International Journal of Medical and Pharmaceutical Research

Online ISSN-2958-3683 | Print ISSN-2958-3675
Frequency: Bi-Monthly
Available online on: https://ijmpr.in/

Original Article

Impact of Diabetes Mellitus on Clinical Outcomes of Orthopedic Trauma Patients Presenting to the Emergency Department: A Prospective Observational Study

Dr. Midde Srikanth[1], Dr. Kontham Honey[2], Dr. Praveen Kumar Kallem[3]

[1]Assistant Professor, Department of Emergency Medicine, MNR Medical College and Hospital, Fasalwadi, Sangareddy, Telangana, India.
[2]Senior Resident, Department of Orthopedics, Government Medical College, Siddipet, Telangana, India.
[3]Assistant Professor, Department of Orthopedics, MNR Medical College and Hospital, Fasalwadi, Sangareddy, Telangana, India

OPEN ACCESS

Corresponding Author:

Dr. Praveen Kumar Kallem
Assistant Professor, Department of Orthopedics, MNR Medical College and Hospital, Fasalwadi, Sangareddy, Telangana, India

Received: 20-06-2026
Accepted: 09-07-2026
Available online: 24-07-2026

ABSTRACT

Background: Diabetes mellitus is a common metabolic disorder that adversely affects wound healing, immune function, and fracture repair, potentially leading to poorer outcomes following orthopedic trauma. Limited prospective data from Indian emergency departments are available regarding its influence on clinical outcomes in trauma patients. This study was designed to evaluate the impact of diabetes mellitus on clinical outcomes among orthopedic trauma patients.
Materials and Methods: A prospective observational study was conducted among 122 adult orthopedic trauma patients presenting to the Emergency Department. Patients were categorized into diabetic (n=61) and non-diabetic (n=61) groups. Demographic characteristics, injury profile, laboratory parameters, emergency management, in-hospital complications, length of hospital stay, and functional outcomes were compared. Multivariable logistic regression and receiver operating characteristic (ROC) curve analyses were performed to determine independent predictors and diagnostic performance of selected biomarkers.
Results: Diabetic patients were significantly older and had higher rates of hypertension, chronic kidney disease, and ischemic heart disease ($P<0.05$). Admission random blood glucose, HbA1c, leukocyte count, serum creatinine, and C-reactive protein were significantly higher, whereas haemoglobin and serum albumin were significantly lower in diabetic patients ($P<0.05$). Wound infection (23.0% vs. 9.8%; $P=0.031$), delayed wound healing (14.8% vs. 4.9%; $P=0.045$), hospital stay (11.8±5.9 vs. 8.3±4.2 days; $P=0.001$), and poorer functional outcomes were significantly more common among diabetic patients. Diabetes mellitus (adjusted OR=2.21), age >60 years, open fractures, HbA1c ≥8%, Injury Severity Score >16, and serum albumin <3.5 g/dL independently predicted adverse clinical outcomes. Serum lactate demonstrated the highest predictive accuracy (AUC=0.84).
Conclusion: Diabetes mellitus significantly increases the risk of complications and delays recovery following orthopedic trauma. Early identification of high-risk patients, optimization of glycaemic control, nutritional assessment, and multidisciplinary management may improve clinical outcomes and reduce morbidity in emergency orthopedic practice.

***Keywords**: Diabetes mellitus, Orthopedic trauma, Fracture healing, Clinical outcomes, Hospital stay, Functional recovery.*

INTRODUCTION

Orthopedic trauma represents one of the leading causes of emergency department visits worldwide and contributes substantially to morbidity, disability, healthcare expenditure, and mortality. Road traffic accidents, falls, sports-related injuries, and occupational trauma are the predominant causes of musculoskeletal injuries requiring urgent evaluation and intervention. Although advances in trauma systems and surgical management have improved survival, patient-related factors such as advanced age, diabetes mellitus, obesity, and other chronic medical conditions continue to influence clinical outcomes following orthopedic trauma. Early identification of high-risk patients is therefore essential for optimizing treatment strategies and improving prognosis (1, 2).

