Does Arterial Blood Gas Analysis Predict an Adverse Course in Patients Admitted with Isolated Diaphyseal Femur Fractures?

A análise da gasometria arterial prevê uma evolução desfavorável em pacientes internados com fraturas diafisárias isoladas do fêmur?

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Abstract

Objective To evaluate the role of arterial blood gas (ABG) parameters in predicting adverse in-hospital outcomes among patients with isolated diaphyseal femur fractures.

Methods A retrospective study was conducted at a tertiary care hospital between April 2020 and June 2021. Patients aged 18 to 70 years of both sexes with isolated diaphyseal femur fractures were included. The ABG parameters were assessed upon admission and 24 hours postadmission. Their association with systemic complications, intensive care unit admission, and length of hospital stay was evaluated.

Results The study included 55 patients with a mean age of 53.8 years. The ABG parameters upon admission and at 24 hours were significantly associated with adverse outcomes, specifically pH < 7.35, bicarbonate (HCO_3^-) < 22 mmol/L, partial pressure of carbon dioxide (PCO_2) < 35 mmHg, partial pressure of oxygen (PO_2) < 83 mmHg, and lactate > 1.8 mmol/L. Elevated lactate levels upon admission were additionally correlated with prolonged hospital stay and systemic arterial hypertension.

Conclusion The ABG parameters assessed upon admission and 24 hours postadmission serve as early predictors of adverse outcomes in patients with isolated diaphyseal

Keywords
- arterial blood gas analysis
- femoral neck fractures
- intensive care units
- patient admission

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femur fractures. These findings suggest that ABG analysis may be a valuable tool in guiding the clinical management of such patients.

Resumo

Objetivo Avaliar o papel dos parâmetros da gasometria arterial (GA) na predição de desfechos desfavoráveis intra-hospitalares em pacientes com fraturas diafisárias isoladas do fêmur.

Métodos Foi realizado um estudo retrospectivo em um hospital terciário entre abril de 2020 e junho de 2021. Foram incluídos pacientes de 18 a 70 anos, de ambos os sexos, com fraturas diafisárias isoladas do fêmur. Os parâmetros da GA foram avaliados à admissão e 24 horas após a admissão. Sua associação com complicações sistêmicas, sua admissão em unidade de terapia intensiva e o tempo de internação foram avaliados.

Resultados Foram incluídos 55 pacientes, com idade média de 53,8 anos. Os parâmetros da GA à admissão e em 24 horas foram significativamente associados a desfechos desfavoráveis, especificamente pH < 7,35, bicarbonato (HCO_3^-) < 22 mmol/L, pressão parcial de dióxido de carbono (PCO_2) < 35 mmHg, pressão parcial de oxigênio (PO_2) < 83 mmHg e lactato > 1,8 mmol/L. Níveis elevados de lactato à admissão foram correlacionados, adicionalmente, com internação prolongada e hipertensão arterial sistêmica.

Conclusão Os parâmetros da GA avaliados à admissão e 24 horas após a admissão servem como preditores precoces de desfechos desfavoráveis em pacientes com fraturas diafisárias isoladas do fêmur. Esses achados sugerem que a GA pode ser uma ferramenta valiosa para orientar o manejo clínico desses pacientes.

Palavras-chave

- admissão do paciente
- análise de gases sanguíneos
- fraturas do colo femoral
- unidades de terapia intensiva

Introduction

Trauma is the leading cause of death worldwide.[1] Premature deaths and disability resulting from trauma impose a substantial economic burden.[2,3] The most frequent major trauma sites involve the extremities (particularly long bone fractures), followed by craniocerebral, abdominopelvic, thoracic, and spinal injuries.[4,5] Long bone fractures can be fatal due to severe hemorrhage.[6] The concept of the "golden hour," which forms the cornerstone of advanced trauma life support (ATLS), emphasizes early recognition of hemorrhagic shock and prompt intervention to prevent tissue hypoperfusion.[7]

Diaphyseal femur fractures (DFFs) are associated with an acute mortality rate of 0.04% but may lead to significant mortality and morbidity if not managed promptly in the initial hours.[8] Systemic complications commonly associated with these fractures include transient desaturation (TD), hemorrhagic shock, fat embolism syndrome (FES), acute respiratory distress syndrome (ARDS), and pulmonary thromboembolism (PTE). Therefore, early identification of prognostic indicators is critical for preventing such complications.

