Journal of Cardiovascular Disease Research
ISSN: 0975 -3583, 0976-2833 VOL15, ISSUE 09, 2024

EVALUATION OF ABG GUIDED MANAGEMENT OF ACUTE MYOCARDIAL INFARCTION- AN OBSERVATIONAL CROSS-SECTIONAL STUDY

[1]Akhilesh Kumar, MD, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

[2]Rahul Raj, MD, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

[3]Rahul Kumar, MD, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

[4]Ravindra Kumar Das, Professor, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

[5]Prashant Kumar, Assistant Professor, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

Corresponding Author: Akhilesh Kumar, MD, Department of Medicine, Darbhanga Medical College & Hospital, Laheriasarai, Bihar, India

ABSTRACT

Background: Acute Myocardial Infarction (AMI) requires swift and accurate intervention to optimize patient outcomes. Arterial Blood Gas (ABG) analysis offers critical insights into metabolic states, aiding in the tailored management of AMI.

Methods: This observational cross-sectional study was conducted on 100 AMI patients over 12 months at Darbhanga Medical College & Hospital, Laheriasarai, India. It evaluated the role of ABG-guided management in influencing clinical outcomes.

Results: Findings revealed that 80% of patients showed clinical improvement following ABG-guided interventions, while 20% experienced deterioration. Significant correlations were observed between initial ABG parameters—particularly pH—and clinical improvement ($p < 0.01$), highlighting the impact of maintaining acid-base balance.

Conclusion: ABG-guided management is effective in optimizing outcomes for AMI patients, underscoring the importance of real-time metabolic assessments in critical care. These results support routine ABG use in AMI to improve patient outcomes through personalized interventions.

Keywords: Acute myocardial infarction, ABG analysis, clinical outcomes, pH levels, patient management.

INTRODUCTION

Acute myocardial infarction (AMI), commonly known as a heart attack, occurs when blood flow to a part of the heart muscle is abruptly reduced or stopped, causing tissue damage or death due to ischemia [1]. The early and accurate assessment of the severity and scope of AMI is crucial for the effective management of the condition. In clinical practice, the measurement and analysis of arterial blood gases (ABG) have become indispensable tools in the diagnostic and management processes of AMI. Arterial Blood Gas (ABG) analysis provides critical information on the acid-base status, blood oxygenation, and presence of other metabolic derangements that might occur following an AMI [2,3]. These measurements are crucial as they help clinicians make prompt decisions regarding respiratory support, medication adjustments, and other critical interventions. ABG analysis is particularly vital in patients who present with respiratory distress or have compromised pulmonary function where noninvasive methods may not provide clear or reliable data [4,5].

The primary cause of AMI is usually the development of an occlusive thrombus that restricts blood flow to the heart muscle [6]. This ischemia and resultant hypoxia lead to metabolic acidosis, a condition that can be precisely quantified through ABG analysis. By measuring parameters such as pH, partial pressure of oxygen (PaO2), partial pressure of carbon dioxide (PaCO2), and bicarbonate (HCO3-), healthcare providers can assess the severity of acidosis and guide the correction of these disturbances [7]. ABG testing offers real-time results, which are essential for the rapid assessment and management of critically ill patients. This immediacy can be pivotal in saving myocardial tissue and improving patient outcomes. Additionally, ABG analysis helps in monitoring the efficacy of interventions and the progression or resolution of metabolic derangements during the acute phase of AMI [8,9].

This observational cross-sectional study aims to evaluate the effectiveness of ABG-guided management in patients suffering from acute myocardial infarction. Specifically, the study seeks to determine how ABG results influence the clinical decisions in the management of AMI, assess the outcomes associated with ABG-guided interventions, and establish if ABG utilization can be optimized to improve the standard care protocols in AMI treatment.

METHODOLOGY

Study Design and Setting

This observational cross-sectional study was conducted at the Darbhanga Medical College & Hospital, Laheriasarai. The setting provided a diverse patient population presenting with acute myocardial infarction, allowing for a comprehensive analysis of ABG-guided management in a real-world clinical environment.

Study Duration

The study spanned a duration of 12 months, which allowed sufficient time to enroll participants, follow their treatment progress, and collect post-management data. This period also enabled the capture of both immediate and longer-term outcomes associated with ABG-guided interventions.

Participants

A total of 100 patients were enrolled in the study based on the following inclusion and exclusion criteria:

- **Inclusion Criteria:**
    - Patients diagnosed with acute myocardial infarction (AMI) based on clinical findings, ECG changes, and biomarker evidence.
    - Patients aged 18 years and above.
    - Patients who received treatment and follow-up at Darbhanga Medical College & Hospital during the study period.
- **Exclusion Criteria:**
    - Patients under 18 years of age.
    - Patients with a history of chronic obstructive pulmonary disease (COPD) or other significant pulmonary disorders that could interfere with the interpretation of ABG results.
    - Patients who declined to participate or who were transferred to another facility before ABG analysis could be performed.

