Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Arterial blood gas analysis in chronic kidney disease, acute exacerbation of chronic obstructive pulmonary disease, and acute coronary syndrome. A cross-sectional observational study.

Dr. Ravindra Kumar Das[1,*], Dr. Prashant Kumar[2], Dr. Kunal[3], Dr. Mukesh Kumar Kushwaha[4], Dr. Pramey Prashant[4], Dr. Akhilesh Kumar[4], Dr. Praneet[4], Dr. Rajeev Ranjan[4]

[1]*Professor, Department of General Medicine, Darbhanga Medical College & Hospital (DMCH), Darbhanga, Bihar, India*
[2]*Assistant Professor, Department of General Medicine, Darbhanga Medical College & Hospital (DMCH), Darbhanga, Bihar, India*
[3]*Senior Resident, Department of General Medicine, Darbhanga Medical College & Hospital (DMCH), Darbhanga, Bihar, India*
[4]*Junior Resident, Department of General Medicine, Darbhanga Medical College & Hospital (DMCH), Darbhanga, Bihar, India*

Abstract

Background:
Arterial blood gas (ABG) analysis plays a critical role in evaluating acid–base disturbances in emergency patients with chronic kidney disease (CKD), acute exacerbation of chronic obstructive pulmonary disease (AECOPD), and acute coronary syndrome (ACS).

Methods:
Three observational cross-sectional studies were conducted at Darbhanga Medical College and Hospital between 2020 and 2025 involving 420 patients. ABG parameters were assessed at admission and correlated with clinical outcomes.

Results:
No linear correlation was observed between estimated creatinine clearance and pH in CKD patients. In AECOPD, ABG-guided management significantly reduced hospital stays and improved survival (96.7% vs 81.7%, p=0.023). In ACS, metabolic acidosis was present in 42% of patients and was associated with higher mortality (40.5%). A strong association between pH correction and clinical improvement was noted (p<0.001).

Conclusion:
Routine ABG-guided management significantly improves outcomes across CKD, AECOPD, and ACS.

Recommendation:
Regular ABG monitoring should be incorporated into emergency protocols for early diagnosis and targeted intervention.

Keywords: Arterial blood gas (ABG), chronic kidney disease (CKD), Acute exacerbation of chronic obstructive pulmonary disease (AECOPD), Acute coronary syndrome (ACS).

Submitted: *September 17, 2025* ***Accepted:*** *November 18, 2025* ***Published:*** *December 30, 2025*

***Corresponding Author:* Dr. Ravindra Kumar Das**
E-mail: ***drrk.das@gov.in***
Professor, Department of General Medicine
Darbhanga Medical College & Hospital (DMCH), Darbhanga, Bihar, India

Introduction

Arterial blood gas (ABG) analysis is a vital investigation in emergency and critical care medicine, offering rapid and accurate assessment of acid–base balance, oxygenation, ventilation, and electrolyte disturbances. Its clinical accuracy and utility in guiding immediate management have been well documented, making it a cornerstone diagnostic tool in critically ill patients (1,2).

Chronic kidney disease (CKD), acute exacerbation of chronic obstructive pulmonary disease (AECOPD), and acute coronary syndrome (ACS) are major public health concerns and leading causes of morbidity and mortality worldwide. These conditions share common risk factors including advancing age, cigarette smoking, hypertension, diabetes mellitus, and sedentary lifestyle. The overlapping pathophysiology of systemic inflammation, oxidative stress, and endothelial dysfunction further contributes to their frequent coexistence and clinical complexity (3).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Metabolic acidosis is a common complication in CKD due to impaired renal acid excretion and reduced bicarbonate regeneration, which accelerates disease progression and worsens patient outcomes (4). Similarly, AECOPD is characterized by respiratory acidosis and hypoxemia arising from alveolar hypoventilation and ventilation–perfusion mismatch, making early physiological assessment essential for severity stratification and treatment planning (5).

The Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2024 guidelines emphasize the importance of ABG analysis in severe exacerbations of COPD for accurate diagnosis, grading of severity, and guiding ventilatory support and pharmacological therapy (6). Evidence has demonstrated that ABG-guided management in AECOPD significantly improves clinical outcomes, reduces hospital stay, and lowers mortality compared with symptom-based treatment alone (7).

In patients with ACS, metabolic acidosis frequently develops as a result of tissue hypoxia and anaerobic metabolism during myocardial ischemia. Acid–base disturbances contribute to myocardial dysfunction, arrhythmias, and hemodynamic instability, thereby increasing the risk of adverse outcomes. Early detection and correction of acidosis through ABG analysis have been associated with improved clinical prognosis (2).

Despite strong evidence supporting its clinical value, ABG analysis remains underutilized as a systematic management tool across these critical conditions. A unified approach to ABG-guided diagnosis and intervention may enhance early detection of life-threatening physiological derangements and improve patient outcomes.

Methodology

Study Design

This observational cross-sectional study consisted of three independent sub-studies evaluating the role of arterial blood gas (ABG) analysis in patients with chronic kidney disease (CKD), acute exacerbation of chronic obstructive pulmonary disease (AECOPD), and acute coronary syndrome (ACS). The studies were conducted over a five-year period from 2020 to 2025.

Study Setting

The study was carried out at Darbhanga Medical College and Hospital, Laheriasarai, Bihar, India, a tertiary care teaching institution that provides emergency services, inpatient medical care, cardiology services, respiratory care, and intensive care facilities to a large population from North Bihar and surrounding regions.

Participants

Adult patients aged 18 years and above presenting to the emergency department or admitted to inpatient wards with a confirmed diagnosis of CKD, AECOPD, or ACS were included in the study. CKD was diagnosed and staged according to KDIGO 2012 guidelines, AECOPD was diagnosed based on clinical presentation supported by ABG parameters, and ACS was confirmed using electrocardiographic findings and cardiac biomarkers. Patients in whom ABG sampling could not be performed, those with incomplete clinical records, and those who declined consent were excluded. Participants were enrolled consecutively during the study period.

Bias Control

Standardized procedures were followed for arterial blood sampling using heparinized syringes, and samples were analyzed immediately using point-of-care ABG analyzers to reduce pre-analytical and analytical errors. Uniform diagnostic criteria and management protocols were applied across all study groups. Data were collected using structured case record forms to minimize information bias.

Study Size

A total of 420 patients were included in the analysis, comprising 200 patients with CKD, 120 with AECOPD, and 100 with ACS. The sample size was based on the number of eligible cases presenting during the study period.