At present, we rely on traditional vital signs such as blood pressure and heart rate to guide the initial workup of these fractures. However, vital signs should only be surrogate markers and not direct measures of oxygen delivery. Better markers for the presence and extent of ongoing hemorrhage may be the actual metabolic products of tissue hypoperfusion such as base deficit (BD) and serum lactic acid (LA) level.[9,10] Studies have shown that the mortality of trauma patients can be predicted by the levels of base deficit within the first 24 hours.[11–13]

Arterial blood gas (ABG) parameters have been identified as useful predictors of the severity of traumatic brain injury and for prognosticating patient outcomes.[14,15] In orthopedic trauma, only a limited number of studies have examined the prognostic role of ABG parameters, and these were primarily conducted in patients with pelvic fractures either isolated or combined with long bone fractures.[16,17] To the best of our knowledge, no previous studies have specifically evaluated the role of ABG values in predicting adverse in-hospital outcomes among patients with isolated DFFs.

Therefore, the primary objective of this study was to assess the role of various ABG parameters in predicting adverse in-hospital outcomes in patients with isolated DFF. A secondary objective was to analyze the association of demographic factors and comorbidities with ABG parameters in the study population.

Materials and Methods

This retrospective observational study was conducted in the Department of Orthopedics at a tertiary care hospital between April 2020 and June 2021.

The inclusion criteria were patients aged 18 to 70 years, presenting within 48 hours of trauma, with open or closed

isolated DFF or unilateral or bilateral subtrochanteric femur fractures (STFFs).

We excluded cases with presentation after 48 hours, severe head injury (Glasgow Coma Scale score < 8), intracranial bleeding, polytrauma, chest injuries, prehospital cardiac arrest, prior stabilization/oxygen therapy elsewhere, and preexisting conditions affecting LA levels (heart failure, chronic obstructive pulmonary disease, liver disease, active coronavirus disease 2019 (COVID-19) infection, or antiretroviral therapy).

The data collected retrospectively included age, sex, mode of injury, fracture type, time since injury, comorbidities, Intensive Care Unit (ICU) admission, need for ventilatory support upon admission, length of hospital stay, and systemic complications. Systemic complications were defined as the occurrence of sepsis, acute kidney injury, ARDS, multi-organ dysfunction syndrome (MODS), deep vein thrombosis (DVT), PTE, or myocardial infarction during hospitalization.

The ABG analysis was performed at two standardized periods: upon admission (within 2 hours of hospital arrival) and at 24 hours postadmission using the Cobas b 221 system (Roche Diagnostics). Parameters recorded included pH, bicarbonate (HCO_3^-), partial pressure of carbon dioxide (PCO_2), partial pressure of oxygen (PO_2), LA, and base excess.

The reference ranges were pH: 7.35 to 7.45; HCO_3^-: 22 to 26 mEq/L; PCO_2: 35 to 45 mmHg; PO_2: 75 to 100 mmHg; LA: 0.20 to 1.80 mmol/L; and base excess: -2 to $+2$ mmol/L. Abnormal values were defined as: pH < 7.35 (acidemia) or > 7.45 (alkalemia); $PCO_2 > 45$ mmHg with pH < 7.35 (respiratory acidosis), or $PCO_2 < 35$ mmHg with pH > 7.45 (respiratory alkalosis); $HCO_3^- < 22$ mEq/L with pH < 7.35 (metabolic acidosis), or $HCO_3^- > 26$ mEq/L with pH > 7.45 (metabolic alkalosis); base excess < -2 or $> +2$ mmol/L; and LA > 1.80 mmol/L (lactic acidosis).

Data were entered using the Epicollect5 software (Centre for Genomic Pathogen Surveillance) and analyzed with the IBM SPSS Statistics for Windows (IBM Corp.), version 26. Descriptive statistics were reported as mean $\pm$ standard deviation (SD) for continuous variables and as frequencies with percentages for categorical variables. The normality of continuous variables was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests, with $p > 0.05$ considered indicative of normal distribution, supported by quantile-quantile (Q–Q) plots. Associations between ABG parameters and demographic or clinical variables were evaluated using the Chi-squared test. Multivariate logistic regression was performed to identify independent predictors of systemic complications, incorporating ABG abnormalities, mode of injury, and comorbidities. Values of $p < 0.05$ were considered statistically significant.

A sample size calculation was based on an assumed 25% incidence of systemic complications among femur fracture patients. To detect a significant difference with 80% power and a 95% confidence level, a minimum of 120 patient records was required. The Institutional Ethics Committee's approval was obtained prior to study initiation, with the reference number CSP-MED/21/NOV/72/138. As this was a retrospective study utilizing anonymized data from existing records, the requirement for informed consent was waived by the institutional authorities.

