterial pH: 7.40
- P_aCO_2 : 40 mmHg
- HCO_3^- : 24 mEq/L
- Albumin: 4.0 g/dL
- Anion gap: 12 mEq/L

Facts & Figures

Metabolic Acidosis (Anion Gap)

MUDPILES

- Methanol
- Uremia
- Diabetic Ketoacidosis (check serum ketones)
- Propylene Glycol or Paraldehydes
- Isoniazid
- Lactic Acidosis (check serum lactate)
- Ethylene Glycol (anti-freeze)
- Salicylates

GOLDMARK

- Glycols (ethylene or propylene)
- Oxopurin (reflects fatty liver damage from glutathione consumption, e.g. acetaminophen toxicity)
- L-Lactate
- D-Lactate (bacterial form)
- Methanol
- Aspirin (salicylate)
- Renal Failure (BUN uremia)
- Ketoacidosis

Metabolic Acidosis (Non-Anion Gap)

GI Loss

- Diarrhea / Laxatives
- Fistula, (pancreatic, biliary)
- Uretero-intestinal diversion (ileal conduit)

Renal Loss

- Renal Tubular Acidosis (Type 1 Distal or Type 2 Proximal)
- Renal Failure
- Hyper-kalemia

Exogenous Acid

- HCl
- Amino Acids

FUSED CARS

- Fistula (pancreatic, biliary)
- Uretero-gastric conduit
- Saline admin (dilutional acidosis)
- Endocrine (hyper-PTH)
- Diarrhea
- Carbonic anhydrase inhibitor (acetazolamide)
- Ammonium chloride
- Renal tubular acidosis
- Spironolactone

Metabolic Alkalosis

Alkaline Input

- Bicarbonate Infusion
- Hemodialysis
- Calcium Carbonate
- Parenteral Nutrition

Proton Loss

- GI Loss (vomiting, NG suction)
- Renal loss
- Diuretics
- Mineralocorticoids

Respiratory Acidosis

Airway Obstruction

- Foreign body, aspiration
- OSA (obstructive sleep apnea)
- Laryngo- or broncho-spasm

Neuromuscular

- Myasthenia gravis
- Hypokalemic periodic paralysis
- Guillain-Barre
- Botulism, Tetanus
- Hypo-kalemia, hypo-phosphatemia
- Cervical spine injury
- Morbid obesity
- Polio, MS, ALS

Central

- Drugs (opiates, sedatives)
- Oxygen treatment in acute hypercapnia
- Brain trauma or stroke

Pulmonary

- Pulmonary edema
- Asthma
- Pneumonia
- ARDS
- COPD
- Pulmonary Fibrosis

Mechanical Ventilation

Respiratory Alkalosis

Hypoxia

- High altitude
- CHF
- Pulmonary Embolism

Lung Disease

- Pulmonary fibrosis
- Pulmonary edema
- Pneumonia

Drugs

- Progesterone
- Nicotine

Stimulation of Respiratory Drive

- Psychogenic
- Neurologic (pontine tumor)
- Sepsis
- Pregnancy
- Mechanical ventilation

LITERATURE

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Validation

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