



THE ROLE OF ARTERIAL BLOOD GAS ANALYSIS ON ADMISSION IN PREDICTING THE MORBIDITY AND MORTALITY IN ACUTE PANCREATITIS PATIENTS AT A TERTIARY HEALTH CENTER

General Surgery

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ABSTRACT

Background- A number of multi and single parameter severity predictors are used to assess severity of acute pancreatitis, including the APACHE-II, Ranson's, BISAP, SIRS, CTSI, BUN, CRP. A significant problem is the extensive quest for parameters that can objectively predict severity and prognosis at the time of hospital admission. **OBJECTIVE:** To assess the arterial blood gas parameters at admission in acute pancreatitis patients and the incidence of complications. **Patients And Methods:** The study was conducted in AJ institute of medical science and research centre, mangalore between November 2021 and December 2022. At the time of admission, an arterial blood gas study was performed, and the onset of complications, local or systemic were noted. Analysis was done on the relationships between different ABG analysis parameters and the emergence of organ failure or local complications, and mortality. **Results:** A total of 71 patients were examined (87.33% males and 12.67% women; mean age 39.19years). Alcohol was the cause of acute pancreatitis in 67.60%. When compared to zero in 55 patients with pH>7.35, 3 of 16 patients (18.8%) with pH7.35 died (p= 0.010). Compared to nil complications (local and systemic) in 30 patients with HCO₃>24, 12 of 41 patients (29.3%) with HCO₃ developed acute fluid collections and acute kidney injury. Compared to 3 in 53 patients with base deficit ≥-4, 9 of 18 patients (50%) developed acute fluid collection and acute kidney injury. **Conclusion:** Alcohol has been observed as the leading cause of acute pancreatitis in our study. Low bicarbonate levels, low arterial pH and a more negative base deficit at presentation indicate a poor prognosis with a higher likelihood of mortality and organ failure. Hence, in individuals with acute pancreatitis, a straightforward diagnostic study of arterial blood gas at admission can aid in identifying unfavourable outcomes.

KEYWORDS

Acute pancreatitis, Arterial blood gas, Base deficit, Bicarbonates, Metabolic acidosis.

INTRODUCTION

Though there are many scoring systems available to assess severity of acute pancreatitis, Ranson's and Glasgow score have been widely used for their prognostic utility¹. Though they are used widely, these scores are criticized for few of their limitations. Few meta-analysis studies have shown that Ranson's is not sufficient to predict the prognosis at admission². Another study was done comparing Ranson's, Glasgow and APACHE-II and found that all three couldn't predict severity sufficiently when used alone³. Both Ranson's and Glasgow scores have few drawbacks in clinical practise. Blood glucose level interpretation in diabetic patients, urea levels in patients with known impaired renal function are few of the limitations. They are also criticized for their assessment at the end of 48 hours before which it is essential to start appropriate treatment if there are any early signs of severe acute pancreatitis, which needs to be picked up by an efficient prognostic indicator.

Lastly, scoring systems including multiple variables are cumbersome to do in routine clinical setting. This is particularly significant for patients treated in the community setting, where early referral to higher centre plays a crucial role. Also in tertiary care centres, early prediction could guide the management strategies of the patients. Hence we need a simple yet efficient predictor of severity at admission.

Metabolic acidosis is one of the characteristics examined within 48 hours of admission as part of Ranson's scoring system, and it has been used as a criterion for predicting a severe course of acute pancreatitis⁴. Arterial pH is also a component of the APACHE-II scoring system that is commonly used in acute pancreatitis⁵. Acute pancreatitis can lead to metabolic acidosis for a variety of reasons, such as lactic acidosis from shock, renal failure, or a loss of bicarbonate-rich pancreatic secretions due to pancreatic duct disruption late in the course of the disease⁴.

Early prognosis has been difficult in patients with severe acute pancreatitis due to the limitations of all grading systems. A significant problem is the extensive quest for tools that can objectively predict severity and prognosis at the time of hospital admission. In this study, patients with acute pancreatitis will have their arterial pH, bicarbonate levels, and base deficit evaluated and their value in predicting mortality, local complications, the necessity for surgery, and organ failure will be assessed.