Results

Among the study population, 29 patients (52.7%) had subtrochanteric fractures and 26 patients (47.3%) had shaft fractures. Males predominated (n = 31, 56.4%) compared to females (n = 24, 43.6%). The mean age was 53.84 ± 17.75 years, with the largest proportion of patients (n = 21, 38.2%) in the 66 to 70 years age group, followed by 16 (29.1%) in the 51 to 65 years group, 10 (18.2%) in the 31 to 50 years group, and 8 (14.5%) in the 18 to 30 years group.

Slip and fall was the most common mode of injury (n = 30, 54.5%), followed by road traffic accidents (n = 25, 45.5%). Right-sided femur fractures (n = 36, 65.5%) were more common than left-sided fractures (n = 19, 34.5%). The delay in ABG analysis from the time of injury was distributed as follows: 1 to 3 hours in 17 patients (30.9%), 4 to 6 hours in 16 (29.1%), 7 to 9 hours in 11 (20.0%), 10 to 12 hours in 6 (10.9%), and more than 12 hours in 5 (9.1%). No significant associations were observed between ABG parameters and demographic variables (age and sex). Similarly, no significant associations were found between ABG parameters and clinical factors (type of fracture, mode of injury, side of injury, time since injury).

Of the study population, 21 patients (38.2%) had no medical comorbidities, 18 (32.7%) had systemic arterial hypertension (SAH) alone, and 16 (29.1%) had multiple comorbidities such as diabetes mellitus (DM), SAH, and hypothyroidism. Comparisons of ABG parameters were made between patients with and without these comorbidities. Among the parameters analyzed, significant differences were observed in LA levels between hypertensive and non-hypertensive patients (►**Table 1**). At admission, patients with systemic hypertension had significantly higher LA levels (> 1.8 mmol/L) compared to non-hypertensive patients ($p = 0.013$). This difference persisted at 24 hours, with LA levels remaining significantly elevated in the hypertensive group ($p < 0.0001$). No other ABG parameters showed significant variation across comorbidity groups (DM, SAH, and hypothyroidism).

Among the 55 study subjects, 19 patients (34.5%) required ICU admission, of whom 9 (47.4%) had shaft fractures and 10 (52.6%) had subtrochanteric ones. No significant association was observed between ICU admission and fracture type.

The most common complication was TD, occurring in 19 patients (34.5%) across both DFF and STFF groups. This was followed by FES and ARDS, each reported in 4 patients (7.3%). Also, PTE was observed in only 1 patient (1.8%) with a subtrochanteric fracture. No significant association was found between the occurrence of systemic complications and the type of fracture.

Among patients with DFF, 14 (53.8%) had a hospital stay of < 10 days, while 12 (46.2%) stayed $\geq$ 10 days. Among patients with STFF, 17 (58.6%) had a stay of < 10 days, and 12 (41.4%) stayed $\geq$ 10 days. However, no statistically

Table 1 Association between ABG parameters and SAH

Variables	SAH	Non-SAH	*p*-value*
pH upon admission			
< 7.35	5	9	0.402
7.35–7.45	18	20	
> 7.45	1	2	
pH at 24 hours			
< 7.35	3	9	0.107
7.35–7.45	19	21	
> 7.45	2	1	
HCO_3^- upon admission (mEq/L)			
< 22	10	14	0.082
22–26	10	16	
> 26	4	1	
HCO_3^- at 24 hours (mEq/L)			
< 22	9	10	0.053
22–26	14	14	
> 26	1	7	
PCO_2 upon admission (mmHg)			
<35	4	5	0.155
35–45	19	21	
> 45	1	5	
PCO_2 at 24 hours (mmHg)			
< 35	4	7	0.052
35–45	19	11	
> 45	1	3	
PO_2 upon admission (mmHg)			
< 83	11	20	0.068
83–108	9	5	
> 108	4	6	
PO_2 at 24 hours (mmHg)			
< 83	4	10	0.154
83–108	17	19	
> 108	3	2	
Base upon admission (mmol/L)			
Base deficit (< −2.0)	11	12	0.143
Normal (−2.0– + 2.0)	12	18	
Base excess (> 2.0)	1	1	
Base at 24 hours (mmol/L)			
Base deficit (< −2.0)	10	12	0.751
Normal (−2.0– + 2.0)	13	18	
Base excess (> 2.0)	1	1	

