

Usefulness of Venous Blood Gas Analysis to Determine Acid-Base Status in Acute Exacerbation of Chronic Obstructive Pulmonary Disease



Biochemistry

KEYWORDS: Venous, Blood gas, pH, chronic obstructive pulmonary disease

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is associated with greatest morbidity and mortality, worldwide. Blood gas analysis is required to know acid-base status of the body in patients of acute exacerbation of COPD. Routinely arterial blood obtained by arterial puncture is used for blood gas analysis. It has been shown that venous blood can be used in place of arterial blood for blood gas analysis. The aim of present study was to see the changes in acid base status of the body in AECOPD patients by using venous blood for blood gas analysis. *Methods:* This study included previously diagnosed 100 patients of acute exacerbation of chronic obstructive pulmonary disease and 100 healthy subjects. VBG sample was taken from each patient analyzed for pH, PCO₂, HCO₃⁻, PO₂ and SO₂. *Results:* The mean ± SD values for pH, PCO₂ and HCO₃⁻ in AECOPD patients were 7.36 ± 0.1, 53.31 ± 18.62 mmHg and 29.21 ± 8.78 mmol/L, respectively. In healthy controls, the mean ± SD values for pH, PCO₂ and HCO₃⁻ were 7.39 ± 0.04, 46.02 ± 6.7 mmHg and 28.3 ± 4.1 mmol/L. *Conclusion:* Venous values of pH were slightly lower while venous values of PCO₂ and HCO₃⁻ were slightly higher in AECOPD patients as compared to the healthy subjects showed that AECOPD patients were in respiratory acidosis state.

INTRODUCTION

Acute exacerbations of chronic obstructive pulmonary disease (AECOPD) are a common cause of morbidity and mortality. Chronic obstructive pulmonary disease (COPD) is characterised by the presence of airflow obstruction due to chronic bronchitis or emphysema; the airflow obstruction is generally progressive, may be accompanied by airway hyperreactivity and may be partially reversible.¹ AECOPD may be defined as a sustained worsening of respiratory symptoms that is acute in onset and usually requires a patient to seek medical help or alter treatment.²

Exacerbation of chronic obstructive pulmonary disease results in hypoxia and respiratory failure that can be debilitating to the patients and may increase mortality rate if left untreated.³ Arterial blood gas analysis is routinely used to determine the changes in acid base status and in oxygenation status of body in AECOPD patients. But arterial puncture is associated with some serious complications.⁴ Also it has been shown that venous blood can be used in place of arterial blood for blood gas analysis.

Venous puncture is an easy technique and associated with less severe complication than arterial puncture. Venous blood can be taken along with other laboratory tests. So, the present study is designed to determine the changes in acid base status in AECOPD patients by using venous blood gas analysis.

MATERIALS AND METHODS

The present study was reviewed and approved by the Human Ethics committee of Government Medical College, Bhavnagar. The Study was carried out in the department of Biochemistry, Govt. Medical College and Sir T. Hospital, Bhavnagar (Gujarat). Present study includes 100 patients with prior diagnosis of COPD presented with acute exacerbation according to the AECOPD criteria and 100 healthy subjects. The patients were recruited from the casualty and pulmonary medicine ward, while the controls were taken from the subjects attending routine check up.

Patients with diabetes mellitus, renal failure, pneumothorax, restrictive pulmonary disease, congestive heart failure, pulmonary emboli and those having unstable hemodynamic status were excluded. Venous blood samples were taken from the AECOPD patients and from healthy controls in the heparinized syringe in supine position. In the Eschweiler blood gas analyzer

at Clinical Biochemistry Section, Sir T. Hospital, Bhavnagar, all the samples were analyzed immediately for pH, PCO₂, HCO₃⁻, PO₂ and SO₂. Statistical analysis of result data were performed using Graph pad Prism 5.0. Data are presented as mean ± SD. Statistical analysis was done by using t test.

RESULTS

The mean age in control group was 50.62 ± 5.77 years, while in AECOPD patients was 59.01 ± 11.42 years. The study group involves 73% male and 27% female patients, while control group involves 63% male and 37% female subjects. Table 1 shows the value of blood gas parameters in venous blood in study and control group.

Table: 1 Venous blood gas analysis in Study and control group (n=100)

Parameter	Study Group			Control Group			p Value
	Min.	Max.	Mean ± SD	Min.	Max.	Mean ± SD	
pH	6.94	7.51	7.365±0.10	7.31	7.47	7.39±0.04	<0.05
PCO ₂ (mmHg)	24.3	132.5	53.31±18.62	28.3	62.1	46.02±6.7	<0.05
PO ₂ (mmHg)	9.2	104.0	29.66±14.83	18.7	46.2	30.1±5.64	0.8437
HCO ₃ ⁻ (mmol/L)	14.0	63.1	29.21±8.78	18	37	28.3±4.1	0.21
SO ₂ (%)	9.4	90.6	47.14± 20.76	22.4	76.4	47.66±13.9	0.8274

Note: *p < 0.05 – significant, **p < 0.001 – highly significant, #p ≥ 0.05 – not significant

PCO₂:

Partial pressure of carbon dioxide (mm Hg), PO₂: Partial pressure of oxygen (mmHg),

HCO₃⁻:

bicarbonate (mmol/L), SO₂: Oxygen saturation (%), SD: standard deviation

DISCUSSION

As chronic obstructive pulmonary disease is a huge health burden all over the world, its management is necessary in all healthcare facilities.⁵ Blood gas analysis is necessary in management to obtain information about the oxygenation and acid base status of body in patients presenting with the acute exacerbation of COPD. Arterial blood gas analysis is gold standard to access acid base and oxygenation status in AECOPD patients. Arterial puncture or insertion of an arterial catheter carries the risk of complications such as local hematoma, infection, aneurysm formation, median nerve damage, arterial thrombosis or embolization with consequent ischemic injury to the digits. Also the arterial puncture is very painful, technically difficult and several attempts may be required.⁶

On the other hand, venous blood is a substitute for the blood gas analysis. Along with that venous puncture is easy, less painful and can be taken at the time of admission with other routine laboratory investigations. Many studies recommend the use of the venous blood in place of arterial blood in management of the AECOPD and other patients.⁷⁻⁹ With the view of these facts; we have done venous blood gas analysis in AECOPD patients and in healthy subjects to determine changes in acid base status of the body of patients.

Table 1 shows that values of pH in the study group is significantly lower than control group ($p < 0.05$), While PCO_2 values are significantly higher in study group than in control group ($p < 0.05$). This shows that AECOPD patients were in respiratory acidosis state.

CONCLUSION

Venous blood gas analysis in patients of acute exacerbation of chronic obstructive pulmonary disease shows that these patients were in respiratory acidosis state.

Further studies are required to recommend the use of VBG to determine acid base status in same patients.

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