Stress-induced hyperglycaemia in elective long bone fracture fixation and the risk of surgical sites infection

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ABSTRACT

Background: Stress-induced hyperglycaemia (SIH) is linked to poor outcomes in surgical patients, including those undergoing orthopaedic procedures. Despite this, data on the frequency of SIH and its association with surgical site infection (SSI) in elective orthopaedic surgery is limited in our setting. This study aimed to determine the frequency of SIH in patients undergoing elective long bone fracture fixation and assess its relationship with SSI. **Methodology:** A prospective cohort study was conducted from April 2021 to March 2022 involving 50 adult patients undergoing elective long bone fracture fixation. Random blood sugar (RBS) was measured peri-operatively: after anaesthesia induction, at wound closure, and on post-operative days (POD) 1, 2, and 5. Patients were categorized into normoglycaemia and SIH groups. Wounds were inspected on POD 5 and weekly until the 4th postoperative week. Data were analysed using SPSS version 20. **Results:** SIH was observed in 10% of patients. The mean RBS associated with increased SSI risk was 112.8±22.1mg/dl. Mean RBS values were 102.4±13.0 (pre-op), 162.7±31.8 (intra-op), and 190.2±42.5mg/dl (POD 1–2), with significant differences between SIH and normoglycaemic groups (p=0.00). There was no significant difference in mean RBS on the operative day (p=0.58) or POD 5 (p=0.61). A strong correlation between elevated glucose and SSI was found. Conclusion: SIH occurred in 10% of cases. A mean RBS of 112.8mg/dl was linked to higher SSI risk. Blood glucose peaked by POD 2, but remained elevated in those who developed infections.

Keywords: Stress, Hyperglycaemia, Surgery, Infection.

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INTRODUCTION

Stress-induced hyperglycaemia (SIH) has been well-documented in critically ill and polytraumatized patients, where it is linked to increased morbidity and mortality. SIH refers to elevated blood glucose levels in response to physiological stress, such as surgery, trauma or infection, in patients without a prior history of diabetes mellitus [1]. Although much of the literature focuses on intensive care or emergency surgical settings, there is a paucity of data on SIH in elective orthopaedic procedures, particularly long bone fracture fixation.

Surgery induces a controlled form of trauma that activates the hypothalamic-pituitary-adrenal axis; leading to increased secretion of catecholamines, cortisol, and glucagon. These hormonal changes oppose insulin action, contributing to insulin resistance and hyperglycaemia via glycogenolysis, proteolysis, and lipolysis. In orthopaedic practice, SIH can impair immune function, compromise wound healing, and serve as a substrate for bacterial growth [1,2].

Mansour et al., and Belmonte et al, [3,4] found that persistent perioperative hyperglycaemia ≥150 mg/dl significantly increased the risk of surgical site infections [SSI] in non-diabetic patients. Similar findings were reported in both stable and critically ill orthopaedic trauma populations. Though elective procedures involve better metabolic control and fluid optimization, glucose-containing intravenous fluids used post-operatively may exacerbate hyperglycaemia and increase SSI risk [2,5].

SSI is a serious complication in orthopaedic surgery, ranging from superficial to deep or implant-related infections, with potentially life-long consequences. Despite existing infection control strategies—like aseptic technique, preoperative screening, and prophylactic antibiotics, SIH remains an underappreciated modifiable risk factor. Monitoring and managing perioperative glucose may thus enhance surgical outcomes in non-diabetic orthopaedic patients [6,7].

Despite clear evidence linking SIH to SSI, no definitive peri-operative prevention guidelines exist for non-diabetic patients in Nigeria and much of sub-Saharan Africa [8–10]. While structured protocols for SIH management are well established in trauma and critical illness in high-income countries, elective surgical populations remain largely overlooked. As a result SIH continued to be under-recognised and insufficiently prevented in elective orthopaedic practice globally [1,6,11,12]. The aim of this study is to evaluate perioperative stress-induced hyperglycaemia in non-diabetic patients and its correlation with surgical site infection following elective long bone fracture fixation. This will be achieve by: the determination of mean random blood glucose levels pre-, peri-, and post-operatively on post-operative days (POD) 1, 2, and 5; determination of the mean blood glucose level at which SSI risk is increased and assessment of the relationship between perioperative blood glucose levels and the presence or absence of wound infection.

MATERIALS AND METHODS

Study design and location

This was a prospective, hospital-based quantitative cohort study conducted from April 2021 to March 2022 at the Ife Hospital Unit and Wesley Guild Hospital Unit, Ilesa—both part of the Obafemi Awolowo University Teaching Hospitals Complex (OAUTHC), Ile-Ife, Osun State, Nigeria.

Ethical consideration

Ethical approval was obtained from the Ethics and Research Committee of OAUTHC (OAUTHC/ERC/2021/02/02). All procedures followed the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to enrolment. Patients who declined participation received standard care without prejudice. The study was funded by the author and supported by the residency training of the federal government of Nigeria.