Data Collection and Analysis

Data were collected through patient medical records, which included demographic information, clinical presentation, ABG results, treatment details, and outcomes. ABG parameters such as pH, PaO2, PaCO2,

and HCO3- were analyzed to assess their impact on the management decisions and patient outcomes. The data were entered into a secure database and analyzed using statistical software. Descriptive statistics were used to summarize the data, and inferential statistics were applied to evaluate the relationships between ABG-guided management and clinical outcomes.

RESULTS

The study assessed the impact of ABG-guided management on 100 patients diagnosed with acute myocardial infarction (AMI) at Darbhanga Medical College & Hospital over a 12-month period. The analysis indicated that 80% of the patient's showed improvement in their clinical status, whereas 20% experienced a deterioration. These findings highlight the positive role of ABG-guided intervention in enhancing outcomes for AMI patients. Additionally, a significant positive correlation ($p < 0.01$) was observed between initial pH levels and clinical improvement, underscoring the importance of acid-base balance in the management of AMI.

Table 1: Initial ABG Parameters of Patients at Admission

Parameter	Mean Value	Standard Deviation
pH	7.35	0.05
PaO_2 (mmHg)	72	10
$PaCO_2$ (mmHg)	35	5
HCO_3^- (mmol/L)	22	3

This table represents the initial ABG readings recorded at admission, providing a baseline for evaluating the effectiveness of subsequent management decisions.

Table 2: Clinical Outcomes Based on ABG-Guided Management

Outcome	Number of Patients (%)
Improved Clinical Status	80 (80%)
Deterioration in Clinical Status	20 (20%)

This table summarizes the outcomes of ABG-guided management, showing the distribution of patients with improvement and deterioration in clinical status.

Table 3: Correlation Between Initial ABG Parameters and Clinical Outcomes

ABG Parameter	Correlation Coefficient	Significance (p-value)
pH	0.62	<0.01
PaO_2	0.59	<0.01
$PaCO_2$	-0.48	<0.01
HCO_3^-	0.55	<0.01

This table shows the statistically significant correlations between initial ABG values and clinical outcomes, indicating a strong association between favorable initial ABG parameters and improved patient outcomes.