Table 1 (*Continued*)

Variables	SAH	Non-SAH	*p*-value*
LA upon admission (mmol/L)			
0.2–1.8	4	26	**0.013****
> 1.8	20	5	
LA at 24 hours (mmol/L)			
0.2–1.8	6	19	< **0.001****
> 1.8	18	2	

Abbreviations: ABG, arterial blood gas analysis; HCO_3^-, bicarbonate; LA, serum levels of lactic acid; PCO_2, partial pressure of carbon dioxide; PO_2, partial pressure of oxygen; SAH, systemic arterial hypertension. **Notes:** *Chi-squared test; **statistically significant ($p < 0.05$).

significant association was observed between fracture type and length of hospital stay.

►**Tables 2**, **3**, and **4** present the associations between ABG parameters and systemic complications, ICU admission, and length of hospital stay. Patients with systemic complications demonstrated significant abnormalities across multiple ABG parameters: 1) lower pH levels at 24 hours ($p = 0.026$), indicating ongoing acidosis; 2) reduced HCO_3^- levels both upon admission ($p = 0.019$) and at 24 hours ($p = 0.025$), suggesting inadequate metabolic compensation; 3) elevated LA levels upon admission ($p = 0.038$); 4) impaired oxygenation with lower PO_2 upon admission ($p = 0.048$) and at 24 hours ($p < 0.0001$); and 5) significant differences in PCO_2 levels upon admission ($p = 0.011$) and at 24 hours ($p = 0.029$), reflecting combined respiratory and metabolic disturbances.

Patients requiring ICU admission exhibited significant derangements in ABG parameters: 1) lower pH levels at both admission ($p = 0.038$) and 24 hours ($p = 0.006$), reflecting persistent acidosis; 2) reduced HCO_3^- levels at 24 hours

Table 2 Association between ABG parameters and systemic complications

Variables	No systemic complications	Systemic complications	*p*-value*
pH upon admission			
< 7.35	4	10	0.146
7.35–7.45	19	19	
> 7.45	1	2	
pH at 24 hours			
< 7.35	2	10	**0.0260****
7.35–7.45	25	16	
> 7.45	1	1	
HCO_3^- upon admission (mEq/L)			
< 22	8	16	**0.019****
22–26	18	8	
> 26	4	1	
HCO_3^- at 24 hours (mEq/L)			
< 22	6	13	**0.025****
22–26	20	8	
> 26	4	4	
PCO_2 upon admission (mmHg)			
<35	1	8	**0.011****
35–45	26	14	
> 45	4	2	

(*Continued*)

Table 2 (*Continued*)

Variables	No systemic complications	Systemic complications	*p*-value*
PCO_2 at 24 hours (mmHg)			
< 35	2	9	**0.029****
35–45	24	16	
> 45	1	3	
PO_2 upon admission (mmHg)			
< 83	15	16	**0.048****
83–108	12	2	
> 108	2	8	
PO_2 at 24 hours (mmHg)			
< 83	1	13	**0.001****
83–108	26	10	
> 108	1	4	
Base upon admission (mmol/L)			
Base deficit (< −2.0)	9	14	0.388
Normal (−2.0– + 2.0)	17	13	
Base excess (> 2.0)	1	1	
Base at 24 hours (mmol/L)			
Base deficit (< −2.0)	7	15	0.168
Normal (−2.0– + 2.0)	18	13	
Base excess (> 2.0)	1	1	
LA upon admission (mmol/L)			
0.2–1.8	18	12	**0.038****
> 1.8	8	17	
LA at 24 hours (mmol/L)			
0.2–1.8	20	14	0.417
> 1.8	10	11	

Abbreviations: ABG, arterial blood gas analysis; HCO_3^-, bicarbonate; LA, serum levels of lactic acid; PCO_2, partial pressure of carbon dioxide; PO_2, partial pressure of oxygen. **Notes:** *Chi-squared test; **statistically significant ($p < 0.05$).

($p = 0.004$), indicating inadequate metabolic compensation; 3) elevated LA levels upon admission ($p = 0.027$); 4) impaired oxygenation with lower PO_2 upon admission ($p = 0.039$) and at 24 hours ($p < 0.0001$); and 5) significant differences in PCO_2 at 24 hours ($p = 0.046$), suggesting combined respiratory and metabolic disturbances associated with ICU requirement.

