# Outcome of Patients with Severe Metabolic Acidosis in an Emergency Medicine Care Unit

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Type of Publication: Original Research Paper
Conflicts of Interest: Nil

**ABSTRACT**
Early recognition of mortality predictors may improve the final outcome of the patient admitted to critical care units. A variety of acid-base abnormalities are present in critically ill patients which have an impact on the patient outcome. We performed a prospective observational study at Department of Emergency of Medicine of Mahatma Gandhi Hospital including 100 patients admitted to the ED unit with APACHE score of 18 or more and a pH Less than 7.2
We found that the incidence of severe metabolic acidosis in critically ill patients was associated with statistically significant mortality accounting for almost 70%. A high anion gap metabolic acidosis may also be associated with a higher mortality rate as compared to normal anion gap acidosis. Another observation in our study was that lower levels of base excess on admission were associated with a statistically significant mortality as compared to group with normal base excess levels ($P = 0.003$).

**Keywords:** NIL

## INTRODUCTION

A variety of acid-base abnormalities are present in critically ill patients which have an impact on the patient outcome. The causes of acidosis in a critically ill patient may be due to a rise in arterial partial carbon dioxide tension ($PaCO_2$), leading to a respiratory acidosis or it may be due to fixed acids causing metabolic acidosis. There are physiological variabilities and difference in patient outcomes in between patients with metabolic and respiratory acidosis. The causes of metabolic acidosis may be an increase in the endogenous production of acid (like lactate or ketoacids), excess loss of bicarbonate (like in diarrhea), or there can be an accumulation of endogenous acids (such as in cases of renal failure). The common causes of metabolic acidosis in ED UNIT patients are lactic acidosis, hyperchloremic acidosis, secondary to renal failure, and ketoacidosis. The causes of metabolic acidosis can be broadly classified based on the Anion Gap as either normal anion gap metabolic acidosis or high anion gap

metabolic acidosis, which can predict the outcome of patients. The severity of acidosis also has an impact on the patient outcome and survival; it is called "severe" when pH is less than 7.20 although a common condition in the intensive care units (ED UNITs), data on entity and outcome are scanty.

MATERIAL AND METHODS:

It was a prospective observational study undertaken at Department of Emergency of Medicine of Mahatma Gandhi Hospital, Jaipur . A written informed consent was taken in all cases. Patient characteristics like Age, Sex, co morbidities, presenting symptoms and signs, diagnosis, relevant investigation reports and an APACHE score was calculated for every patient on the day of admission to the unit using APACHE II scoring system.

**Inclusion criteria** included all patients admitted above the age of 18 years with an APACHE II score

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of 18 or more. Further all of these patients who had pH of less than 7.20 on first 24 hours of admission were included.

 **Exclusion criteria** included all patients with single respiratory acidosis and evidence of mixed acidosis on ABG.

Further,  treatment and intravenous fluids used, duration of  stay and any episode of complications thereof, duration of  mechanical ventilation  and mortality in the hospital , ABG values of  pH levels, HCO3 − levels, lactate levels, anion gap and APACHE II score . This study included 100 patients admitted to the emergency unit of the department during a period of 1 year (January 2018- January 2019).Statistical analysis was performed using SPSS version 16.0 for Microsoft windows.

RESULTS:

Out of the total 100 patients evaluated, a total of 56 patients were males and 44 were females. Mean age of patients was 59.39 ± 1.05 years for males and 56.41 ± 1.81 years for females. Out of the 100 patients who presented with  severe metabolic acidosis defined as pH < 7.20 , the average pH value found in our study  was 7.08 with the lowest value being 6.80 . Mean duration of stay in our study was 3 ± 1 day. Out of the total 100 cases evaluated who had single severe metabolic acidosis (pH < 7.2) on admission, 70 cases expired and 30 cases were discharged in stable condition (Figure 1). Severe metabolic acidosis on admission is associated with significant mortality in critically ill patients (P = 0.001). Out of 100 patients, 88 patients had APACHE II score of >20 and 12 patients had APACHE II score between 18 and 20. Of the 88 patients who had APACHE II score more than 20, 64 patients expired (72.7%) compared to 20 patients (27.8%) who were discharged with stable condition which is statistically significant (P = 0.001).

In our study, 30 patients had normal anion gap metabolic acidosis while 60 patients had high anion gap  metabolic acidosis however there  was no statistically significant difference in the outcome of the two groups (P = 0.540). Out of the 100 patients, 68 patients had base excess value <−2. Out of these 68 patients, 54 (79.4%) patients expired compared to 14 (20.6%) patients with normal base excess. The higher mortality was seen in base excess group <−2

compared to normal base excess group, and this was statistically significant (P = 0.003). Out of 55 patients who were put on mechanical ventilator on the first day, 45 (81.8%) patients expired compared to 10 (18.2%) patients who did not need mechanical ventilation. Patients who needed mechanical ventilation on admission had significantly higher mortality compared to patients who did not need mechanical ventilator support (P = 0.04). Out of 37 patients who required vasopressor support, 34 (91.8%) cases had lactic acidosis and 3 (8.2%) cases were non-lactic acidosis cases. Most common diagnosis in patients with severe metabolic acidosis in the present study was lactic acidosis. Most common diagnosis in patients with lactic acidosis in the present study was sepsis with septic shock. Most common diagnosis in patients with high anion gap non-lactic acidosis was diabetic ketoacidosis, whereas bicarbonate loss from gastrointestinal (GI) tract (acute gastroenteritis [GE]) was common cause of normal anion gap acidosis.

DISCUSSION

A pH value of less than 7.20 is termed as severe acidosis.  Although not an uncommon entity in critically ill patients. A report by Jung *et al*.5 showed much higher mortality in critically ill patients who had  severe metabolic acidosis.

In our present study, the evidence of severe metabolic acidosis in critically ill patients was associated with statistically significant mortality accounting for almost  70% patients who expired compared to 30% patients who were discharged in stable condition (P = 0.001) this was similar to the findings of  Jung *et al*.5 Serum lactate levels has been proved to be  an important prognostic marker in cases of metabolic acidosis and when elevated it is associated with significantly higher mortality levels, which was also reported by a study by Jung *et al*.5   G A study done by Gunnerson1 compared the outcomes in patients who had  high lactate levels to those with normal lactate levels and they demonstrated a significant higher mortality in patients who had high lactate level. Another study by Smith *et al*.6  also reported a higher mortality rate amongst the high lactate group . In our study, we found that lactic acidosis was associated with a higher mortality as compared to the non-lactic acidosis group and a higher serum lactate levels were associated with a  statistically significant

mortality ($P$ = 0.04), this was consistent to the findings of previous studies. A high anion gap metabolic acidosis may also be associated with a higher mortality rate as compared to normal anion gap acidosis which was reported by reported by Jung *et al*.,5 whereas two studies by Cusack *et al*.7 and Rocktaeschel *et al*.8 reported no statistical difference between the outcomes of the two groups. In our present study, 31 patients had normal anion gap severe metabolic acidosis while 69 patients had high anion gap. We found to statistically significant difference in the patient outcome amongst the two group (P = 0.540). Another observation in our study was that lower levels of base excess on admission were associated with a statistically significant mortality as compared to group with normal base excess levels ($P$ = 0.003) which are consistent with the previous studies.

CONCLUSION:

Our present study highlights the magnitude of evidence of single severe metabolic acidosis on admission in critically ill patients admitted to the Emergency Department at Mahatma Gandhi Medical College and Hospital, Sitapura, Jaipur the study proves that Severe metabolic acidosis in critically ill patients is associated with a significant mortality. Other markers of higher mortality being a High serum lactate and base deficit. Patients with a higher APACHE II score on admission had a high mortality rate. The most common diagnosis in patients with severe metabolic acidosis in our present study was lactic acidosis. The most common diagnosis in patients with lactic acidosis in the present study was sepsis and septic shock. The most common diagnosis in patients with high anion non-lactic acidosis being diabetic ketoacidosis, whereas bicarbonate loss from GI tract (acute GE) contributed to a common cause of normal anion gap acidosis. Hence, early recognition of mortality predictors may improve the final outcome of the patient admitted to critical care units.

REFERENCES

1. Gunnerson KJ. Clinical review: The meaning of acid-base abnormalities in the intensive care unit. Crit Care 2005;9:508-16.

2. Kellum JA, Song M, Subramanian S. Acidemia: Good, bad or inconsequential? In:, editor. In Yearbook of Intensive Care and Emergency Medicine. Berlin: Springer; 2002. p. 510-16.

3. Li J, Hoskote A, Hickey C, Stephens D, Bohn D, Holtby H, *et al.* Effect of carbon dioxide on systemic oxygenation, oxygen consumption, and blood lactate levels after bidirectional superior cavopulmonary anastomosis. Crit Care Med 2005;33:984-9.

4. Kraut JA, Madias NE. Metabolic acidosis: pathophysiology, diagnosis and management. Nat Rev Nephrol 2010;6:274-85.

5. Jung B, Rimmele T, Le Goff C, Chanques G, Corne P, Jonquet O, *et al.* Severe metabolic or mixed acidemia on intensive care unit admission: incidence, prognosis and administration of buffer therapy. A prospective, multiple-center study. Crit Care 2011;15:R238.

6. Smith I, Kumar P, Molloy S, Rhodes A, Newman PJ, Grounds RM, *et al.* Base excess and lactate as prognostic indicators for patients admitted to intensive care. Intensive Care Med 2001;27:74-83.

7. Cusack RJ, Rhodes A, Lochhead P, Jordan B, Perry S, Ball JA, *et al.* The strong ion gap does not have prognostic value in critically ill patients in a mixed medical/surgical adult ED UNIT. Intensive Care Med 2002;28:864-9.

8. Rocktaeschel J, Morimatsu H, Uchino S, Bellomo R. Unmeasured anions in critically ill patients: can they predict mortality? Crit Care Med 2003;31:2131-6.

9. Kaplan LJ, Kellum JA. Initial pH, base deficit, lactate, anion gap, strong ion difference, and strong ion gap predict outcome from major vascular injury. Crit Care Med 2004; 32:1120-4.