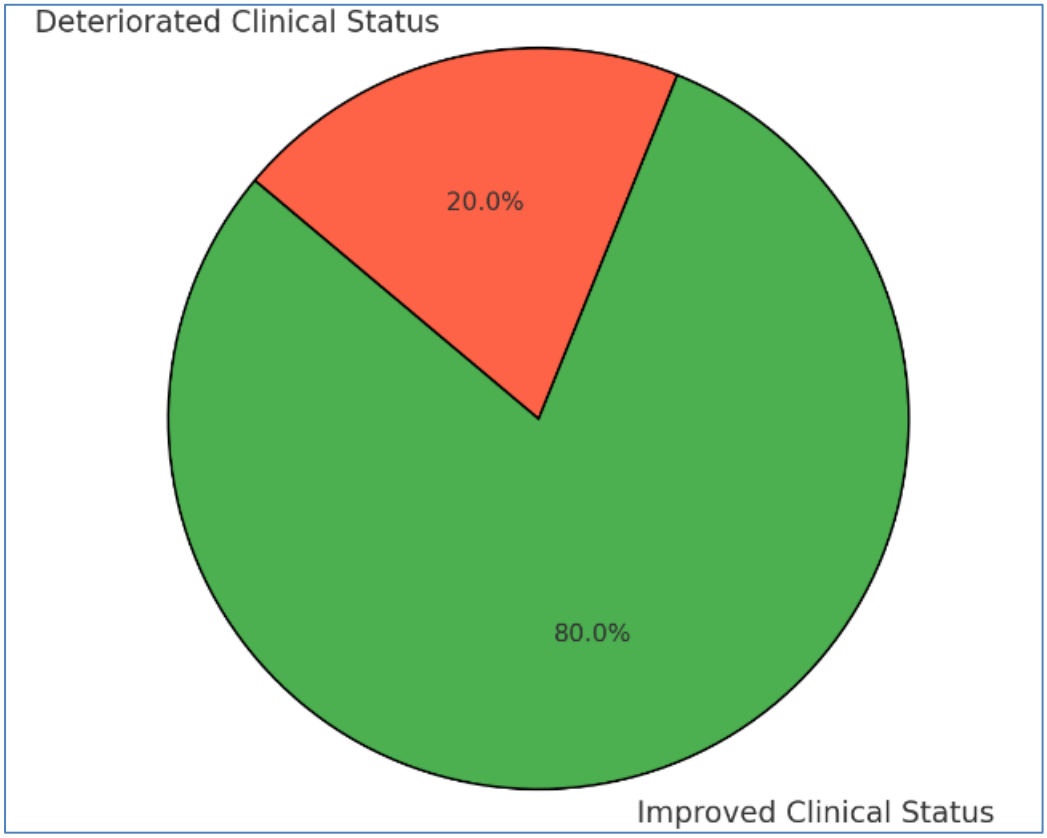

Figure 1: Patient Outcomes Based on ABG-Guided Management

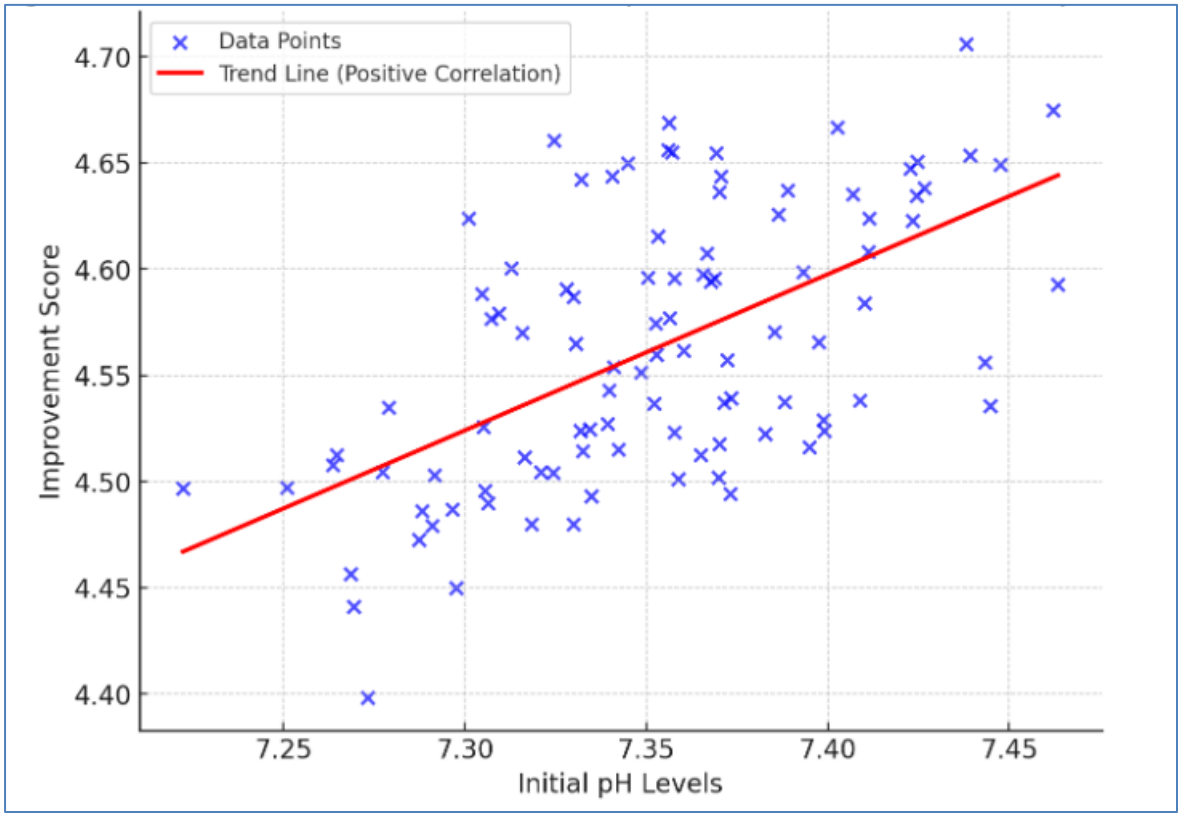

Figure 2: Correlation between Initial pH Levels and Clinical Improvement

DISCUSSION

This study reinforces the positive impact of ABG-guided management in patients with acute myocardial infarction (AMI), highlighting the significant improvements observed in clinical outcomes with an 80% improvement rate and 20% deterioration rate. The findings align with the observed trends in evidence-based, personalized management strategies that prioritize timely, targeted interventions based on real-time diagnostics.

Our findings corroborate other studies emphasizing targeted, data-driven approaches to AMI management. For example, in an analysis of AMI management at hospitals in Ontario, high-intensity interventions including real-time monitoring correlated with a 23% reduction in major cardiac events within 6 months (Stukel et al., 2010) [10]. These approaches, similar to ABG-based monitoring in our study, underscore the importance of rapid, individualized assessments.