Diabetes mellitus (DM) is one of the most prevalent chronic non-communicable diseases globally, affecting more than 530 million adults, with India accounting for one of the largest diabetic populations. Chronic hyperglycaemia is associated with microvascular and macrovascular complications, impaired immune function, endothelial dysfunction, neuropathy, and delayed tissue repair. These pathophysiological changes adversely affect fracture healing and increase susceptibility to postoperative complications, particularly in patients sustaining traumatic musculoskeletal injuries (3-5). Several studies have demonstrated that diabetic patients experience higher rates of wound infection, delayed union, non-union, implant-related complications, prolonged hospitalization, and increased healthcare utilization following orthopedic procedures. Hyperglycaemia impairs osteoblast differentiation, collagen synthesis, angiogenesis, and inflammatory regulation, all of which are fundamental to fracture healing. In addition, diabetes is frequently accompanied by hypertension, chronic kidney disease, obesity, and cardiovascular disorders that further complicate peri-traumatic management and recovery (6-9).

Emergency physicians and orthopedic surgeons are increasingly challenged by the growing number of trauma patients with diabetes presenting to tertiary care hospitals. Early recognition of diabetes-related risk factors at the time of admission may facilitate timely glycaemic optimization, infection prevention, multidisciplinary care, and individualized treatment planning. Biomarkers such as admission random blood glucose, glycated haemoglobin (HbA1c), serum lactate, and serum albumin have emerged as potential predictors of adverse outcomes in trauma patients and may improve early risk stratification when combined with established clinical assessment tools (10-12).

Despite growing evidence from developed countries, there remains limited prospective data from Indian tertiary-care emergency departments evaluating the influence of diabetes mellitus on clinical outcomes among orthopedic trauma patients. Regional variations in patient demographics, injury patterns, healthcare accessibility, and comorbidity profiles necessitate institution-specific evidence to guide clinical decision-making.

Therefore, the present study was undertaken to evaluate the impact of diabetes mellitus on clinical outcomes among orthopedic trauma patients presenting to the Emergency Department.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in the Department of Emergency Medicine in collaboration with the Department of Orthopaedics at MNR Medical College and Hospital, Sangareddy, Telangana, India from January 2025 to March 2026. The written informed consent was obtained from all eligible participants or their legally authorized representatives before enrolment after obtained prior approval from the institutional ethic committee. A total of 122 consecutive adult patients presenting to the Emergency Department with acute orthopedic trauma requiring evaluation and management.

Inclusion Criteria: Patients aged ≥18 years, with acute orthopedic trauma within 24 hours of injury, radiologically confirmed fractures, dislocations, major musculoskeletal injuries requiring emergency orthopedic evaluation and patients willing to provide written informed consent.

Exclusion Criteria: Patients <18 years of age, pathological fractures secondary to malignancy, metabolic bone disease, polytrauma patients with severe traumatic brain injury, major thoracoabdominal injuries requiring immediate transfer to other specialties, with chronic osteomyelitis, pre-existing musculoskeletal infections, pregnancy, patients who declined consent or were lost before completion of in-hospital follow-up

Patients were categorized into two groups based on the status of diabetes mellitus. Group A with diabetes patients and group B with non-diabetic patients. Diabetes mellitus was defined as a previously diagnosed condition receiving treatment with oral hypoglycaemic agents or insulin, or newly diagnosed diabetes based on admission blood glucose levels and glycated haemoglobin (HbA1c) according to the current diagnostic criteria. Following admission to the Emergency Department, all eligible patients underwent a standardized clinical evaluation. Demographic characteristics and associated medical comorbidities such as hypertension, ischemic heart disease, chronic kidney disease, and peripheral vascular disease were recorded. Details of injury including mechanism of trauma, time from injury to hospital presentation, mode of transport, type of fracture (open or closed), anatomical site involved, Injury Severity Score (ISS), and Gustilo-Anderson classification for open fractures were documented. Baseline vital signs including heart rate, systolic and diastolic blood pressure, respiratory rate, oxygen saturation, temperature, and Shock Index were recorded at presentation.

Patients underwent routine laboratory investigations comprising complete blood count, random blood glucose, fasting blood glucose (when feasible), HbA1c, serum electrolytes, renal function tests, liver function tests, serum albumin, C-reactive protein (CRP), and serum lactate where clinically indicated. Radiological evaluation included plain radiographs of the affected region, while computed tomography (CT) or magnetic resonance imaging (MRI) was performed when indicated for complex injuries.

