

## ASSESSMENT OF ACID BASE DISORDERS IN CRITICALLY ILL MEDICAL PATIENTS

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### ABSTRACT

**Background:** Acid base disorders represents the pathogenesis and gravity of the underlying disease which accounts for morbidity and mortality rates. A previous study reported that around 64% of patients admitted in intensive care unit show complex acid-base and electrolyte disorders, among them the most common was acute metabolic acidosis. **Material & Methods:** In the present retrospective study, patients who were admitted in ICU during the one year of study period were enrolled by simple random sampling. Clearance from hospital ethics committee was taken before start of study. Written informed consent was taken from each study participant. **Results:** In the present study, majority of study participants 80% (40) were in the group of non-infectious etiology, 8% (4) patients had sepsis and 12% (6) patients had other infectious cause. Out of the total study participants 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Among the patients with simple acid base disorders 8 had metabolic acidosis, 3 had metabolic alkalosis, 1 had respiratory alkalosis and 4 had respiratory acidosis. Among the patients with mixed acid base disorders, 10 had metabolic acidosis + respiratory alkalosis, 7 had metabolic alkalosis + respiratory alkalosis, 10 had metabolic alkalosis + respiratory acidosis and 7 had metabolic acidosis + respiratory acidosis. **Conclusion:** We concluded from the present study that acid base disorders play important role in effective treatment of various pathological diseases specially among the critically ill patients.

**Key words:** Acid base disorder, Intensive care units, metabolic acidosis, respiratory acidosis.

### INTRODUCTION

Various studies reported that acid base disorders play important role in effective treatment of various pathological diseases specially among the critically ill patients (1). Acid base disorders represents the pathogenesis and gravity of the underlying disease which accounts for morbidity and mortality rates. A previous study reported that around 64% of patients admitted in intensive care unit show complex acid-base and electrolyte disorders, among them the most common was acute metabolic acidosis (2). Acid-base disorders act as a alarming signal for physicians to diagnose the possible underlying cause of the diseases. For example, the anion gap acidosis gives

representation about the underlying metabolic disorders which were ranging from uremia to sepsis. Respiratory alkalosis and acidosis are linked with ventilation and these disorders are aggravated by underlying conditions such as sepsis (3).

Among the cases of respiratory acidosis there is a left shift due to the addition of CO<sub>2</sub>, which result in increases in the concentration of hydrogen and bicarbonates. Among the cases of respiratory alkalosis there is a right shift due to the removal of CO<sub>2</sub>, which result in decreasing the concentration of CO<sub>2</sub>, protons and bicarbonates (4). Among cases of metabolic acidosis, there is increased concentration

of protons and decreased concentration of bicarbonate due to either addition of a proton with an anion other than bicarbonate or removal of bicarbonate with a cation (5). Among cases of metabolic alkalosis, there is decreased concentration of protons and increased concentration of bicarbonate due to removal of a proton with addition of bicarbonate. Several conditions such as sepsis due to respiratory, gastro-intestinal and neurological causes are usually associated with metabolic and respiratory acid base disorders more specifically metabolic acidosis and respiratory alkalosis same condition found among the cases of pneumonia (6). We conduct present study to assess acid base disorders in critically ill medical patients at tertiary care hospital.

## MATERIALS & METHODS

The present retrospective study was conducted at our tertiary care hospital and the study duration was one year from January 2018 to December 2018. A sample size of 50 was calculated at 95% confidence interval at 5% of maximum allowable error. Patients who were admitted in ICU during the one year of study period were enrolled by simple random sampling. Clearance from hospital ethics committee was taken before start of study. Written informed consent was taken from each study participant.

All the data were recorded related to detailed clinical history cause of admission, APACHE -2 scores, and co-morbidities. All study participants admitted in the ICU were subjected for arterial blood for arterial blood gas analysis and acid base disorders were recorded according to various samples. Data analysis was carried out using SPSS v22. All tests were done at alpha (level significance) of 5%; means a significant association present if p value was less than 0.05.

