



Short Communication

Should arterial blood-gas analysis be done in all ICU patients?

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Abstract

Introduction: Understanding and use of blood gas analysis enable providers to interpret respiratory, circulatory and metabolic disorders and its severity. It is an important tool of analysis especially amongst critical care patients.

Objective: This study was done with the objective to find out which acid base disorder is more prevalent amongst ICU patients and importance of early ABG analysis in these patients.

Materials and Methods: A retrospective Cross-sectional study was carried out from data of 500 patients admitted to ICU of B. J. Medical College, Ahmedabad. The arterial blood sample was sent well packed in ice packs within 15 mins of collection. The sample was immediately analysed in the laboratory by Eschweiler Combi-Line.

Results: In this study extremes of blood pH in either direction are observed, with respiratory alkalosis being most common and respiratory acidosis the least common

Conclusion: From this study we conclude that arterial blood-gas analysis is essential in diagnosis and treatment of acid base imbalance and lung functioning and therefore should be done in all critical care patients.

Take Home Message: Accurate and timely analysis of blood can help in early diagnosis and initiation of treatment. Continuous monitoring in these patients is equally crucial. Regular training and updating of ICU staff regarding the ventilator operation and management should also be given adequate importance

Keywords: Arterial Blood-Gas Analysis, ABG, ICU, Critical care.

Received: 23-09-2025; **Accepted:** 18-10-2025; **Available Online:** 24-10-2025

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1. Introduction

Amongst the various investigations carried out in an Intensive Care Unit (ICU), Arterial Blood Gas monitoring is of utmost importance. Arterial blood gas analysis is a commonly used diagnostic tool to evaluate the partial pressures of gas in blood and acid-base content. Understanding and use of blood gas analysis enable providers to interpret respiratory, circulatory and metabolic disorders and its severity. Also to assess pre-op patients as well as patients on ventilator and assist in their weaning. The importance of mandatory ABG for these patients is controversial considering its short pre-analytical phase, high chances of manual errors and limited time for corrective action. In this study we are focusing on the importance of ABG tests in all ICU patients as it can indicate the parameters that require immediate correction and therefore help stabilize

the patient before further interventions. While the current literature does not focus on the overcorrection and monitored maintenance of acid-base imbalance in ICU patients our study focuses more on these aspects.

2. Materials and Methods

2.1. Inclusion criteria

ICU patients in age group between 18 to 70 years.

2.2. Exclusion criteria

Patients below 18 and above 70 years of age, Known cases of acid-base imbalance with ongoing treatment, pregnant patients.

Accurate results for ABG estimation depend on proper methods of collection, handling and analysis of the specimen.

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The site for puncture is usually the radial artery, dorsalis pedis, brachial artery or femoral artery.

Around 2 ml of blood is collected in heparinized syringe under strict anaerobic conditions and kept at 0°C until the sample is processed.

A retrospective Cross-sectional study was carried out from data of 500 patients admitted to ICU of B. J. Medical College, Ahmedabad. The arterial blood sample was sent well packed in ice packs within 15 mins of collection. The sample was immediately analysed in the laboratory by Eschweiler Combi-Line to obtain values of various parameters like:

Blood pH,

Partial pressure of dissolved oxygen in blood (pO₂), Partial pressure of carbon dioxide in blood (pCO₂), Base excess in extra cellular fluid

Bicarbonate ion level in blood (HCO₃⁻).

Table 1: The normal ranges for estimated arterial blood gas analysis parameters are given below:

No.	Sr.	Parameters	Reference range
1		Blood pH	7.35-7.45
2		pO ₂	75-100 mm Hg
3		pCO ₂	35-45mm Hg
4		Base exvess in e.c.f	-2-2 mmol/l
5		HCO ₃	22-26 mmol/l

The tests were done as a part of routine investigation protocol of ICU patients in the hospital and a separate intervention for this study was not done. Therefore an ethical approval was not required for the proceedings as such.