Diabetic status was confirmed using previous medical records, medication history, admission blood glucose levels, and HbA1c estimation. Glycaemic control among diabetic patients was categorized as good (HbA1c <7.0%), moderate (7.0–8.9%), or poor (≥9.0%).

All patients received emergency management according to institutional Advanced Trauma Life Support (ATLS)-based protocols, including pain management, immobilization, wound care, tetanus prophylaxis, antibiotic administration for open fractures, fluid resuscitation, and definitive orthopedic intervention as indicated. The decision regarding conservative management or surgical treatment was made by the attending orthopedic surgeon according to standard clinical guidelines.

Statistical Analysis

The collected data were extracted into Microsoft Excel sheet and analyzed using SPSS v.26.0. Continuous variables were presented as mean and standard deviation (SD). Categorical variables were represented as frequencies and percentages. Comparisons between study groups were performed using the independent samples Student's *t*-test for normally distributed continuous variables and the Mann Whitney *U* test for non-normally distributed variables. The Chi-square test was used to compare categorical variables as appropriate. Univariate logistic regression analysis was initially performed to identify variables associated with adverse clinical outcomes. ROC curve analysis was performed to evaluate the predictive performance of admission blood glucose and HbA1c for wound infection and prolonged hospital stay. Statistical significance was defined as a p-value <0.05.

RESULTS

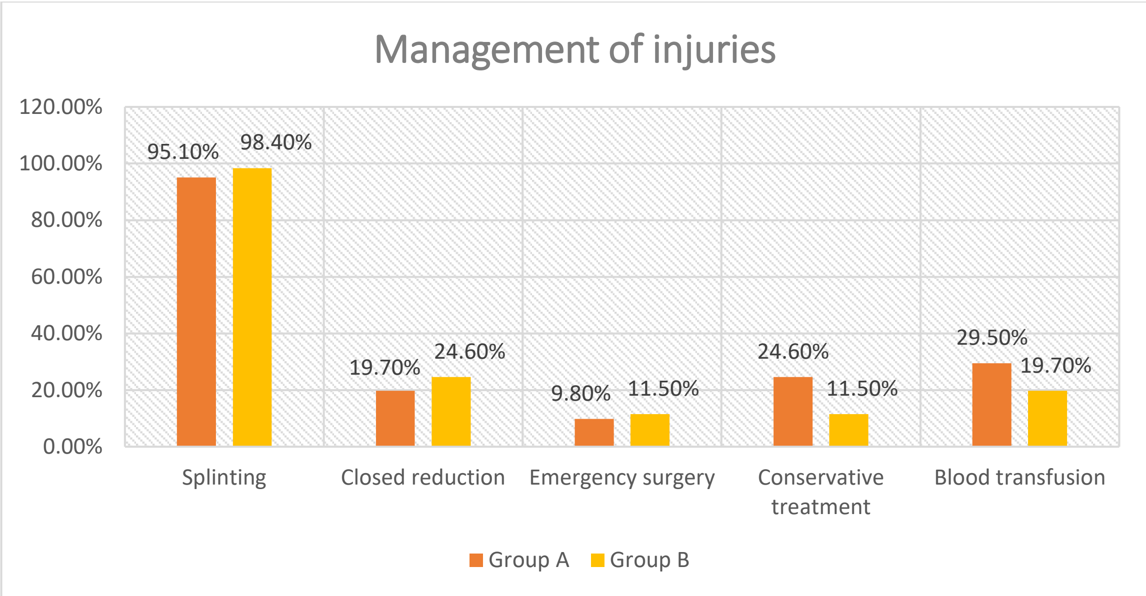
Table 1: Demographic and clinical characteristics of the study population (n=122)