## RESULTS

In the present study, we enrolled 50 patients with acid base disorders who were admitted in intensive care units. Out of the total study participants (21) 42% were females and (29) 58% were males. The mean age of study population was  $59.80 \pm 7.9$  years. Direct admissions in the intensive care units were 78% (39) and 22% (11) were transferred from wards

of our hospital. Majority of study participants 80% (40) were in the group of non-infectious etiology, 8% (4) patients had sepsis and 12% (6) patients had other infectious cause. Out of the total study participants 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Among the patients with simple acid base disorders 8 had metabolic acidosis, 3 had metabolic alkalosis, 1 had respiratory alkalosis and 4 had respiratory acidosis. Among the patients with mixed acid base disorders, 10 had metabolic acidosis + respiratory alkalosis, 7 had metabolic alkalosis + respiratory alkalosis, 10 had metabolic alkalosis + respiratory acidosis and 7 had metabolic acidosis + respiratory acidosis. (Table 1)

**Table 1:** Distribution of study participants according to acid base disorders.

Acid base disorders		Number of patients
Simple acid base disorders	Metabolic acidosis	8
	Metabolic alkalosis	3
	Respiratory alkalosis	1
	Respiratory acidosis	4
Mixed acid base disorders	Metabolic acidosis + respiratory alkalosis	10
	Metabolic alkalosis + respiratory alkalosis	7
	Metabolic alkalosis + respiratory acidosis	10
	Metabolic acidosis + respiratory acidosis	7

In the present study, out of the total study participants on the basis of acid base disorders, 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Majority of study participants 80% (40) were in the group of non-infectious etiology. Out of these 40 patients on the basis of acid base disorder, among simple acid base disorders 7 had metabolic acidosis, 2 had metabolic alkalosis, none of them had respiratory alkalosis and 4 had respiratory acidosis. Among the patients with mixed acid base disorders, 8 had metabolic acidosis + respiratory alkalosis, 6 had

metabolic alkalosis + respiratory alkalosis, 9 had metabolic alkalosis + respiratory acidosis and 4 had metabolic acidosis + respiratory acidosis. This difference was statistically significant (p value < 0.05). (Table 2)

**Table 2:** Distribution of noninfectious etiology patients and acid base disorders.

Acid base disorders		Number of patients
Simple acid base disorders	Metabolic acidosis	7
	Metabolic alkalosis	2
	Respiratory alkalosis	0
	Respiratory acidosis	4
Mixed acid base disorders	Metabolic acidosis + respiratory alkalosis	8
	Metabolic alkalosis + respiratory alkalosis	6
	Metabolic alkalosis + respiratory acidosis	9
	Metabolic acidosis + respiratory acidosis	4

In the present study, out of the total study participants on the basis of acid base disorders, 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Majority of study participants 20% (10) were in the group of infectious etiology. Out of these 10 patients on the basis of acid base disorder, among simple acid base disorders 1 had metabolic acidosis, 1 had metabolic alkalosis, 1 had respiratory alkalosis and none of them had respiratory acidosis. Among the patients with mixed acid base disorders, 2 had metabolic acidosis + respiratory alkalosis, 1 had metabolic alkalosis + respiratory alkalosis, 1 had metabolic alkalosis + respiratory acidosis and 3 had metabolic acidosis + respiratory acidosis. This difference was statistically non-significant (p value > 0.05). (Table 3)

**Table 3:** Distribution of infectious etiology patients and acid base disorders.

Acid base disorders	Number of patients

Simple acid base disorders	Metabolic acidosis	1
	Metabolic alkalosis	1
	Respiratory alkalosis	1
	Respiratory acidosis	0
Mixed acid base disorders	Metabolic acidosis + respiratory alkalosis	2
	Metabolic alkalosis + respiratory alkalosis	1
	Metabolic alkalosis + respiratory acidosis	1
	Metabolic acidosis + respiratory acidosis	3

