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TO STUDY ARTERIAL BLOOD GAS ANALYSIS IN PATIENTS OF ACUTE PANCREATITIS PRESENTING TO TERTIARY CARE CENTRE.

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Conflicts of Interest: Nil

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Abstract:

Background: Acute pancreatitis is an inflammatory process of the pancreas, with variable involvement of peripancreatic tissues and remote organ systems. In 80% of the cases the disease is mild, with interstitial oedema, and leads to recovery within days or weeks. The development of metabolic acidosis (MA) is a common occurrence during critical illness. Arterial base deficit/excess (BD/E) is a commonly used marker of MA in critically ill patients. MA has been one of the criteria used for predicting a severe course of AP.

Methods: Patients with acute pancreatitis presenting to Gastroenterology section of Medicine Department between November 2015 and October 2016 were prospectively studied. ABG analysis was done at admission and development of organ failure, any need for intervention, and mortality were noted. The association between various parameters of ABG analysis and the development of organ failure or local complications, need for interventions (endoscopic/radiological/surgical) and mortality were analysed.

Results: In the present study of 55 patients, ABG parameters were used and correlated with organ failure and mortality in patients of acute pancreatitis. In current study respiratory failure was present in 66.66% patients with p02 <75 mm hg compared to 4.76% with p02 >75 mm hg. All 4 deaths in study were in the group with p02 <75 mm Hg. Thirty eight patients in our study had base deficit of >-4, whereas 13 had base deficit of <-4 mEq/L. Organ failure was present in 15 of the patients (39.47%) with base deficit >-4 mEq/L. In current study, patients with evidence of pH <7.35 had higher frequency of Organ failure (pulmonary failure, shock and renal failure).

Conclusion: In our study, 55 patients of Acute Pancreatitis were enrolled and ABG was done from the day of admission for consecutive 5 days. Parameters included were p02, pC02, bicarbonate, base deficit and oxygen saturation. There was a male predominance with 81.18% of the patients being male. This could be because of higher consumption of alcohol in males as compared to females.66.66% patients had oxygen saturation < 75 mm Hg.29.09% patients experienced Organ failure and 27.27% had Respiratory failure, 7.27% had Renal failure, 3.63% developed Shock and 7.27% patients died.

Keywords: Acute pancreatitis; Base deficit; metabolic acidosis; Organ failure

Introduction

Acute pancreatitis (AP) is an acute inflammatory process of the pancreas that can result in local or systemic complications [1]. The assessment of severity of AP is one of the most important issues in its management. Although multiple criteria are available for prognosis and determination of severity of Acute Pancreatitis, there is a need to

identify better predictors of outcome. Various prognostic factors and scoring systems have been proposed for accurate assessment of the severity of AP and reliable prediction of high-risk and potentially fatal cases; some of them include multiple biochemical parameters and therefore result in a cumbersome scoring, as in the Ranson's criteria, while others have attempted to simplify the prediction of severity, as in the Bed Side Index for Severity of Acute Pancreatitis (BISAP) scoring system [2, 3].

With respect to scoring systems, the most widely validated of these remains the Acute Physiology and Chronic Health Examination (APACHE) II score [4]. These all have comparable levels of overall accuracy. The development of metabolic acidosis (MA) is a common occurrence during critical illness. Early and accurate identification and correction of significant metabolic acidosis is particularly relevant to patients in the intensive care unit (ICU). Arterial base deficit/excess (BD/E) is a commonly used marker of metabolic acidosis in critically ill patients. Metabolic acidosis has been one of the criteria used for predicting a severe course of Acute Pancreatitis; it is one of the factors measured within 48 hours of admission as a part of Ranson's scoring system. Arterial pH is also a component of the APACHE-II scoring system that is commonly used in AP [5]. MA can occur in AP for multiple reasons that include lactic acidosis resulting from shock, renal failure or—late in the course of disease—because of loss of bicarbonate-rich pancreatic secretions due to pancreatic duct disruption. There is paucity of data on the prognostic value of various individual parameters of arterial blood gas (ABG) analysis carried out in AP patients at admission. The objective of the present study was to evaluate arterial pH, bicarbonate levels and base deficit at admission in patients with AP and to study their value in predicting organ failure, local complications, need for surgery or intervention and mortality.The development of metabolic acidosis (MA) is a common occurrence during critical illness. Early and accurate identification and correction of significant MA is particularly relevant to patients in the intensive care unit (ICU). Arterial base deficit/excess (BD/E) is a commonly used marker of MA in critically ill patients. MA has been one of the criteria used for predicting a severe course of AP (6, 7).