Data Sources and Measurement

Demographic characteristics, clinical history including smoking status and comorbidities, laboratory investigations, and clinical outcomes were obtained from hospital medical records. ABG parameters measured included pH, partial pressure of carbon dioxide, bicarbonate concentration, and serum electrolytes. For patients with CKD, estimated creatinine clearance was calculated using the Cockcroft–Gault equation and disease staging was performed according to KDIGO criteria. Severity of AECOPD was graded based on pH levels obtained from ABG analysis. In ACS patients, ABG findings were correlated with clinical outcomes following standard cardiac evaluation and treatment.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 21. Descriptive statistics were used to

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

summarize demographic and clinical variables. Pearson correlation analysis was applied to assess the relationship between renal function and acid–base parameters. Chi-square tests were used to compare outcomes between management approaches. Statistical significance was set at a p-value of less than 0.05.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Ethics Committee of Darbhanga Medical College and Hospital. Written informed consent was secured from all participants prior to enrollment, and patient confidentiality was maintained throughout the study.

Results

Participant Flow and Baseline Characteristics

A total of 450 patients were assessed for eligibility during the study period, of whom 420 met the inclusion criteria and were included in the final analysis. Thirty patients were excluded due to incomplete data or inability to obtain ABG samples.

The study population comprised 200 patients with chronic kidney disease, 120 with acute exacerbation of chronic obstructive pulmonary disease, and 100 with acute coronary syndrome. The majority of participants were male, and a high proportion had a history of smoking and comorbidities such as hypertension and diabetes mellitus

Study 1 – CKD

Table 1 presents the distribution of acid–base disturbances across different stages of CKD. Although metabolic acidosis was the most common abnormality observed, it was not present in all patients, including those in advanced stages of disease. Notably, a small proportion of patients demonstrated normal acid–base status.

Scatter plot analysis demonstrated a parabolic relationship between estimated creatinine clearance and bicarbonate levels (Figure 1) as well as between creatinine clearance and pH values (Figure 2). No significant linear correlation was observed between renal function and acid–base parameters ($p > 0.05$).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

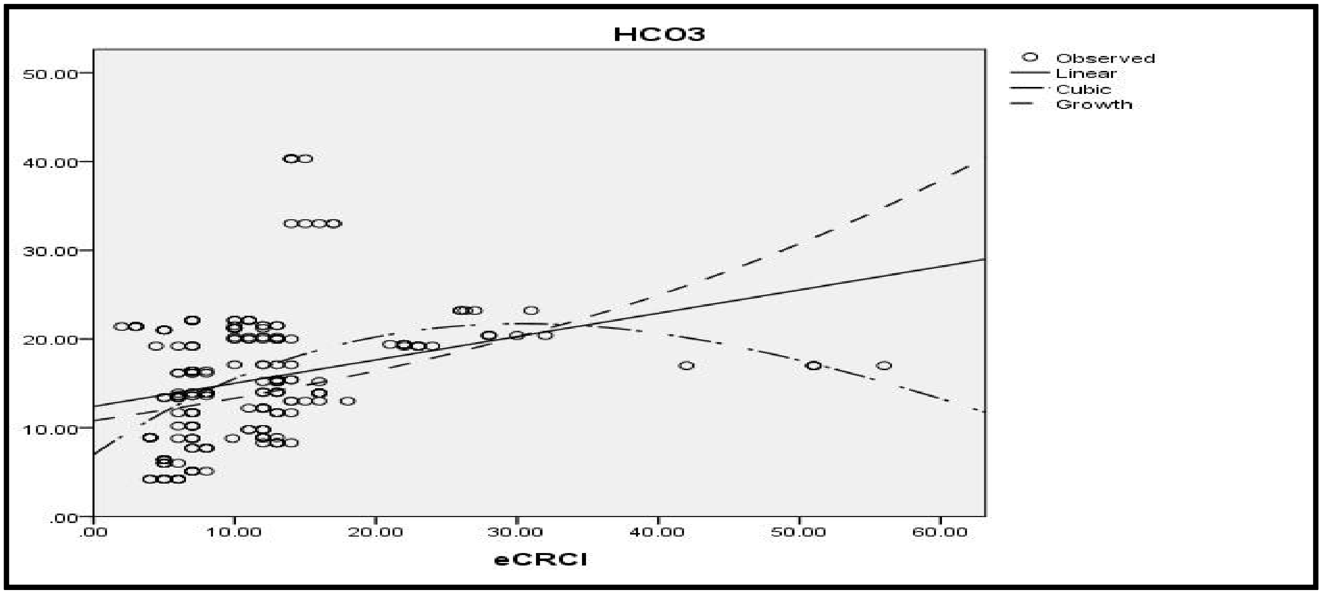
Table-1. Acid base disorder vs eGFR stages

Variables	Stage IIIa (n=3)	Stage IIIB (n=5)	Stage IV (n= 33)	Stage V (n= 179)
(NAGMA)	3	2	2	24
(HAGMA)	0	0	6	23
Respiratory Alkalosis	0	0	3	32
NAGMA + Respiratory Alkalosis	0	3	17	80
HAGMA + Respiratory Alkalosis	0	0	0	10
Respiratory Acidosis + Metabolic Alkalosis	0	0	4	1
No Acid Base Disorder	0	0	1	9
Total	3	5	33	179

In the study maximum number of patients were of stage v (n=179). Not all patients were of metabolic acidosis. Even 9 patients had no acid base disorder.