## DISCUSSION

In the present study, we enrolled 50 patients with acid base disorders who were admitted in intensive care units. Out of the total study participants (21) 42% were females and (29) 58% were males. The mean age of study population was  $59.80 \pm 7.9$  years. Direct admissions in the intensive care units were 78% (39) and 22% (11) were transferred from wards of our hospital. Majority of study participants 80% (40) were in the group of non-infectious etiology, 8% (4) patients had sepsis and 12% (6) patients had other infectious cause. Similar results were obtained in a study conducted by Bryan Carmody et al and found similar study to the present study. They conducted study among seven pediatric patients admitted in intensive care units (ICUs) and found nearly similar results to the present study (7). Similar results were obtained in a study conducted by Paul K. Hamilton et al and found similar study to the present study. They conducted study among patients admitted in intensive care units (ICUs) and found that nearly similar results to the present study (8).

In the present study, out of the total study participants 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Among the patients with simple acid base disorders 8 had metabolic acidosis, 3 had metabolic alkalosis, 1 had respiratory alkalosis and 4 had respiratory acidosis. Among the patients with mixed acid base disorders, 10 had metabolic acidosis + respiratory alkalosis, 7 had metabolic alkalosis + respiratory alkalosis, 10 had metabolic alkalosis + respiratory acidosis and 7 had metabolic acidosis + respiratory acidosis. Similar results were obtained in

a study conducted by Rajendran B et al and found similar results to the present study. They conducted study among 46 patients admitted in intensive care units of tertiary care hospital and found that acid base disorders contributing in mortality and morbidity (9). Similar results were obtained in a study conducted by Mohammed A et al and found similar results to the present study. They conducted study among patients admitted in intensive care units of tertiary care hospital and found that acid base disorders contributing in mortality and morbidity (10).

In the present study, out of the total study participants on the basis of acid base disorders, 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Majority of study participants 80% (40) were in the group of non-infectious etiology. Out of these 40 patients on the basis of acid base disorder, among simple acid base disorders 7 had metabolic acidosis, 2 had metabolic alkalosis, none of them had respiratory alkalosis and 4 had respiratory acidosis. Among the patients with mixed acid base disorders, 8 had metabolic acidosis + respiratory alkalosis, 6 had metabolic alkalosis + respiratory alkalosis, 9 had metabolic alkalosis + respiratory acidosis and 4 had metabolic acidosis + respiratory acidosis. This difference was statistically significant ( $p$  value < 0.05). Similar results were obtained in a study conducted by Yun Kyu et al and found similar results to the present study. They conducted study among patients admitted in intensive care units of tertiary care hospital and found that acid base disorders contributing in mortality and morbidity (11).

In the present study, out of the total study participants on the basis of acid base disorders, 16 patients had simple acid base disorder and 34 patients had mixed acid base disorder. Majority of study participants 20% (10) were in the group of infectious etiology. Out of these 10 patients on the basis of acid base disorder, among simple acid base disorders 1 had metabolic acidosis, 1 had metabolic alkalosis, 1 had respiratory alkalosis and none of them had respiratory acidosis. Among the patients with mixed acid base disorders, 2 had metabolic

acidosis + respiratory alkalosis, 1 had metabolic alkalosis + respiratory alkalosis, 1 had metabolic alkalosis + respiratory acidosis and 3 had metabolic acidosis + respiratory acidosis. This difference was statistically non-significant ( $p$  value > 0.05). Similar results were obtained in a study conducted by Lee E. Anderson et al and found similar results to the present study. They conducted study among patients admitted in intensive care units of tertiary care hospital and found that acid base disorders contributing in mortality and morbidity (12).

## CONCLUSION

We concluded from the present study that acid base disorders play important role in effective treatment of various pathological diseases specially among the critically ill patients. Acid base disorders represents the pathogenesis and gravity of the underlying disease which accounts for morbidity and mortality rates.

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