Variable	Group A (n=61)	Group B (n=61)	p-value
Mean age (years)	56.6±13.1	42.6±15.0	0.001
Gender			
Male	41 (67.2%)	43 (70.5%)	0.69
Female	20 (32.8%)	18 (29.5%)	
BMI (kg/m²),	28.6±4.3	24.7±3.7	0.001
Hypertension	28 (45.9%)	17 (27.9%)	0.036
Chronic Kidney Disease	9 (14.8%)	3 (4.9%)	0.044
Ischemic Heart Disease	12 (19.7%)	5 (8.2%)	0.048
Smoking	18 (29.5%)	16 (26.2%)	0.70
Alcohol consumption	15 (24.6%)	12 (19.7%)	0.53
Mode of injury			
Road traffic accident	38 (62.3%)	36 (59%)	0.71
Fall from standing height	12 (19.7%)	27 (22.1%)	0.52
Fall from height	6 (9.8%)	6 (9.8%)	1.00
Sports injury	3 (4.9%)	5 (4.1%)	0.65
Assault	2 (3.3%)	4 (3.3%)	1.00
Pattern of orthopedic injuries			
Femur fracture	16 (16.2%)	13 (21.3%)	0.51
Tibia/Fibula fracture	18 (29.5%)	17 (27.9%)	0.83
Radius/Ulna fracture	9 (14.8%)	11 (18%)	0.59
Humerus fracture	6 (9.8%)	6 (9.8%)	1.00
Hip fracture	6 (9.8%)	4 (6.6%)	0.53
Pelvic fracture	3 (4.9%)	5 (8.2%)	0.45
Shoulder dislocation	2 (3.3%)	3 (4.9%)	0.65
Time to surgery	33.2±16.9	28.1±14.7	0.07

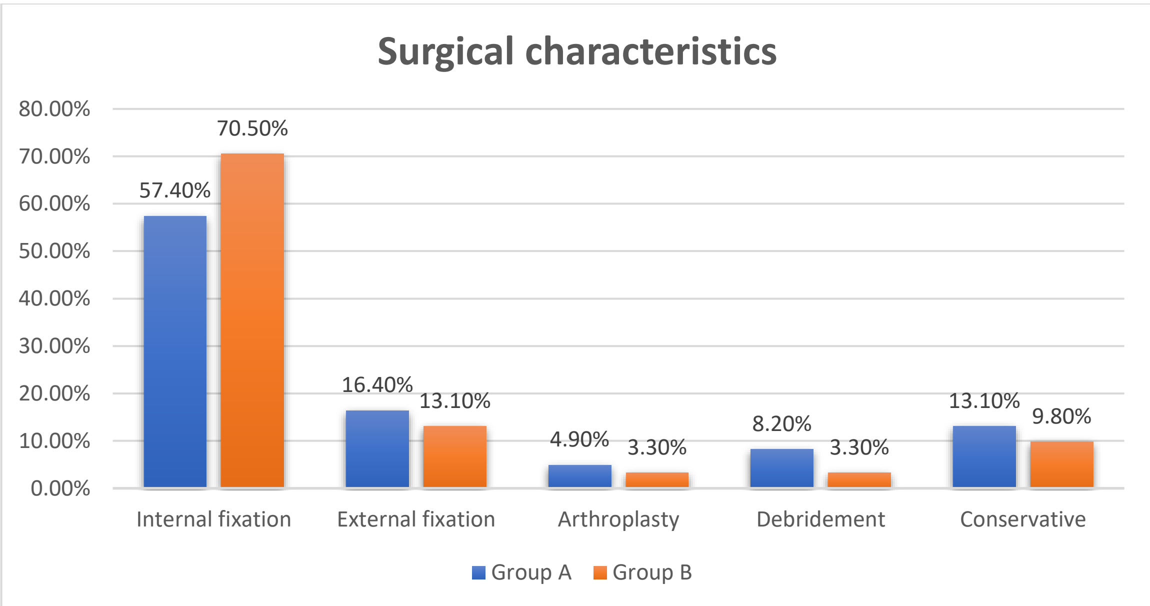
Table 2: Clinical presentation and laboratory investigations among study groups.