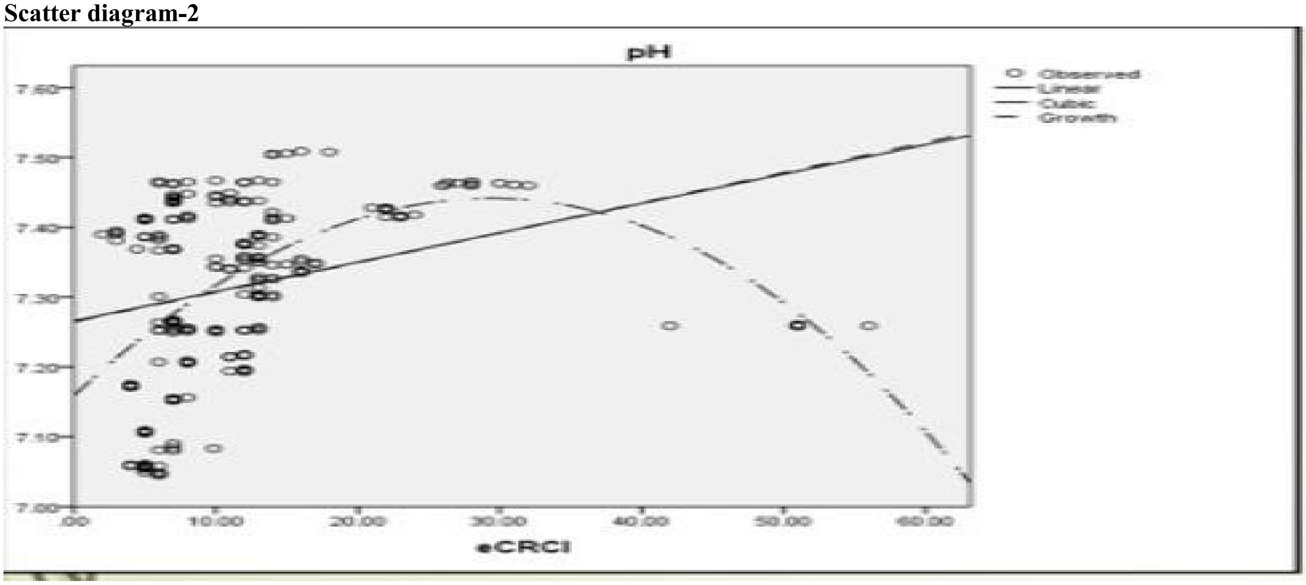
Scatter diagram-1

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article



The relationship between eCrCl and HCO3- were parabolic

Scatter diagram-2



The relationship between eCrCl and pH were parabolic.

There is no linear relationship between eCrcl and pH

Study 2 – AECOPD

Comparison between clinical severity assessment and ABG-based severity grading is shown in Table 2. ABG analysis reclassified disease severity in a significant number of patients. A statistically significant association was observed between clinical severity and ABG-derived severity grading ($\chi^2 = 5.27$, $p = 0.021$).

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Following ABG-guided management, a significant improvement in pH levels was observed within 24 hours of treatment (Table 3), indicating effective correction of respiratory acidosis.

Hospital stay duration was significantly shorter in patients managed using ABG-guided protocols compared with those treated according to conventional GOLD guideline-based clinical assessment (Figure 3).

Primary outcomes are presented in Table 4. Survival was significantly higher in the ABG-guided management group (96.7%) compared to the conventional management group (81.7%). Mortality was lower in the ABG-guided group (3.3% vs 11.6%), and no patients required referral in the ABG-guided group. The difference in outcomes was statistically significant (χ^2 = 7.53, p = 0.023).

Table-2. Clinical severity vs. ABG severity

Cases	ABG severity grading (n=60)	Severity by clinical parameters (n=60)
Mild	15(25.0%)	27(45%)
Moderate	33 (55%)	33(55.0%)
Severe	12(20%)	
Total	60(100.0%)	60(100.0%)
Statistical inferences	Chi-square value- 5.2747 P Value- 0.021	

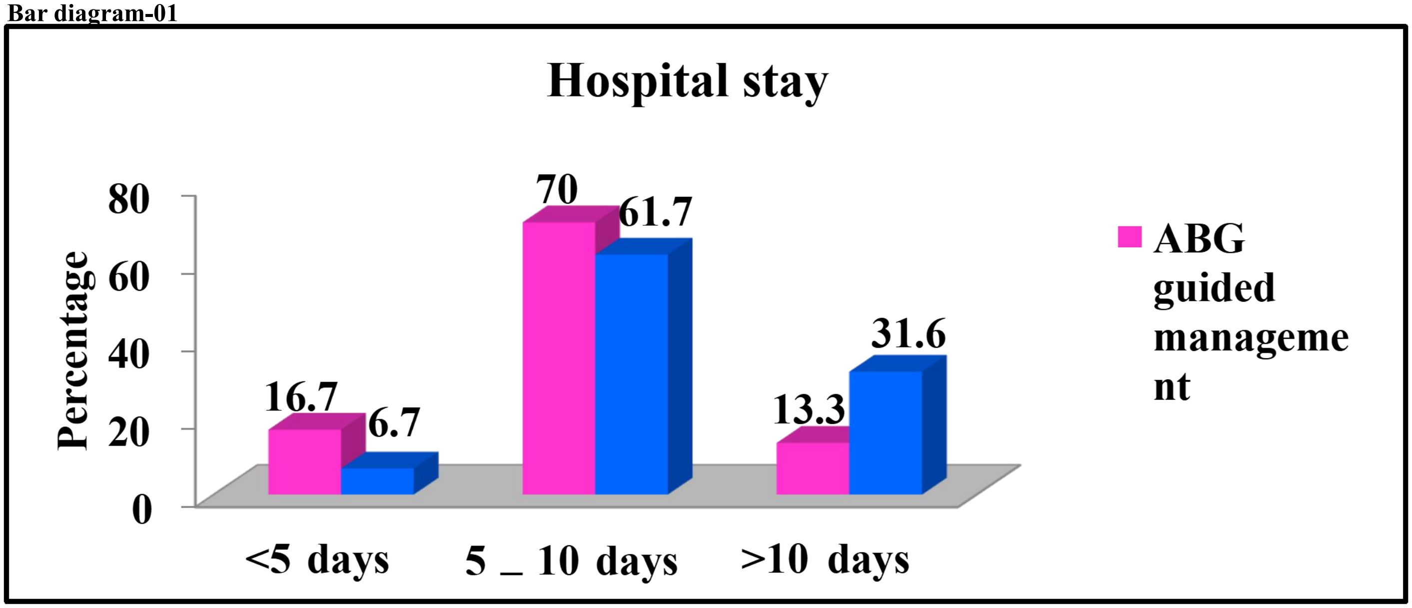
Table-3. Severity of acute exacerbation of COPD patient's 24 hours after treatment

ABG Findings and RR and SpO2	24 hours after treatment		
	Baseline (n=60)	Treatment after 24 hours (n=60)	p Value
	Mean ±SD	Mean ±SD	Mean ±SD
pH	7.26±0.08	7.40±0.10	0.048
pO2	57.16±20.47	61.07±20.34	<0.0001
pCO2	77.19±16.55	63.07±17.52	<0.0001
HCO3	35.45±8.53	36.82±8.40	0.023
RR	28.56±2.47	25.46±2.11	0.011
SpO2	90.78±2.45	91.50±4.75	0.010
Na+	134.36±10.71	131.11±9.33	0.662
K+	4.16±0.72	4.84±0.75	0.098

pH significantly improved in 24 hours when managed according to ABG parameters.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Bar diagram-01



Hospital stay was more in traditional GOLD guideline thus ABG guided method.