AIMS AND OBJECTIVES:

1. To assess the role of arterial blood gas analysis on admission in predicting the morbidity and mortality in acute pancreatitis patients at a tertiary health centre.
2. To assess the arterial blood gas parameters presenting with acute pancreatitis.
3. To assess the incidence of acute fluid collections/ necrotising pancreatitis requiring percutaneous drainage/ open pancreatic necrosectomy.
4. To assess the incidence of shock/ renal failure/ respiratory failure.
5. To assess the incidence of deaths during the course of the hospital stay.

METHODOLOGY

The study was conducted in AJ institute of medical science and research center, mangaluru from November 2020 to December 2022. All patients who were admitted in department of general surgery and general medicine with features suggestive of acute pancreatitis like typical epigastric pain, vomiting, S. amylase more than thrice the normal limit, elevated serum amylase and/ or sonological features suggestive of acute pancreatitis, who were brought to hospital within 48 hours of onset of symptoms were included in the study. The patients were followed up till discharge from the hospital.

For all the patients the following parameters were recorded at the time of admission: age, gender, etiology and arterial blood gas analysis report consisting of arterial pH, bicarbonate, base deficit.

Sample Collection:

- On the day of admission, 1-2ml of arterial blood was collected from radial/ brachial/ femoral in a heparinised syringe with a 23/25 gauge needle inserted at an angle just distal to the palpated pulse.
- Sample blood is then analysed by blood gas analyser (Radiometer ABL80 Flex)
- Following outcomes were studied: development of systemic or local complications including acute fluid collections, necrosis, development of organ failure, interventions if done any, duration of hospital stay and mortality.
- All the patients were managed with nil per oral till symptoms subsided, IV fluids based on urine output, antibiotics if sepsis present.

Inclusion Criteria:

Age >18 years, Clinical history suggestive of acute pancreatitis, Serum amylase >3 times of upper limit, Elevated serum lipase and/or Positive abdominal imaging (Ultrasound/CT Abdomen)

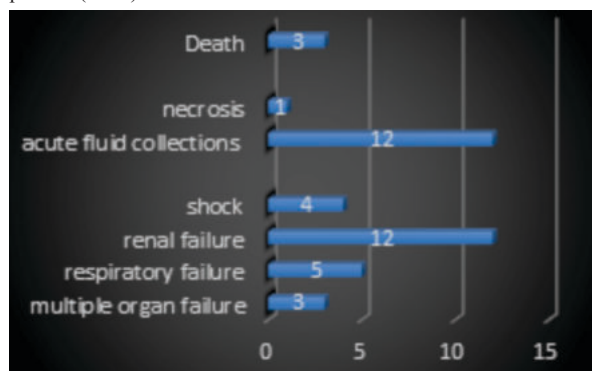
Exclusion Criteria:

Patients on treatment before presenting to hospital, Coronary artery disease/ pre-existing cardiac disorder, Renal failure, Malignancy, Pregnancy, Underlying acid-base disorder, Delayed presentation to hospital, Patient refusing consent

RESULTS:

Out of 71 patients in the study, 87.33% were males and 12.67% were females. The mean age of the patients in the study was 39.19 years (range: 17-66 years)

The etiology of acute pancreatitis was alcohol in 48 patients (67.60%), gall stone disease in 18 patients (25.35%), post ERCP in 3 patients (4.2%), trauma in 2 patients (2.8%). The mean period from onset of symptoms to presentation at hospital was 2.8 days. 13 patients (18.30%) developed organ failure with multiple organ failure in 3 patients (4.2%), respiratory failure in 5 patients (7.04%), renal failure in 12 patients (16.9%) and 4 patients developed shock (5.63%) while 12 patients (16.90%) developed local complications (acute fluid collections in 12 patients-16.90%, necrosis in 1 patient-1.4%) and 3 patients (4.2%) succumbed to death.



No interventions (percutaneous/ endoscopic) or surgeries were done in any acute pancreatitis in our institution during the study period.