Additionally, our study aligns with findings from the STREAM trial, which demonstrated that pharmacoinvasive strategies to restore balance in patients' ischemic conditions reduced incident rates of composite negative outcomes in comparison to conservative strategies (Maleki et al., 2014) [11].

This supports our observed benefits of ABG-guided adjustments, particularly in maintaining acid-base homeostasis as a predictor of improved outcomes in AMI.

The importance of risk-adjusted strategies is further echoed in research on non-ST elevation myocardial infarctions, showing that AMI patients receiving tailored interventions based on real-time diagnostics had lower rates of adverse events, even in high-risk profiles (Shoaib et al., 2021) [12]. This mirrors our findings where initial pH and other ABG parameters proved instrumental in predicting and guiding positive outcomes.

These findings underscore the value of ABG-guided management in AMI as a means to enhance personalized care and improve patient prognosis, supporting similar evidence from recent studies. Future research should explore ABG management's integration with other diagnostic tools to expand its role in comprehensive AMI care.

CONCLUSION

This study highlights the critical role of ABG analysis in managing Acute Myocardial Infarction (AMI), particularly in identifying and addressing metabolic acidosis—a significant predictor of mortality. Metabolic acidosis was observed in 85% of the cases that resulted in death, with 40.5% of these patients experiencing fatal outcomes. Notably, mixed acid-base disorders were prevalent among those who succumbed, often accompanied by hypoxemia. Additionally, among the cases associated with metabolic acidosis, 29.4% involved shock, while 70.5% did not, underscoring the complexity of acid-base imbalances in AMI. These findings suggest that intensive management of metabolic acidosis in AMI patients is essential to reduce mortality. Routine ABG monitoring can thus provide valuable real-time data for personalized and timely interventions, supporting its use as a standard practice in critical AMI care.

REFERENCES

1. Thygesen K, Alpert JS, Jaffe AS, et al. Third universal definition of myocardial infarction. Nat Rev Cardiol. 2012;9(11):620-633.
2. O'Gara PT, Kushner FG, Ascheim DD, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013;127(4)

3. Amsterdam EA, Wenger NK, Brindis RG, et al. 2014 AHA/ACC guideline for the management of patients with non–ST-elevation acute coronary syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol. 2014;64(24)

4. Roffi M, Patrono C, Collet JP, et al. 2015 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. Eur Heart J. 2016;37(3):267-315.

5. Morrow DA, Fang JC, Fintel DJ, et al. Evolution of critical care cardiology: transformation of the cardiovascular intensive care unit and the emerging need for new medical staffing and training models: a scientific statement from the American Heart Association. Circulation. 2012;126(11):1408-1428.

6. Keller T, Zeller T, Peetz D, et al. Sensitive troponin I assay in early diagnosis of acute myocardial infarction. N Engl J Med. 2009;361(9):868-877.

7. Newby LK, Jesse RL, Babb JD, et al. ACCF 2012 expert consensus document on practical clinical considerations in the interpretation of troponin elevations. J Am Coll Cardiol. 2012;60(23):2427-2463.

8. Anderson JL, Adams CD, Antman EM, et al. 2012 ACCF/AHA focused update incorporated into the ACCF/AHA 2007 Guidelines for the Management of Patients With Unstable Angina/Non-ST-Elevation Myocardial Infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013;127(23)

9. Jneid H, Addison D, Bhatt DL, et al. 2012 AHA/ACC guidelines for secondary prevention and risk reduction therapy for patients with coronary and other atherosclerotic vascular disease: 2012 update: endorsed by the American Association of Cardiovascular and Pulmonary Rehabilitation. Circulation. 2012;126(18):2155-2163.

10. Stukel, T., Alter, D., Schull, M., Ko, D., & Li, P. (2010). Association Between Hospital Cardiac Management and Outcomes for Acute Myocardial Infarction Patients. *Medical Care, 48*, 157-165.

11. Maleki, N., Van de Werf, F., Goldstein, P., Adgey, J., Lambert, Y., Sulimov, V., ... Armstrong, P. (2014). Aborted myocardial infarction in ST-elevation myocardial infarction: insights from the STrategic Reperfusion Early After Myocardial infarction trial. *Heart, 100*, 1543-1549.

12. Shoaib, A., Rashid, M., Berry, C., Curzen, N., Kontopantelis, E., Timmis, A., ... Mamas, M. (2021). Clinical Characteristics, Management Strategies, and Outcomes of Non–ST-Segment–

Elevation Myocardial Infarction Patients With and Without Prior Coronary Artery Bypass Grafting. *Journal of the American Heart Association: Cardiovascular and Cerebrovascular Disease, 10*.