Table-4. Death and Discharge

Primary Outcome	**ABG guided management(n=60)**		**Traditional management (n=60)**	
	No of cases	Percentage	No of cases	Percentage
Survive	58	96.7	49	81.7
Death	2	3.3	7	11.6
Referral	0	0.0	4	6.7
Statistical Inferences	Chi- square value- 7.5347 P value – 0.023			

Discharge of the patient treated on traditional management as guided by GOLD is 81.77%, while discharge was 96.7% in ABG guided management.

Study 3 – ACS

Among the ACS patients, ST-elevation myocardial infarction cases were more frequent than non-ST-elevation myocardial infarction cases (Table 5).

ABG analysis revealed that metabolic acidosis was present in 42% of patients, while electrolyte abnormalities such as hypokalemia were observed in 13% (Table 6).

Patients with metabolic acidosis demonstrated substantially higher mortality compared to those without acidosis (Figure 4). Among patients with metabolic acidosis, 40.5% died during hospitalization, whereas mortality was markedly lower in patients with normal acid–base status.

Table 7 illustrates the association between metabolic acidosis and length of hospital stay. Patients without metabolic acidosis showed earlier discharge, while prolonged hospitalization was more common among those with acidosis.

Analysis of shock status revealed that 29.4% of patients with metabolic acidosis presented with cardiogenic shock, while 70.6% did not (Figure 5).

Student’s Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Overall clinical outcomes indicated that the majority of deaths occurred within the first two days of hospitalization, whereas most discharges occurred between days six and seven (Figure 6).

Table-5. Distribution of cases among STEMI & Non-STEMI

Variables	No of cases	Percentage
STEMI	52	52.0
Non-STEMI	48	48.0
Total	100	100.0

STEMI was more than NSTEMI

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Table-6. ABG analysis category

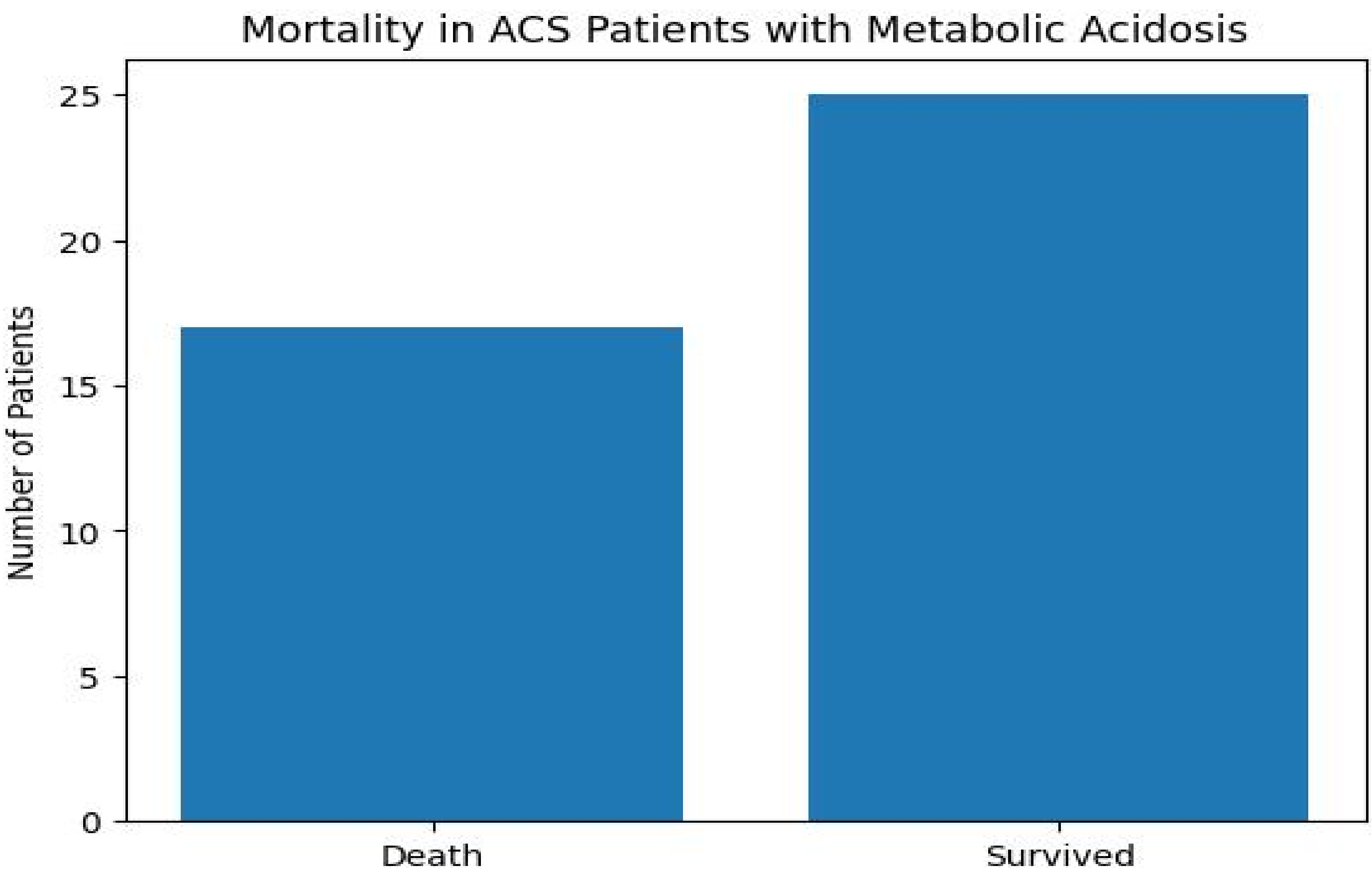
ABG Analysis Type	No of Cases	Percentage (%)
METABOLIC ACIDOSIS	42	42.0%
METABOLIC ALKALOSIS	11	11.0%
MILD HYPOXEMIA	33	33.0%
MODERATE HYPOXEMIA	16	16.0%
SEVERE HYPOXEMIA	14	14.0%
RESPIRATORY ALKALOSIS	35	35.0%
RESPIRATORY ACIDOSIS	7	7.0%
HYPONATREMIA	48	48.0%
HYOPKALEMIA	13	13.0%
HYPERKALEMIA	1	1.0%
NO ACID BASE DISORDER	5	5.0