Materials and Methods;

The present study was conducted in the Department of Medicine, GMC Jammu for a period of one year, *w.e.f* November 2015 to October 2016. The protocol of the study was approved by Institutional Ethical Committee. All principles of bioethics were followed in the current study.

Inclusion Criteria:

1. Age more than 12yrs, both sexes
2. All patients with a diagnosis of Acute Pancreatitis. The diagnosis of Acute Pancreatitis was based on following three criteria:

(1) Typical abdominal pain in the epigastrium that may radiate to the back,

(2) Threefold or greater elevation in serum lipase and/or amylase, and

(3) Confirmatory findings of acute pancreatitis on cross-sectional abdominal imaging.(60)

Informed consent was obtained from all the patients prior to enrolment in the study and they were given standard medical care throughout the study period.

Exclusion Criteria:

Those with Coronary artery disease/pre-existing cardiac disorder, Diabetes mellitus, Renal failure, Malignancy, Pregnancy, Chronic obstructive pulmonary disease,Underlying chronic pancreatitis, Pancreatic malignancy, Underlying acid base disorder, Those who presented >10 days after the onset of pain and those patients who refused consent for participation.All the participants were thoroughly interviewed and were subjected to clinical and laboratory examination. Haematological investigations, Blood sugar,Serum amylase, blood urea and serum creatinine were done. ABG analysis was carried out on the day of admission and subsequently for 5 consecutive days.

For ABG analysis, 1mL of blood was collected from the Radial artery into Heparinised syringes and was immediately analysed using the Cobas b 121 analyser (Roche, Germany). The analysis included measurement of arterial pH, the partial pressure of arterial carbon dioxide (PaCO2), the

partial pressure of arterial oxygen (PaO2) and oxygen saturation (S02). Standard bicarbonate (HCO3) was calculated from the observation parameters pH and PaCO2. Base deficit / excess (BD/E), which represents the amount of acid or base required to normalize the pH in a litre of blood, was directly calculated by the blood gas analyser from PaCO2, pH and serum HCO3 values were applied to a standard normogram. End point of study was clinical recovery or death in patient.

Statistical Analysis

Statistical analysis was done by appropriate method. Data was expressed as Mean±SD for quantitative variable and as n (%) for qualitative variable. Statistical studies were made using SPSS software (Statistical Product and Service Solutions). Continuous data were evaluated by *t* rest, and categorized data were analyzed by Chi-square test or Fisher's exact test. P-value <0.05 was considered statistically significant.

Results and Observation

The present study was conducted in the gastroenterology section of Medicine, GMC Jammu. In this study 80 patients of acute pancreatitis were enrolled in this study from October 2015 to September 2016. Routine examination and ABG analysis of all patients was carried out for 5 consecutive days from admission. 25 patients were excluded from study due to non-functioning of ABG machine. 55 patients were included.

The results of the study are tabulated below as table 1,2,3,4,5,6,7

Males had significantly higher prevalence of acute pancreatitis. Out of total 55 patients studied 45(81.81%) were male and 10(18.18%) were females (as depicted in Table 1). All the patients were divided into 3 groups. Out of these ,3 patients fell under the age group <25 years (5.45%), 41 fell in the age group between 25-55 years (74.54%) and 11 were in the age group >55 years (20%).Maximum age was 86 years and minimum age was 20 years with Mean of 42.04 ± 14.50 (Table 2). Out of 55patients, alcohol was the cause in 35(60%) patients, gall stone in 1(1.82%), ERCP in 2(3.64%) and in 17(30.91%) patients cause was not known (Table 3).