Variable	Group A	Group B	P-value
Clinical presentation			
Time to hospital (hours)	3.4±1.8	2.9±1.6	0.11
Shock Index	0.89±0.22	0.82±0.19	0.06

Systolic blood pressure	126.8±18.6	128.7±17.5	0.56
Heart rate	98.6±16.0	94±14.6	0.11
Glasgow Coma Scale	14.1±1.6	14.4±1.3	0.24
Injury Severity Score	17.3±7.2	15.4±6.3	0.11
Laboratory investigations			
Random Blood Sugar (mg/dl)	186.4±57.6	104.7±22.8	0.001
HbA1c (%)	8.1±1.7	5.6±0.6	0.001
Haemoglobin (g/dl)	11.6±1.8	12.3±1.7	0.03
Total Leukocyte Count (x10^3/µL)	11.8±3.2	10.1±2.8	0.002
Serum Creatinine (mg/dL)	1.02±0.32	0.83±0.18	0.001
Serum Albumin (g/dL)	3.4±0.5	3.8±0.4	0.001
C-reactive protein (mg/L)	22.6±17.1	15.2±12.3	0.001



Graph 1: Emergency department management



Graph 2: Surgical characteristics

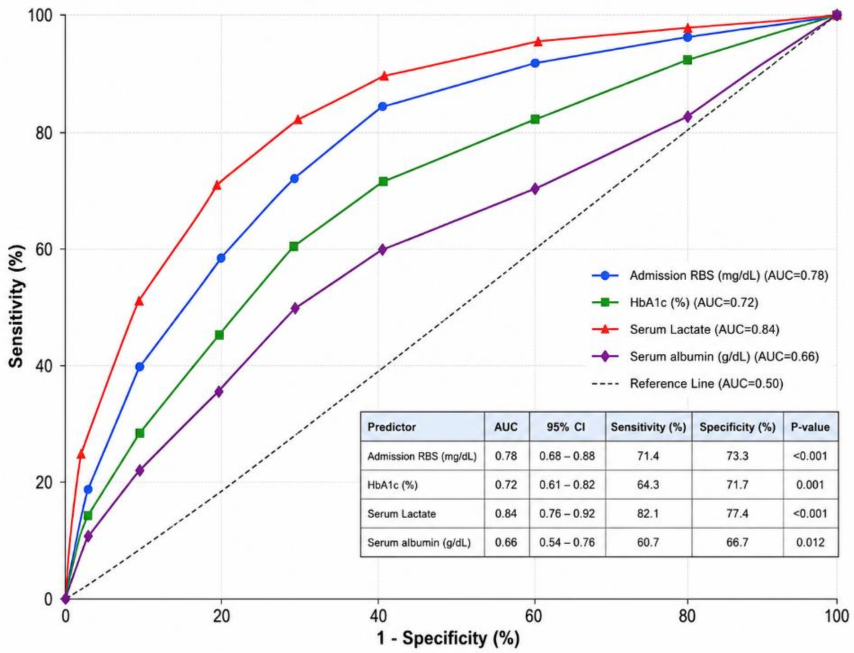
Table 3: Details of in-hospital complications and hospital stay and functional outcome.

Complication	Group A	Group B	p-value
In-hospital complications			
Wound infection	14 (23%)	6 (9.8%)	0.031

Delayed healing	9 (14.8%)	3 (4.9%)	0.045
Sepsis	6 (9.8%)	2 (3.3%)	0.26
Acute kidney injury	5 (8.2%)	1 (1.6%)	0.09
Deep vein thrombosis	4 (6.6%)	2 (3.3%)	0.67
ICU admission	11 (18%)	5 (8.2%)	0.07
Re-operation	6 (9.8%)	2 (3.3)	0.26
In hospital mortality	2 (3.3%)	1 (1.6%)	1.00
Details of hospital stay			
Mean hospital stay (days)	11.8±.9	8.3±4.2	0.001
ICU stay (Days)	2.6±2.1	1.4±1.3	0.001
Functional outcome at discharge			
Independent ambulation	25 (41%)	39 (63.9%)	0.018
Walking with support	24 (39.3%)	16 (26.2%)	0.103
Wheelchair dependent	8 (13.1%)	4 (6.6%)	0.28
Bed ridden	4 (6.6%)	2 (3.3%)	0.41
Barthel Index	71.2±18	82.6±14.9	0.001

Table 4: Multivariate logistic regression analysis for predictors of poor clinical outcome.