Metabolic acidosis was found in 42% of cases while hypokalemia was in 13% Bar diagram-02, Analysis of Mortality in cases of Metabolic Acidosis

A. Mortality in patients with Metabolic Acidosis

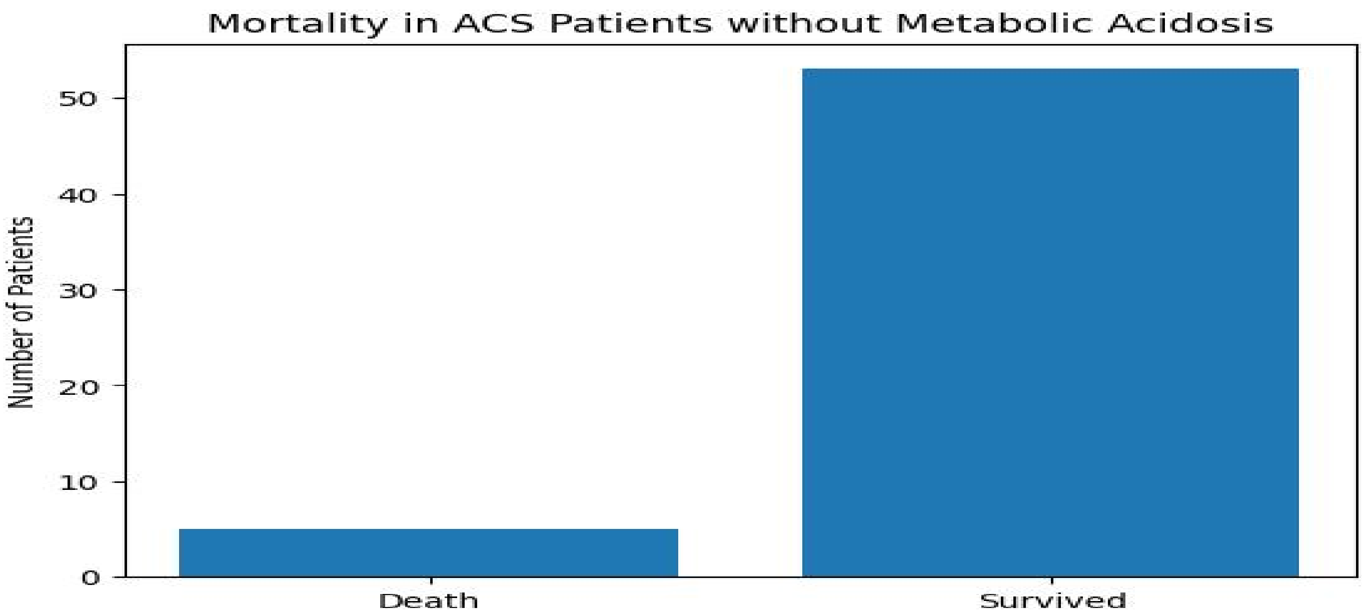
Out of the total ACS patients, metabolic acidosis was observed in **42% of cases**. Among patients with metabolic acidosis, **40.5% resulted in mortality**, indicating a strong association between acidosis and adverse outcomes.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article



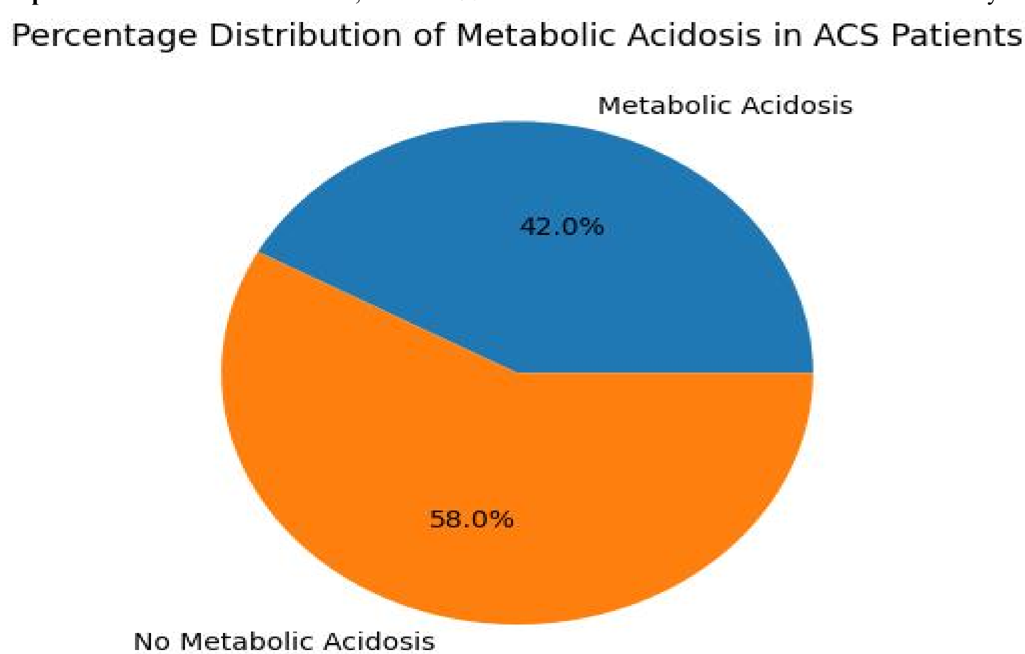
B. Mortality in patients without Metabolic Acidosis

Patients without metabolic acidosis showed significantly lower mortality compared to those with metabolic acidosis, highlighting the prognostic importance of acid–base status in ACS.



C. Percentage of Metabolic Acidosis

Overall, **42% of ACS patients** had metabolic acidosis, while **58% did not exhibit metabolic acidosis** on ABG analysis.



Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

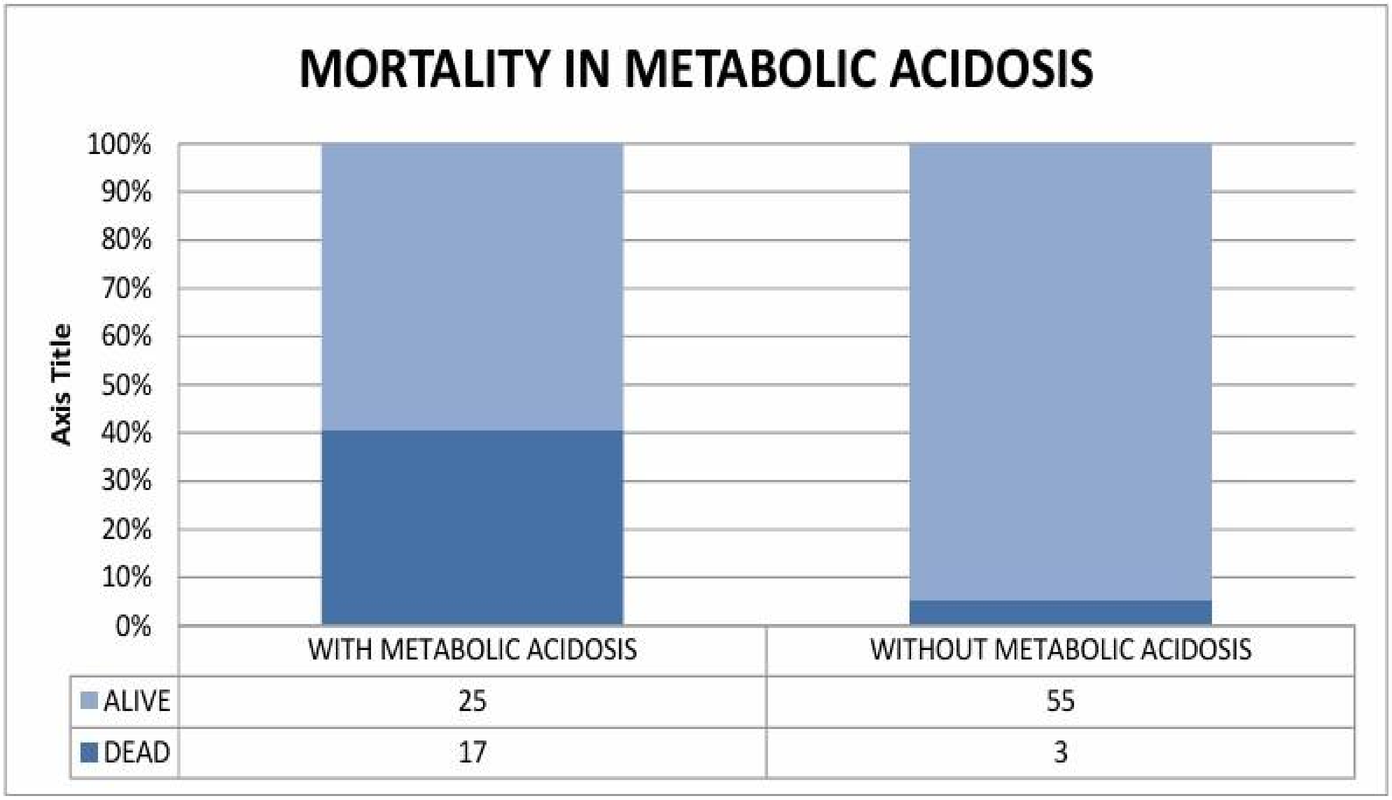
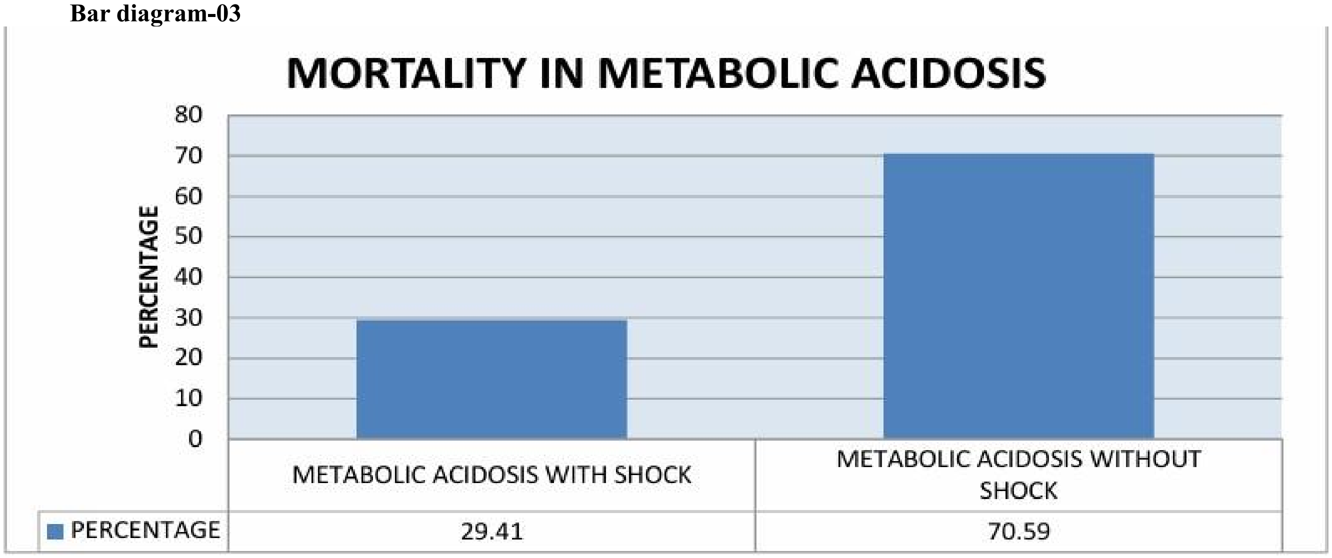


Table-07, Correlation between metabolic acidosis and length of hospital stay.

	With metabolic acidosis	Without acidosis metabolic
Day 10	2	0
Day 8	5	0
Day 7	10	21
Day 6	8	25
Day 5	0	6
Day 4	0	3