The mean arterial pH was 7.39 ± 0.44 and $pH < 7.35$ was present in 13 patients (18.3%). The mean arterial bicarbonate level was 23.40 ± 16 mEq/L, with 41 patients (58%) having values < 24 mEq/L. Base deficit more than -4 mEq/L was found in 25 patients (36%). The incidence of complications in patients presenting on admission with $pH < 7.35$ was statistically significant in predicting AKI, ARDS, AFC, MOF, shock and mortality

Table 1 Association Of Ph With Various Complications

VARIABLES	pH $\leq$ 7.35(n=16)	pH>7.35 (n=55)	P value
AFC	8	4	0.00
MOF	3	0	0.01
Shock	4	0	0.02
ARDS	5	0	0.00
AKI	9	3	0.00
NECROSIS	1	0	0.225
MORTALITY	3	0	0.010

The incidence of complications in patients presenting on admission with $HCO_3^- < 24$ mEq/L was statistically significant in predicting AKI and AFC, MOF.

Table 2: Association Of Bicarbonate With Various Complications

VARIABLES	$HCO_3^- < 24$ (n=41)	$HCO_3^- > 24$ (n=30)	P value
AFC	12	0	0.001
MOF	3	0	0.258
Shock	4	0	0.132
ARDS	5	0	0.069
AKI	12	0	0.001
NECROSIS	1	0	1.00
MORTALITY	3	0	0.258

The incidence of complications in patients presenting on admission with base deficit < 4 was statistically significant in predicting AKI, AFC, MOF, shock and mortality.

Table 3: Association Of Base Deficit With Various Complications

VARIABLES	BASE DEFICIT < -4 (n=18)	BASE DEFICIT > -4 (n=53)	P value
AFC	9	3	0.000
MOF	3	0	0.014
Shock	3	1	0.048
ARDS	2	3	0.595
AKI	9	3	0.000
NECROSIS	1	0	0.254
MORTALITY	3	0	0.014

DISCUSSION

The mean arterial pH was 7.39 ± 0.44 and $pH < 7.35$ was present in 13 patients (18.3%). The mean arterial bicarbonate level was 23.40 ± 16 mEq/L, with 41 patients (58%) having values < 24 mEq/L. Base deficit more than -4 mEq/L was found in 25 patients (36%).

Out of 71 patients with acute pancreatitis, 16 patients (22.5%) had a pH less than 7.35 and 55 patients had a pH more than 7.35; 41 patients (57.7%) had HCO_3^- less than 24 and 30 patients (42.2%) had HCO_3^- more than 24; 18 patients (25.3%) had base deficit less than -4 and 53 patients (74.6%) had base deficit more than -4 . 12 out of 71 patients (16.9%) in the study developed AKI out of which 9 patients had pH less than 7.35 at admission, which is statistically significant ($p = 0.00$). All 12 patients with AKI had bicarbonate less than 24 mEq/L at admission which is statistically significant ($p = 0.001$). 9 out of 12 patients had base deficit less than -4 mEq/L which is statistically significant ($p = 0.000$). 5 out of 71 patients (7%) developed ARDS. All 5 patients had pH less than 7.35 at admission which is statistically significant ($p = 0.00$). All 5 patients had HCO_3^- less than 24 mEq/L but wasn't statistically significant ($p = 0.069$). 2 out of 5 patients had base deficit less than -4 mEq/L which was not statistically significant.

4 out of 71 patients (5.6%) developed shock. All 4 patients (25%) had pH less than 7.35 at admission which is statistically significant ($p = 0.02$). All 4 patients had HCO_3^- less than 24 mEq/L but that wasn't statistically significant ($p = 0.132$). 3 out of 4 patients had base deficit more than -4 mEq/L which is statistically significant ($p = 0.048$).

In a prospective study of 279 patients with acute pancreatitis, 17 patients (6.09%) were found to have succumbed to death and patients who had multiple organ failure had a ten fold greater mortality rate. In our study, out of 71 patients with acute pancreatitis, 3 patients (4.2%) developed MOF. All 3 patients had pH less than 7.35 at admission which was statistically significant. All 3 patients had HCO_3^- less than 24 mEq/L at admission but wasn't statistically significant ($p = 0.258$). All 3 patients had base deficit more than -4 mEq/L at admission which was statistically significant (0.014).

CONCLUSIONS

- Alcohol has been observed as the leading cause of Acute Pancreatitis in our study as opposed to the previous available data/studies where it was the second most common cause after gall bladder stones.
- Low bicarbonate levels, low arterial pH, and a more negative base deficit at presentation indicate a poor prognosis with a higher likelihood of mortality and organ failure.
- Hence, in individuals with acute pancreatitis, a straightforward diagnostic study of arterial blood gas at admission can aid in identifying unfavourable outcomes.

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