Prolonged hospital stay was associated with significant ABG abnormalities: 1) lower pH levels at both admission ($p = 0.003$) and 24 hours ($p = 0.001$), indicating persistent acidosis; 2) elevated LA levels upon admission ($p = 0.005$); and 3) impaired oxygenation (PO_2) at 24 hours ($p = 0.038$), reflecting ongoing metabolic and respiratory compromise. Although HCO_3^- and PCO_2 did not reach statistical significance, they showed a trend toward abnormal values in patients with extended hospitalization.

Discussion

Pelvic and long bone fractures, particularly femoral shaft fractures, are severe injuries due to their proximity to major vascular structures and the effect of strong muscle contractions, which exacerbate tissue damage.[18] Hemorrhage from these fractures can rapidly lead to shock, while complications such as FES, ARDS, pneumonia, and PTE significantly contribute to morbidity and mortality. Patients with long bone fractures have been reported to have a 2.35-fold higher risk of ARDS in the early hospital period. The ABG abnormalities have been identified as reliable indicators of trauma severity.[19–23] This study aimed to evaluate the clinical relevance of these parameters in predicting adverse outcomes in patients with isolated DFFs.

Table 3 Association between ABG parameters and ICU admission

Variables	No ICU admission	ICU admission	*p*- value*
pH upon admission			
< 7.35	6	8	**0.038****
7.35–7.45	29	9	
> 7.45	1	2	
pH at 24 hours			
< 7.35	6	8	**0.006****
7.35–7.45	17	8	
> 7.45	1	1	
HCO_3^- upon admission (mEq/L)			
< 22	14	10	0.636
22–26	17	9	
> 26	4	1	
HCO_3^- at 24 hours (mEq/L)			
< 22	7	12	**0.004****
22–26	23	5	
> 26	6	2	
PCO_2 upon admission (mmHg)			
< 35	3	6	0.052
35–45	29	11	
> 45	5	1	
PCO_2 at 24 hours (mmHg)			
< 35	4	7	**0.046****
35–45	30	10	
> 45	2	2	
PO_2 upon admission (mmHg)			
< 83	18	13	**0.039****
83–108	13	1	
> 108	5	5	
PO_2 at 24 hours (mmHg)			
< 83	3	11	**0.001****
83–108	32	4	
> 108	1	4	
Base upon admission (mmol/L)			
Base deficit (< −2.0)	13	10	0.261
Normal (−2.0– + 2.0)	23	7	
Base excess (> 2.0)	1	1	
Base at 24 hours (mmol/L)			
Base deficit (< −2.0)	10	12	0.053
Normal (−2.0– + 2.0)	24	7	
Base excess (> 2.0)	1	1	

(*Continued*)

Table 3 (*Continued*)

Variables	No ICU admission	ICU admission	*p*- value*
LA upon admission (mmol/L)			
0.2–1.8	23	7	**0.027****
> 1.8	12	13	
LA at 24 hours (mmol/L)			
0.2–1.8	24	10	0.308
> 1.8	12	9	

Abbreviations: ABG, arterial blood gas analysis; HCO_3^-, bicarbonate; ICU, intensive care unit; LA, serum levels of lactic acid; PCO_2, partial pressure of carbon dioxide; PO_2, partial pressure of oxygen. **Notes:** *Chi-squared test; **statistically significant ($p < 0.05$).

Table 4 Association between ABG parameters and length of hospital stay

Variables	< 10 days stay	≥ 10 days stay	*p*-value*
pH upon admission			
< 7.35	6	8	**0.038****
7.35–7.45	29	9	
> 7.45	1	2	
pH at 24 hours			
< 7.35	6	8	**0.006****
7.35–7.45	17	8	
> 7.45	1	1	
HCO_3^- upon admission (mEq/L)			
< 22	14	10	0.636
22–26	17	9	
> 26	4	1	
HCO_3^- at 24 hours (mEq/L)			
< 22	7	12	**0.004****
22–26	23	5	
> 26	6	2	
PCO_2 upon admission (mmHg)			
< 35	3	6	0.052
35–45	29	11	
> 45	5	1	
PCO_2 at 24 hours (mmHg)			
< 35	4	7	**0.046***
35–45	30	10	
> 45	2	2	
PO_2 upon admission (mmHg)			
< 83	18	13	**0.039****
83–108	13	1	
> 108	5	5	
PO_2 at 24 hours (mmHg)			
< 83	3	11	**0.001****
83–108	32	4	
> 108	1	4	

Table 4 (*Continued*)

Variables	< 10 days stay	≥ 10 days stay	*p*-value*
Base upon admission (mmol/L)			
Base deficit (< −2.0)	13	10	0.261
Normal (−2.0– + 2.0)	23	7	
Base excess (> 2.0)	1	1	
Base at 24 hours (mmol/L)			
Base deficit (< −2.0)	10	12	0.053
Normal (−2.0– + 2.0)	24	7	
Base excess (> 2.0)	1	1	
LA upon admission (mmol/L)			
0.2–1.8	23	7	**0.027****
> 1.8	12	13	
LA at 24 hours (mmol/L)			
0.2–1.8	24	10	0.308
> 1.8	12	9	

Abbreviations: ABG, arterial blood gas analysis; HCO_3^-, bicarbonate; LA, serum levels of lactic acid; PCO_2, partial pressure of carbon dioxide; PO_2, partial pressure of oxygen. **Notes:** *Chi-squared test; **statistically significant ($p < 0.05$).

The lack of correlation between ABG values and demographic or fracture-related variables in this study indicates that adverse outcomes are not determined by age, sex, or fracture type alone. Instead, systemic and metabolic stress responses, reflected in ABG derangements, appear to play a central role in determining clinical progression.

One notable observation was the strong association between SAH and elevated LA levels at both admission and 24 hours. Hypertension is known to cause endothelial dysfunction and microvascular impairment, which may reduce tissue perfusion and delay LA clearance during acute trauma. This finding is consistent with previous studies demonstrating the prognostic impact of LA and perfusion markers in trauma patients.[24,25]

Mohsenian et al.[17] highlighted the prognostic value of ABG indices such as O_2 saturation, base excess, and PCO_2 in trauma patients with femoral and pelvic fractures. In line with their observations, the present study underscores that abnormalities in PO_2, pH, and LA can serve as early warning signs for systemic complications and critical care needs. Although mortality was not observed in this cohort, a decline in oxygenation and metabolic compensation mirrored trends described in previous studies, suggesting that ABG monitoring can provide prognostic information even in isolated fracture cases.

Interestingly, hypocapnia rather than hypercapnia was observed in association with adverse outcomes. This likely reflects compensatory hyperventilation in response to metabolic acidosis. Clinically, this finding is important because hypocapnia may mask the severity of metabolic stress if interpreted in isolation. Recognizing this compensatory mechanism is essential, as it may identify patients at high risk of deterioration despite apparently normal ventilation parameters.[26] Ross et al.[27] previously demonstrated that severe acidosis (pH < 7.0) correlates with poor outcomes, and our findings reinforce the concept that even milder derangements in pH (< 7.35) should not be overlooked in trauma care.

Prior studies have emphasized the prognostic value of LA and base deficit in trauma patients. Ward et al.[28] demonstrated significantly poorer survival among patients with elevated LA or base deficit on arrival, while Oladipo et al.[29] linked these elevations to postoperative morbidity and prolonged hospitalization in orthopedic trauma. These observations align with the present findings, where elevated LA and impaired acid–base balance were predictive of adverse outcomes and prolonged hospital stay.

The high incidence of inapparent hypoxemia, particularly TD, further highlights the subclinical respiratory complications that accompany long bone fractures. Rosenkrantz et al.[30] documented similar patterns, attributing them to FES, microvascular plugging, and inflammatory responses. This underlines the importance of routine oxygen monitoring and serial ABG assessments in seemingly stable fracture patients.

Taken together, these findings suggest that ABG analysis is not merely a laboratory adjunct but a clinically relevant tool for early risk stratification in femoral fractures. Persistent derangements in pH, LA, and PO_2 reflect inadequate tissue oxygenation and impaired compensatory mechanisms, which can guide decisions on ICU monitoring, aggressive resuscitation, and complication surveillance.

The present study has limitations. Its retrospective design and modest sample size may limit generalizability. The impact of surgical fixation timing and intramedullary reaming on ABG derangements was not evaluated. Future prospective studies incorporating serial perioperative ABG monitoring may clarify these aspects further.

Conclusion

The ABG values at both admission and 24 hours were found to play a role in the early prediction of adverse outcomes in patients with isolated DFF. Therefore, routine monitoring of ABG parameters is recommended in such patients. Given the retrospective design and limited sample size of this study, future prospective studies with larger cohorts are warranted to validate these findings.

Data Availability

Data will be available upon request to the corresponding author.

Authors' Contributions

DS: conceptualization, methodology, and software; TS: data curation and writing – original draft; AAX: visualization and investigation; LC: software and validation; and SA: writing – review and editing.

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Conflict of Interests

The authors have no conflict of interests to declare.

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