## ARTERIAL BLOOD pH
### LOW PH AS PREDICTOR OF PROGNOSIS

**DR. SHAFIQ AHMED**  
Associate Professor Anaesthesia  
Multan Medical and Dental College  
Multan

**DR. SARFRAZ JANJUA**

**DR. HAMID ALI**

### 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 patients 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 survivors. 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. It is not the pH which is affecting the disease process rather it is the disease process itself which determines the pH. 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.

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

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. 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 al 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 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 has no benefit in acidic patients but it is very difficult to withhold sodium bicarbonate when pH is less than 7.1. 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 been 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.

Copyright © 09 Aug, 2011.

REFERENCES
A man who does not think for himself does not think at all.

Oscar Wilde