Table 1: Gender wise distribution of patients

	Number(n)	Percentage (%)
Total no. of patients	55	100%
Male	45	81.81%
Female	10	18.18%

Table 2: Age (in years) wise distribution of patients

	No. of patients(n)	Percentage (%)
Age <25	3	5.45
25-55	41	74.54
>55	11	20
TOTAL	55	100

N=55, Max=86, Min=20, Mean ± Standard deviation = 42.04 ± 14.50

Table 3: Etiology wise distribution of patients of acute pancreatitis

Cause	Number(n)	%age
Alcohol	35	60%
Gall stone	1	1.82%
Post ERCP	2	3.64%
Unknown	17	30.91%
TOTAL	55	100

ABG Parameters:

The mean arterial pH was 7.35±0.12 and pH <7.35 were present in 14 patients (25.45%). The mean arterial bicarbonate level was 19.66±4.10mEq/L, with 40 patients (72.72%) having values <22 mEq/L. Base deficit more than -4 mEq/L was found in 38 (69.09%) patients.

Association of arterial pH with various outcome Parameters:

The patients with evidence of pH <7.35 had a higher frequency of Organ failure (pulmonary failure, shock and renal failure). 12 (85%) of the 14 patients with pH <7.35 experienced Organ failure, whereas Organ failure was present in 6/41 (14.63%) in those with pH >7.35. 4 patients with arterial pH <7.35 succumbed to their illness, whereas no patients with pH value >7.35 died, and this difference was statistically significant (P = 0.003). (Table 4)

Table 4: Association of Arterial pH with various outcome Parameters

Variables	Ph <7.35 (N=14)	Ph >_7.35 (N-41)
Organ failure	12(85%)	6(14.63%)
Respiratory failure	11(78.57%)	5(12.19%)
Renal failure	6(42.85%)	0
Mortality	4(28.57%)	0

Association of arterial HCO3 with various outcome Parameters:

We compared outcomes in the two bicarbonate groups, i.e those with arterial HCO3 of less than 22 v/s those >22 mEq/L. 15 (37.5%) of the 40 patients with bicarbonate <22 mEq/L had Organ failure, whereas Organ failure was present in 2 (13.33%) in those with bicarbonate levels> 22 mEq/L. Respiratory failure was present in 14 patients (35%). 4 patients (10%) had renal failure with bicarbonate levels <22 mEq/L. The mortality was significantly higher in patients with low bicarbonate levels. Out of total 4 deaths, all 4 had bicarbonate <22mEq/L. (p <0.001). (Table 5)

Table 5: Association of Arterial HCO3 with various outcome parameters

Variables	Hc03 _<22 N=40	Hc03 >22 N=15
Organ failure	15(37.5%)	2(13.33%)
Respiratory failure	14(35%)	0
Renal failure	4(10%)	0
Mortality	4(10%)	0

Association of arterial base deficit with various outcome parameters:

38(69.09%) patients had base deficit of >-4, whereas13 had base deficit of <-4 mEq/L. Organ failure waspresent in 15 of the patients (39.47%) with base deficit>-4 mEq/L compared with 3 (17.64%) in the other group The frequencies of renal failure (15.78% v/s 0%)was higher in the greater-base-deficit group. 4 deaths occured in this study and all in patientswith base deficit >-4 mEq/L, compared with no deaths in the second group. The mortality was significantly higher in these patients (P = 0.005) (Table 6).