3. Results

Results obtained from this study are as follows:

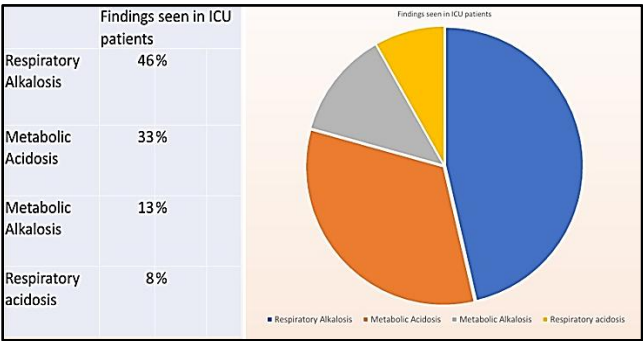


Figure 1: Extremes of blood pH in either direction is observed, with respiratory alkalosis being most common and respiratory acidosis the least common.

Table 2: The acid-base disorders were categorized based on following reference:

Disturban ce	pH	Primary Change	HCO3 : CO2 RATIO	Secondar y Change
Metabolic acidosis	Decreased	Deficit of bicarbonate	< 20	Decrease in PaCO ₂
Metabolic alkalosis	Increased	Excess of bicarbonate	>20	Increase in PaCO ₂
Respiratory acidosis	Decreased	Excess of carbonic acid	<20	Increase in bicarbonate
Respiratory alkalosis	Increased	Deficit of carbonic acid	>20	Decrease in bicarbonate

4. Discussion

Arterial blood gas analysis is a standard method of analysing a patient’s oxygenation, ventilation and acid base status. This study shows that a majority of patients admitted to ICU have either any one or more acid– base disorders, most common being respiratory alkalosis to least common being respiratory acidosis. Various supporting studies have shown similar results. In respiratory alkalosis there is a primary deficit of carbonic acid.^{1,2}

Here the HCO: H CO ratio is more than 20 mainly due to hyperventilation, resulting in washing out of carbon dioxide. Main pathological causes of respiratory alkalosis are hysterical hyperventilation, raised intracranial pressure and brainstem injury. Post-hypercapnic alkalosis is a complication of mechanical ventilation in patients with chronic obstructive pulmonary disease. Although acidosis is more common at ICU admission, bicarbonate increases over time. In case of mechanical Ventilation, incorrect ventilator settings can lead to over-ventilation and CO₂ removal leading to CO₂ washout.³

In respiratory alkalosis pCO₂ is low, pH is high and bicarbonate level increases. But bicarbonate level falls, when compensation occurs. In acute stages, compensation occurs immediately whereas in prolonged chronic cases, renal compensation sets in. Bicarbonate level is decreased by reducing the reclamation of filtered bicarbonate.

Clinically, hyperventilation, muscle cramps, tingling and paraesthesia are seen. Alkaline pH will favour increased binding of calcium to proteins, resulting in a decreased ionized calcium, leading to paraesthesia.

Some studies suggest increased cases of metabolic alkalosis cases amongst ICU patients which may be constant from the time of admission and on continuous follow up indicating that the acid-base imbalance in these cases is unrelated with the interventional complications.⁰⁻⁴

5. Conclusion

From this study we conclude that arterial blood-gas analysis is essential in diagnosis and treatment of acid base imbalance and lung functioning and therefore should be done in all critical care patients. It emphasizes that proper sample collection, analysis and reporting is significant in diagnosis and treatment. Also, availability of arterial blood gas monitoring at ICUs and wards can lead to better prognosis and medical help in urgent cases. At the same time, emphasis should be given on proper ventilation setting and monitoring to avoid overcorrection of these cases which could lead to further imbalance in these patients. Therefore, accurate and timely analysis of blood can help in early diagnosis and initiation of treatment. Continuous monitoring in these patients is equally crucial. Regular training and updating of ICU staff regarding the ventilator operation and management should also be given adequate importance.

5.1. Scope of improvement

This being a cross-sectional study has its limitations in data regarding patient admission data and patient follow-up. Therefore, the progressive change in the ICU patient's blood pH from the time of admission till discharge cannot be analysed. Hence a definitive conclusion for the causative factor for the increased number of respiratory alkalosis cannot be provided.

6. Conflict of Interest

This is to declare that there is no conflict of interest amongst the concerned parties with respect to this research paper.

7. Source of Funding

None.

8. Conflict of Interest

None.

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Cite this article: Nair DP, Khubchandani A. Should arterial blood-gas analysis be done in all ICU patients? *Int J Clin Biochem Res*. 2025;12(3):172-174.