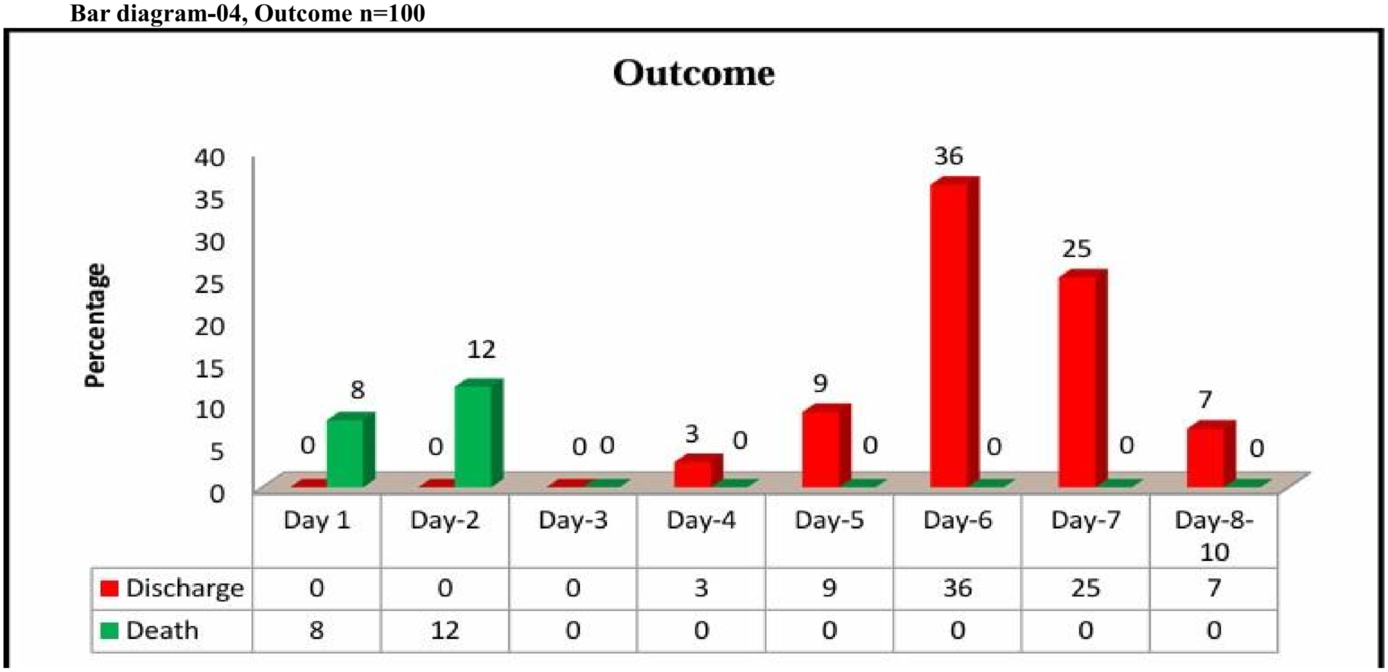
Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Bar diagram-03



29.4% patients of metabolic acidosis was in cardiogenic shock while 70.6 % was without shock.

Bar diagram-04, Outcome n=100



Maximum death observed in Day 1 and 2 while maximum discharge on day 6 and 7

Study 1- CKD:

As renal failure progresses, the amount of bicarb drops. Low serum HCo3 level is associated with greater risk of CKD progression, according to the national kidney foundation. Most patients with CRF have metabolic acidosis.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

Numerous studies have demonstrated a connection between the different acid-base balance parameters and creatinine clearance. This study found exactly not true. There is no linear co-relation between creatinine clearance and acidbase change.

Study 2:- AECOPD:

In the study group, total number of smokers were 82 (68%), male 49 (59.75%) and female 33 (40.25%). It is in correlation with sagarSDr (etal) findings, smoking is the most important risk factor. There was significant (p = 0.002) difference in length of stay in hospital between two groups of patients.

There was significant improvement in acidosis as mean pH at time of admission was 7.26 and at time of discharge it was 7.40 (p = 0.021).

Positive outcomes are predicted and guided by initial pH and other ABG characteristics.

Study 3:- ACS:

The study has observed significant improvement in clinical outcome was 80% than 20%.

Findings of the study correlate other studies emphasizing targeted datadriven approach and AMI management. High intensity interventions are used in Ontario. Within six months, using a real-time monitor is associated with a 23% decrease in serious cardiac events. These methods emphasize the significance of quick, customized evaluations, much as ABG-based monitoring in our study.

The results of the STREAM trial, which demonstrate the value of ABG-guided correction, especially in preserving acid-base homeostasis as a predictor of better outcomes in AMI, are consistent with the study.

According to Shoaib et al. (2021), risk-adjusted measures are crucial for reducing adverse event rates in NSTEMI. This is consistent with the study's findings, which indicated that initial pH and other ABG factors improved morbidity and led to favorable results. These results highlight the benefits of ABG-guided treatment for AMI.

Discussion

This study examined the role of arterial blood gas (ABG) analysis in guiding management and improving outcomes in patients with chronic kidney disease (CKD), acute exacerbation of chronic obstructive pulmonary disease (AECOPD), and acute coronary syndrome (ACS). Metabolic acidosis was the most common acid–base disturbance observed in CKD patients; however, no linear relationship was identified between estimated creatinine clearance and pH or bicarbonate levels. In AECOPD, ABG-guided severity assessment significantly improved clinical outcomes, including reduced hospital stay and lower mortality. In ACS patients, metabolic acidosis was present in 42% of cases and was strongly associated with increased mortality and prolonged hospitalization.

The predominance of metabolic acidosis in CKD patients observed in this study is consistent with the findings reported by Das et al. [7], who demonstrated frequent acid–base disturbances in patients with varying stages of renal dysfunction. Kraut and Madias further described metabolic acidosis as a characteristic complication of progressive CKD due to impaired acid excretion [9]. However, the lack of a linear association between creatinine clearance and acid–base parameters in this study supports earlier observations that renal function alone may not accurately predict systemic acid–base balance [7].

In AECOPD, the superior outcomes achieved through ABG-guided management align with previous work by Das et al. [4], who reported improved survival and shorter hospital stays in patients treated according to ABG parameters. These findings are also supported by the GOLD 2024 guidelines, which recommend ABG assessment for severity stratification and therapeutic decision-making in severe exacerbations [3]. Shivram and Sudharsan demonstrated that ABG abnormalities closely correlate with clinical severity, reinforcing the prognostic significance of arterial blood gas analysis in acute COPD exacerbations [5].

Regarding ACS, the strong association between metabolic acidosis and mortality observed in this study is consistent with findings reported by Shoaib et al. [6], who emphasized the importance of physiological derangements in predicting adverse outcomes in myocardial infarction. Additionally, Stukel et al. showed that early identification and correction of critical physiological parameters significantly reduced serious cardiac events, supporting real-time monitoring approaches similar to ABG-guided management [10].

The absence of a linear relationship between renal function and acid–base disturbances in CKD may be explained by variability in renal tubular compensation, buffering mechanisms, dietary acid load, and therapeutic interventions such as bicarbonate therapy,

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

which can modify systemic pH independently of creatinine clearance [7,9].

The improved outcomes in AECOPD patients managed using ABG-guided protocols likely reflect early detection of respiratory failure severity, allowing timely initiation of ventilatory support and targeted pharmacological treatment. Objective assessment through pH-based grading provides greater accuracy than clinical evaluation alone, which may underestimate physiological compromise [3–5].