Table 6: Association of Arterial base deficit with various outcome parameters

Variables	Base deficit >-4.0 N=38	Base deficit <-4.0 N=17
Organ failure	15(39.47%)	3(17.64%)
Respiratory failure	14(36.84%)	3(17.64%)
Renal failure	6(15.78%)	0
Mortality	3(7.89%)	0

Association of arterial oxygen saturation with various outcome parameters:

14 out of 21 patients (66.66%) having p02 <75 mm hg developed organ failure compared to 5.88% in other group with p02 >75 mm hg. Respiratory failure was present in 66.66% patients with p02 <75 mm hg compared to 4.76% with p02 >75 mm hg. All 4 deaths in study were in the group with p02 <75 mm hg (p value – 0.008) which was significant (Table 7)

Table 7: Association of oxygen saturation with various outcome parameters

Variables	S02 <75% N=21	S02 >75% N=35
Organ failure	14(66.66%)	2(5.71)
Respiratory failure	14(66.66%)	1(2.86)
Renal failure	3(14.28)	1(2.86)
Mortality	4(19.04)	0

Discussion:

Predicting the severity and outcome of AP remains challenging for a physician. Although multiple scoring systems, as well as single markers, are being used for predicting a severe outcome in AP, there is no consensus regarding the use of one or the other in clinical practice. Arterial blood gas parameters have not been evaluated for prediction of severity and outcome in acute pancreatitis, even though individual parameters form components of multi-score assessment like Ranson's and APACHE; in fact one of the reports criticised ABG as an unnecessary tool in AP patients. This report, unfortunately, focused primarily on the blood gas- and oxygenation-related parameters. In other critical illnesses there is sufficient evidence to implicate ABG parameters as important predictors of outcome. It has been observed that patients with organ failure at admission have higher mortality than those who do not. The development of organ failure, whether at admission or thereafter, implies a worse prognosis. The highest mortalities are among patients with multiple- and persistent organ failure. In the present series thirty eight patients in our study had base deficit of >-4, whereas 13 had base deficit of <-4 mEq/L. Organ failure was present in 15 of the patients (39.47%) with base deficit >-4 mEq/L compared with 3 (17.64%) in the other group. The frequencies of renal failure (15.78% v/s 0%) were higher in the greater-base-deficit group which is similar to study done by Chatzicostas C et al (5).In current study, patients with evidence of pH <7.35 had higher frequency of Organ failure (pulmonary failure, shock and renal failure) which is consistent with another study done by Emanuel Burri et al(6).In our study 14 out of 21 patients (66.66%) with p02 <75 mm hg developed organ failure compared to 5.88% in other group with p02 >75 mm hg. This is in consistence with study done by CW Imrie et al (7) where severe arterial hypoxia was recorded in 38 (45 per cent) of a group of 84 patients with acute pancreatitis when arterial blood gas monitoring was performed during the first week of illness. In the present study of 55 patients, ABG parameters were used and correlated with organ failure and mortality in patients of acute pancreatitis. In current study respiratory failure was present in 66.66% patients with p02 <75 mm

hg compared to 4.76% with p02 >75 mm hg. All 4 deaths in study were in the group with p02 <75 mm hg. This is in consistence with the study done by JH Ranson et al and Johnson CD et al (8, 9) where early respiratory insufficiency was found in acute pancreatitis which can be diagnosed early by arterial blood gas sampling. We found out in our study that 12 (85%) of the 14 patients with pH <7.35 experienced Organ Failure, whereas Organ failure was present in 6/41 (14.63%) in those with pH >7.35. Fifteen (37.5%) of the 40 patients with bicarbonate <22 mEq/L had Organ failure, whereas Organ failure was present in 2 (13.33%) in those with bicarbonate levels> 22 mEq/L. Organ failure was present in 15 of the patients (39.47%) with base deficit >-4 mEq/L compared with 3 (17.64%) in the other group. This is similar to studies done by Lei kong et al (10)

Conclusion:

In patients with acute pancreatitis, low arterial pH and bicarbonate levels and higher base deficit at presentation predict an adverse outcome with higher frequency of organ failure, need for intervention and mortality. Thus a simple diagnostic analysis of arterial blood gas in patients with acute pancreatitis can help in predicting adverse outcome.Though these are preliminary studies where increase mortality and severity has been found but further studies are required to assess the importance of ABG markers for severe pancreatitis.

Limitations of the study:

Less number of patients (n=55).

Short time period study (1 year).

No control group was taken in the study.

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