Variable	**Adjusted OR**	**95% CI**	**p-value**
Diabetes mellitus	2.21	1.01-4.83	0.047
Age >60 years	2.45	1.15-5.21	0.020
Open fracture	2.88	1.32-6.26	0.008
HbA1c ≥8%	2.62	1.22-5.59	0.013
ISS >16	2.19	1.04-4.58	0.039
Serum Albumin <3.5 g/dL	2.76	1.29-5.93	0.009



Graph 3: ROC curve analysis for predictors of poor clinical outcome.

DISCUSSION

In the present study, diabetic patients had a significantly higher mean age than non-diabetic patients (56.6±13.1 vs 42.6±15.0 years; P=0.001). Similar observations have been reported by Richards et al., who found that diabetic trauma patients were generally older and had a higher prevalence of cardiovascular and renal comorbidities, contributing to increased perioperative risk and postoperative complications (10). Diabetes is frequently associated with hypertension, chronic kidney disease, ischemic heart disease, and obesity, all of which adversely affect physiological reserve and fracture recovery (4, 5). Our findings of significantly higher rates of hypertension, chronic kidney disease, and ischemic heart disease among diabetic patients support these previous reports.

Although the mechanism and anatomical distribution of injuries were comparable between diabetic and non-diabetic patients, laboratory investigations demonstrated marked metabolic and inflammatory differences. Diabetic patients exhibited significantly higher admission random blood glucose, HbA1c, leukocyte counts, serum creatinine, and C-reactive protein levels, together with lower haemoglobin and serum albumin concentrations. Hyperglycaemia promotes oxidative stress, endothelial dysfunction, impaired neutrophil chemotaxis, and dysregulated inflammatory responses, thereby increasing susceptibility to infection and delaying tissue repair. Experimental studies have shown that chronic hyperglycaemia suppresses osteoblast activity while enhancing osteoclast-mediated bone resorption, ultimately impairing fracture healing (8, 9).

Emergency department management and definitive surgical procedures were broadly similar between the two groups, suggesting that differences in outcome were primarily attributable to patient-related biological factors rather than variations in treatment. However, diabetic patients required blood transfusion more frequently and experienced a longer interval to definitive surgery, although the latter did not reach statistical significance. Previous studies have likewise demonstrated that optimization of glycaemic status and associated medical comorbidities may delay operative intervention but is often necessary to reduce perioperative complications (11).

One of the most important findings of the present study was the significantly higher incidence of wound infection and delayed wound healing among diabetic patients. The wound infection rate was more than twice that observed in non-diabetic patients (23% vs 9.8%), while delayed healing occurred in 14.8% and 4.9% of patients, respectively. Similar findings have been reported in several orthopedic studies, where diabetes increased the risk of surgical-site infection by two- to three-fold (6). Hyperglycaemia impairs leukocyte phagocytic activity, collagen synthesis, angiogenesis, and fibroblast proliferation, resulting in delayed soft tissue repair and increased bacterial colonization (7, 13). Although higher rates of sepsis, acute kidney injury, ICU admission, and re-operation were also observed in diabetic patients, these differences were not statistically significant, possibly because of the relatively modest sample size.

Hospital resource utilization was substantially greater among diabetic patients. Mean hospital stay and ICU stay were significantly longer than those of non-diabetic patients, consistent with previous reports demonstrating prolonged hospitalization and increased healthcare costs associated with diabetes following trauma (14). Longer hospitalization may reflect slower wound healing, increased infection rates, medical optimization, and rehabilitation requirements. Functional recovery was also inferior in diabetic patients, as evidenced by lower rates of independent ambulation and significantly reduced Barthel Index scores at discharge. Diabetes-related peripheral neuropathy, impaired muscle strength, delayed fracture union, and chronic vascular insufficiency likely contribute to delayed mobilization and poorer rehabilitation outcomes (3).

The multivariable logistic regression analysis identified diabetes mellitus, age greater than 60 years, open fractures, HbA1c ≥8%, Injury Severity Score >16, and serum albumin <3.5 g/dL as independent predictors of poor clinical outcome. These findings agree with earlier investigations showing that poor pre-injury glycaemic control and hypoalbuminemia independently increase the likelihood of postoperative infection, delayed healing, prolonged hospitalization, and mortality (15, 16). The ROC analysis further suggested that serum lactate demonstrated the greatest predictive accuracy for adverse outcomes, followed by admission blood glucose and HbA1c, indicating that combining metabolic and injury related biomarkers may improve early risk stratification in emergency settings.