In ACS, metabolic acidosis likely reflects underlying tissue hypoxia and impaired perfusion, leading to anaerobic metabolism and accumulation of acidic metabolites. Acidosis contributes to myocardial depression, arrhythmias, and hemodynamic instability, thereby increasing mortality risk. Early recognition and correction through ABG analysis may help mitigate these adverse effects and improve patient survival [6,10].

Conclusion

CDK:

Metabolic acidosis is the most common finding in CKD. There is no linear correlation between eCrCl and acid-base disturbance. ABG measurement and analysis is essential in all suspected cases of CKD for the management and to delay the progression of disease.

AECOPD:

Males have higher chance of exacerbation of COPD.

Analysed report of ABG is better for grading of severity in AECOPD.

ABG helps in correcting the clinical diagnosis.

Mortality is 100% in patients with severe persistent hypoxemia in AECOPD.

Mortality rate was significantly low (3.3%) in ABG-guided management group than 11.6% with conventional therapy group (p value 0.002).

Hospital stay in ABG group was significantly less than traditional therapy group (p = 0.025). ABG-guided management group of patients do not need referral.

Success rate in ABG-guided management group was significantly high (96.7%) than traditionally managed group (81.7%), p value 0.023.

ACS:

ABG analysis in the treatment of AMI, especially in detecting and treating metabolic acidosis, which is a major mortality predictor. Among those who died, mixed acid-base disorders were common and frequently accompanied by hypoxemia. In 42% of the patients, metabolic acidosis was found. Of these patients, 40.5% had fatal results. Of the instances linked to metabolic acidosis, 70.5% did not involve shock, whereas 29.5% did. Reducing mortality in AMI patients requires intensive care of metabolic acidosis. Regular ABG monitoring can support its implementation as a regular procedure in critical AMI care by offering useful real-time data for prompt treatments.

Overall, In CKD, AECOPD, and ACS, ABG-guided treatment greatly enhances results. Mixed acid-base disorders are associated with worse results, particularly when hypoxemia is present. For tailored, successful interventions, regular ABG monitoring offers vital real-time data.

Generalizability

The findings of this study are applicable to tertiary care hospitals and emergency settings where patients with chronic kidney disease, acute exacerbation of chronic obstructive pulmonary disease, and acute coronary syndrome are commonly managed. Given that the study population reflects typical clinical presentations seen in resource-limited and developing healthcare systems, the results may be generalizable to similar institutional settings. However, extrapolation to primary care facilities or highly specialized cardiac centers should be undertaken with caution.

Limitations

This study had several limitations. First, the observational cross-sectional design limits the ability to establish causal relationships between ABG-guided management and clinical outcomes. Second, the study was conducted at a single tertiary care center, which may restrict the external validity of the findings. Third, variations in treatment adherence and physician decision-making could have

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

influenced outcomes. Additionally, long-term follow-up was not performed to assess sustained clinical benefits.

Recommendations

Routine arterial blood gas analysis should be incorporated into emergency and inpatient management protocols for patients with CKD, AECOPD, and ACS. ABG-based severity stratification should guide early therapeutic interventions, particularly ventilatory support in AECOPD and metabolic correction in ACS. Multicenter prospective studies with larger sample sizes are recommended to further validate these findings and establish standardized ABG-guided treatment algorithms.

Acknowledgement

The authors sincerely acknowledge the medical staff, nursing personnel, and laboratory technicians of Darbhanga Medical College and Hospital for their cooperation and support during the conduct of this study.

List of Abbreviations

ABG – Arterial Blood Gas

CKD – Chronic Kidney Disease

AECOPD – Acute Exacerbation of Chronic Obstructive Pulmonary Disease

ACS – Acute Coronary Syndrome

AMI – Acute Myocardial Infarction

$PaCO_2$ – Partial Pressure of Carbon Dioxide

HCO_3^- – Bicarbonate

KDIGO – Kidney Disease Improving Global Outcomes

GOLD – Global Initiative for Chronic Obstructive Lung Disease

ECG – Electrocardiogram

Author Contributions

Dr. Ravindra Kumar Das conceptualized and supervised the study. Dr. Prashant Kumar and Dr. Kunal contributed to patient recruitment and clinical data collection. Dr. Mukesh Kumar Kushwaha and Dr. Pramey Prashant assisted in laboratory analysis and data interpretation. Dr. Akhilesh Kumar, Dr. Praneet, and Dr. Rajeev Ranjan contributed to statistical analysis and manuscript preparation. All authors reviewed and approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

Source of Funding

This study did not receive any external funding.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Author Biography

Dr. Ravindra Kumar Das is a Professor in the Department of General Medicine at Darbhanga Medical College and Hospital, Bihar, India, with extensive experience in emergency medicine, arterial blood gas analysis, and critical care research. His research focuses on improving diagnostic strategies and patient outcomes in acute medical conditions.

The co-authors are faculty members and resident doctors in the Department of General Medicine at Darbhanga Medical College and Hospital, actively involved in clinical research and patient care.

References

1. Das RK. Accuracy of arterial blood gas: a quality improvement study. Int J Med Biomed Stud. 2024;8(6):63–69.

2. Akhilesh Kumar D, et al. Evaluation of arterial blood gas–guided management of acute myocardial infarction. 2024;15(9).

3. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: 2024 report.

4. Das RK. Relation between arterial blood gas values and outcomes of patients admitted with acute exacerbation of chronic obstructive pulmonary disease. GIS Sci J. 2023;10(6):403–414.

Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 12 (2025): December 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i12.2441
Original Article

5. Shivram SD, Sudharsan S. Correlation between clinical features, spirometry, and arterial blood gas in acute exacerbation of obstructive lung disease. Cougl. 2021;11(4):46–52.

6. Das RK. Relation between estimated creatinine clearance and acid–base balance status in chronic kidney disease patients. J Cardiovasc Dis Res. 2021;12(4).

7. Das RK. Arterial blood gas: gold standard in emergency department. J Med Sci Clin Res. 2019;7(11):660–650.

8. Kraut JA, Madias NE. Metabolic acidosis of chronic kidney disease: an update. Am J Kidney Dis. 2016;67(2):307–317.

9. Shoaib A, et al. Clinical characteristics, management strategies, and outcomes of non-ST-segment elevation myocardial infarction patients with and without prior coronary artery bypass grafting. J Am Heart Assoc. 2021;10.

10. Stukel TA, et al. Association between hospital cardiac management and outcomes for acute myocardial infarction patients. Med Care. 2010; 48:157–165.

PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa