ARTERIAL BLOOD pH
LOW PH AS PREDICTOR OF PROGNOSIS

ORIGINAL
PROF-1803

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ABSTRACT... Background: Arterial blood gas analysis is the most commonly performed investigation in intensive care unit(ICU) as the changes in acid-base balance are common in critically ill patients. Changes in pH are directly related to severity of disease. Keeping in view our clinical experience and literature search, we assume that patients whose pH is less than 7 at any time in the course of disease carries poor prognosis. **Design:** Quasi experimental study**. Setting:** ICUs of Combined Military Hospital Rawalpindi and Combined Military Hospital Multan**. Period:** From 1st Jan 2006 to 6th Aug 2007 and 7th Aug 2007 to 31st May 2010 respectively. **Material and Methods:** All the patients having pH less than 7 at any time in the course of disease were considered and patient having otherwise fair state of health before recent insult were included. Moribund terminally ill patient were excluded. **Results:** All the thirty patients needed intubation and ventilation except one who remained conscious despite having pH. 6.95. Twenty two patients (73.4%) died and eight patients (26.6%) survived. All patients who survived were diabetic except one having tracheal stenosis. All patients who died were non diabetic. Only one non diabetic patient was among the survivor. Survival among diabetic patient as group was 100%(7/7). **Conclusions:** Patients having pH below 7 at any time in the course of disease carry poor prognosis especially if they are non diabetic. Diabetic has best prognosis. However it is a small study of thirty cases only, further multi centre studies are needed to demonstrate the co-relation of pH with prognosis prediction.

Key words: pH, prognosis, critically ill patients, ICU.

INTRODUCTION

Acid-base abnormalities are common in intensive care units. pH is generally indicative of severity of the disease[1]. It is not the pH which is affecting the disease process rather it is the disease process itself which determines the pH[2]. Maintenance of pH in physiological range is important for functioning of body. If pH is grossly deranged it adversely affects the biochemical reactions and vicious cycle of deterioration sets in. Human body has very complex and efficient system to maintain pH in physiological range[3].

Minor changes in pH are corrected to some extent by well established compensatory mechanisms and usually pH returns to normal when offending insult is brought under control. However when pH become grossly deranged, it is very difficult to bring it back within normal range[1]. Keeping this observation in mind we started collecting data about patient whose pH was below 7 any time in course of disease ,recorded all events and treatments given and final out come .

MATERIAL AND METHODS

In this quasi experimental study we included thirty cases admitted to ICUs of Combined Military Hospital Rawalpindi from 1st jan 2006 to 6th Aug 2007 and Combined Military Hospital Multan from 7th Aug 2007 to 31st May 2010 respectively.

INCLUSION CRITERIA

All the patients having pH less than 7 any time in course of disease who had otherwise fair state of health before recent insult were included. Fair state of health mean that person was able to perform daily activities without limitation.

EXCLUSION CRITERIA

Moribund terminally ill patients were excluded and patients having limited activity because of systemic disease were also excluded.

All the routine base line investigations like blood complete picture, coagulation profile, blood glucose, serum urea creatinine and electrolytes, urine routine examination, chest X ray and 12 leads ECG were carried out. Central venous line was passed and its pressure was monitored. Arterial blood gas analysis was performed at the start of admission in ICU and then repeated as required. Data was recorded and analyzed statistically by using SPSS version 11.

RESULTS

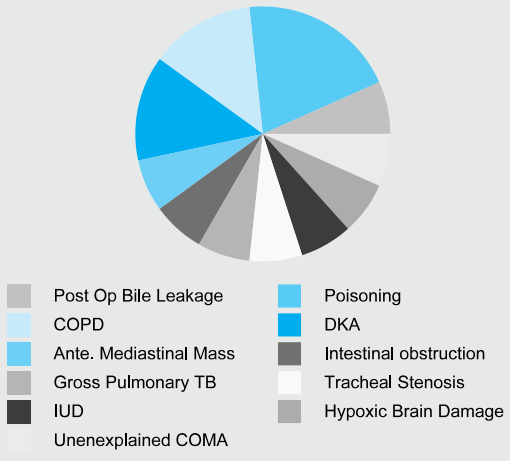
There were thirty patients included in this study, out of which 18 were males (60%) and 12 were females (40 %). The mean age was 41.37 ±17.14 years.

All the thirty patients needed intubation and ventilation except one who remained conscious despite having PH. 6.95. Twenty two patients (73.4%) died and eight patients (26.6%) survived. All patients who survived were diabetic except one having tracheal stenosis. All patients who died were non diabetics table I. There were six patients(20%) who were admitted due to poisoning fig 1.

Table-I. Demographic data and out come

Total No. of cases	30
Male/female	18\12
Mean age	41.37±17.14
Died	73.4% (22/30)
Survived	26.6% (8/30)
Diabetic	23.33% (7/30)
Non-diabetic	77.67% (23/30)
Poisoning	20% (6/30)

Fig-1. Demographic data and outcome



IUD: Intra Uterine Death, DKA : Diabetic Ketoacidosis, COPD : Chronic obstructive pulmonary disease

DISCUSSION

All of our patients were from main ICU where patients needing ventilatory or cardiac support are admitted. None of our patient was trauma patient. All the patients in our study group who survived (23.6%) were diabetic except one who was having tracheal stenosis. Why diabetics have better survival? It may be that diabetics tend to get lower pH than non diabetics with similar degree of disease or cause of low pH in diabetics is lack of insulin which when provided treat the cause. There may be any other association, which need to be explored. All the patients who died in our study group were non diabetic[8]. It may be a chance finding but worth noting. If we exclude diabetic patients from study then mortality become extremely high 22/23(95.6%).If we consider diabetic patient as a group then survival is 7/7(100%).

In chronic obstructive pulmonary disease (COPD) pH less than 7 may indicate end stage disease, even though four patients of COPD were brought under control but they were unable to maintain unassisted breathing and died. In a study of thirty seven trauma patients who had ph<7 on admission , Robertson R , Edit J , Blitzer L , Wallace B ,Collin T, Parks-Miller C et[4] showed that 50% of patients responded to initial resuscitation and almost 33% of patients survived and were discharged from the hospital. Survival in trauma patients (33%) is better than that of non-trauma patients (26%).

Though pH less than 7 carries poor prognosis but it is not disappointing at all. Mixed cases has about 27% survival, trauma patients 33% survival[4] and diabetic 100% survival. This is the non diabetic and non trauma patients group which carries less than 5% survival.

Use of sodium bicarbonate to correct severe acidosis, as shown by various studies[5,6] has no benefit in acidotic patients but it is very difficult to withhold sodium bicarbonate when pH is less than 7.1[12]. We administered sodium bicarbonate to all of our patients as there pH fell below 7.1 but we could not demonstrate any benefit of it.

Among all 22 patients who died we were able to bring back pH within normal range in only 8 patients, in rest of 14 patients normal range pH could not be achieved.

Hemofiltration facility was not available within ICU in both institutions at that time and patients of poisoning were too unstable to transfer to hemodialysis units. Hemodialysis was started in two patients(2/6) but they could not be taken again for hemodialysis because of unstable general condition. Had hemofiltration facility be available in our ICUs, patients of poisoning(20%) might have shown better prognosis. As it is a small study of 30 cases only, it is not justified to generalize the results. Further multi centre studies are needed to make any generalizations. However this study may help intensive care clinicians in counseling relatives and family friends about seriousness of patients condition in intensive care units and for clinicians themselves to realize that extraordinary measures[if any] need to be taken to save a patient when pH fall below 7 especially if patient is non diabetic.

CONCLUSIONS

Patients having pH below 7 at any time in the course of disease carry poor prognosis especially if they are non diabetic. Diabetics has best outcome. However it is a small study of thirty cases only, further multi centre studies are needed to demonstrate the co-relation of pH with prognosis prediction .

REFERENCES

1. Hucker TR, Mitchell GP, Blake LD, Cheek E, Bewick V, Grocutt M et al. **Identifying the sick: can biochemical measurements be used to aid decision making on presentation to the accident and emergency department.** Br J Anaesth 2005 ; 94: 735-41.

2. Balasubramanyan N, Havens PL, Hoffman GM. **Unmeasured anions identified by the Fencl-Stewart method predict mortality better than base excess, anion gap, and lactate in patients in the pediatric intensive care unit.** Crit Care Med 1999 ; 27:1577-81.

3. 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.

4. Robertson R , Eidt J , Bitzer L , Wallace B ,Collin T, Parks-Miller C et al. **Severe acidosis alone does not predict mortality in the trauma patient.** Am J Surg 1995; 170 : 691-5.

5. Assal JP, Aoki TT, Manzano FM, Kozak GP. **Metabolic effects of sodium bicarbonate in management of diabetic ketoacidosis.** Diabetes 1974; 23:405-11.

6. Forsythe SM, Schmidt GA. **Sodium bicarbonate for the treatment of lactic acidosis.** Chest 2000 ; 117: 260-7.

7. Noritomi DT, Soriano FG, Kellum JA, et al. **Metabolic acidosis in patients with severe sepsis and septic shock: a longitudinal quantitative study.** Crit Care Med. Aug 24 2009;[Medline].

8. Maciel AT, Park M. **Differences in acid-base behavior between intensive care unit survivors and nonsurvivors using both a physicochemical and a standard base excess approach: A prospective, observational study.** J Crit Care. Mar 26 2009;[Medline].

9. Adrogue HJ. **Metabolic acidosis: pathophysiology, diagnosis and management.** J Nephrol. Mar-Apr 2006;19 Suppl 9:S62-9.

10. Batlle DC, Hizon M, Cohen E, et al. **The use of the urinary anion gap in the diagnosis of hyperchloremic metabolic acidosis.** N Engl J Med. Mar 10 1988;318(10):594-9. [Medline].

11. DuBose TD Jr. **Hyperkalemic hyperchloremic metabolic acidosis: pathophysiologic insights.** Kidney Int. Feb 1997;51(2):591-602. [Medline].

12. Forsythe SM, Schmidt GA. **Sodium bicarbonate for the treatment of lactic acidosis.** Chest. Jan 2000;117(1):260-7. [Medline].

13. Kamel KS, Halperin ML. **An improved approach to the patient with metabolic acidosis: a need for four amendments.** J Nephrol. Mar-Apr 2006;19 Suppl 9:S76-85.

14. Magner PO, Robinson L, Halperin RM, et al. **The plasma potassium concentration in metabolic acidosis: a re-evaluation.** Am J Kidney Dis. Mar 1988;11(3):220-4. [Medline].

15. Wrenn KD, Slovis CM, Minion GE, et al. **The syndrome of alcoholic ketoacidosis.** Am J Med. Aug 1991;91(2):119-28. [Medline].

Article received on: 23/06/2011 Accepted for Publication: 09/08/2011 Received after proof reading: 02/12/2011

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Article Citation:
Ahmed S, Janjua S, Ali H. Low pH as predictor of prognosis. Professional Med J Dec 2011;18(4): 667-670.

A MAN WHO DOES NOT THINK FOR HIMSELF DOES NOT THINK AT ALL.

OSCAR WILDE