CONCLUSION

Diabetes mellitus was associated with significantly poorer clinical outcomes among orthopedic trauma patients presenting to the emergency department. Diabetic patients exhibited higher rates of wound infection, delayed wound healing, prolonged hospital stay, and poorer functional recovery compared with non-diabetic patients. Advanced age, open fractures, poor glycaemic control, higher injury severity, and hypoalbuminemia were identified as independent predictors of adverse outcomes. These findings emphasize the importance of early risk stratification, optimal glycaemic control, prompt multidisciplinary management, and nutritional optimization to minimize complications and improve recovery. Larger multicenter studies with long-term follow-up are warranted to validate these findings and guide evidence-based trauma care.

REFERENCES

1. Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. Injury. 2006;37(8):691-697.
2. Haagsma JA, Graetz N, Bolliger I, et al. The global burden of injury: incidence, mortality, disability-adjusted life years and time trends from the Global Burden of Disease study 2013. Inj Prev. 2016;22(1):3-18.
3. Magliano DJ, Boyko EJ; IDF Diabetes Atlas 10th edition scientific committee. IDF DIABETES ATLAS [Internet]. 10th edition. Brussels: International Diabetes Federation; 2021. Available from: https://www.ncbi.nlm.nih.gov/books/NBK581934/
4. American Diabetes Association Professional Practice Committee. 2. Diagnosis and Classification of Diabetes: Standards of Care in Diabetes-2024. Diabetes Care. 2024;47(Suppl 1): S20-S42.

5. Brownrigg JRW, Davey J, Holt PJ, Davis W, Thompson MM, Ray KK et al. The association of ulceration of the foot with cardiovascular and all-cause mortality in patients with diabetes: a meta-analysis. Diabetologia. 2012; 55:2906-2912.
6. Loder RT. The influence of diabetes mellitus on the healing of closed fractures. Clinical Orthopaedics and Related Research. 1988;(232):210-216.
7. Marhoffer W, Stein M, Maeser E, Federlin K. Impairment of polymorphonuclear leukocyte function and metabolic control of diabetes. Diabetes Care. 1992;15(2):256-260.
8. Kayal RA, Tsatsas D, Bauer MA, et al. Diminished bone formation during diabetic fracture healing is related to the premature resorption of cartilage associated with increased osteoclast activity. J Bone Miner Res. 2007;22(4):560-568.
9. Jiao H, Xiao E, Graves DT. Diabetes and Its Effect on Bone and Fracture Healing. Curr Osteoporos Rep. 2015;13(5):327-335.
10. Richards JE, Kauffmann RM, Zuckerman SL, Obremskey WT, May AK. Relationship of hyperglycemia and surgical-site infection in orthopaedic surgery. J Bone Joint Surg Am. 2012;94(13):1181-1186.
11. Mraovic B, Suh D, Jacovides C, Parvizi J. Perioperative hyperglycemia and postoperative infection after lower limb arthroplasty. J Diabetes Sci Technol. 2011;5(2):412-418.
12. Dunne JR, Tracy JK, Scalea TM, Napolitano LM. Lactate and base deficit in trauma: does alcohol or drug use impair their predictive accuracy? J Trauma. 2005;58(5):959-966.
13. Jeffcoate WJ, Harding KG. Diabetic foot ulcers. Lancet. 2003;361(9368):1545-1551.
14. Ries Z, Rungprai C, Harpole B, et al. Incidence, Risk Factors, and Causes for Thirty-Day Unplanned Readmissions Following Primary Lower-Extremity Amputation in Patients with Diabetes. J Bone Joint Surg Am. 2015;97(21):1774-1780.
15. Mannion JD, Rather A, Manifold S, et al. Postoperative Hyperglycemia in Patients with and without Diabetes After Major Joint Replacement: The Impact of an Enhanced Glucose Management Program. JB JS Open Access. 2021;6(3): e20.00172.
16. Koval KJ, Skovron ML, Aharonoff GB, Zuckerman JD. Predictors of functional recovery after hip fracture in the elderly. Clin Orthop Relat Res. 1998;(348):22-28.