Sample size

Altogether, 50 consenting non-diabetic patients, aged 18 years and above, scheduled for elective internal fixation of closed long bone fractures (femur, tibia, fibula, humerus, radius and ulna) or aseptic non-unions, were recruited. Patients with diabetes, emergency fracture fixation, open fractures, immunosuppressive conditions, chronic alcohol/tobacco use, or a family history of diabetes were excluded. The sample size was calculated using the Leslie-Kish formula,

$$n = \frac{Z^2pq}{d^2}$$

Where;

n = the minimum sample size

Zα = Standard normal deviate of α at 95% confidence level (i.e. probability of making a type 1 error) = 1.96.

p = Expected proportion of SIH in the population based on previous studies or pilot studies (3%= 0.03)(13).

q = 1 – p (1-0.03=0.97)

d = Absolute error or precision – (precision of 95% will be used for this study).

Hence,

$$n = \frac{1.96^2 \text{ x}(0.03 \text{ x}(1-0.03))}{0.05^2} = \frac{3.8416 \text{ x}0.03 \text{ x } 0.97}{0.0025} = \frac{0.1179056}{0.0025} = 44.71$$

Where the minimum expected response is 90% (allowing for 10% loss to follow-up)

$$\frac{N}{0.9} = \frac{44.71}{0.9} = 49.67 \simeq 50.$$

The estimated sample size for this study is 50.

Pre-operative screening

All participants underwent pre-operative diabetic screening (fasting blood sugar [FBS], and two-hour post-prandial glucose), and infection screening using full blood count and erythrocyte sedimentation rate. Eligible patients were fasted overnight or for at least six hours prior to surgery. Waist circumference was measured a day before surgery.

Peri-operative blood glucose monitoring

Patient's FBS was measured between 7:00 and8:00 a.m. on the day of surgery, while the RBS Rwas checked at five perioperative points: at anaesthesia induction, at wound closure, and on post-operative days (POD) 1, 2, and 5 using a validated Finetest glucometer via a sterile finger prick of the thumb or middle finger. Hyperglycaemia was defined as RBS ≥200 mg/dL on two occasions or FBS ≥125 mg/dL.

Participants were divided into two groups:

- **Group A:** Normoglycaemic
- **Group B:** Stress-Induced Hyperglycaemia (SIH)

Surgical procedure and post-operative care

All surgeries followed departmental aseptic protocols derived from World Health Organisation (WHO) SSI guidelines, 2018 [14]. Prophylactic intravenous cefuroxime was administered at induction, and intra-operative blood loss was visually estimated. Post-operative care involved antibiotics for 48–72 hours, appropriate analgesia, and intravenous fluids. Patients' wounds were inspected on POD 5 and weekly thereafter for four weeks to assess for signs of early surgical site infection (SSI), using the Southampton Wound Grading System [15].

Data analysis

Data were analysed using **SPSS version 20** (IBM Corp., Armonk, NY, 2011). Descriptive statistics were used to summarise patient demographics and clinical characteristics. The incidence of SIH was expressed as a percentage of the total population. Mean RBS values were calculated for the entire cohort and the two subgroups (normoglycaemic and SIH).

The relationship between perioperative blood glucose levels and the development of SSI was assessed. Specifically:

- The mean RBS of patients with SSI in the SIH group was compared to those in the normoglycaemic group using the Student's t-test**.**
- The correlation between RBS and SSI was analysed using the Pearson's correlation coefficient.

Results were presented in words and tables.

RESULTS

Fifty patients were recruited for this study, and all completed the study. Patients' demographic distribution were shown in Table 1. The male: female ratio was 2: 1. Age range of the study population was between 18years and 99years and the mean age was 49.3±20.1 years. A total of 61 long bone fractures were managed surgically in this study. The distribution of site of injuries was displayed on Table 2. There was no co-morbid condition in 72% of the study population while 22% had hypertensive heart disease (HHD). Three of this HHD patients developed SIH and a further 3 of these HHD group developed SSI. But only one patient with HHD and SIH developed SSI. The incidence of SIH in this study was 10% (5 participants). The male-female ratio of SIH was 4:1, (t=0.775, p=0.495) which was not statistically significant.

SIH occurred in 5 of 41 patients who had sub-arachnoid block and none in the 3 patients who had general anaesthesia and 6 patients who had regional block. Also, SIH occurred in 3 patients who had estimated blood loss (EBL) less than 500millilitres and in 2 patients with EBL greater than 1500mls. No SIH in patients who had EBL 500 – 1500mls. Three patients developed SIH out of 36 who had single fracture fixation. While two patients had SIH out of the 9 patients who had two or more fractures fixation at surgery. Forty percent of cases of SIH occurred in patients whose surgeries lasted for more than 3hours. Otherwise, SIH occur with the same frequency(20%) in the groups with duration of surgery lasting ≤1hour; 1-2hours or 2-3hours.

The mean pre-operative RBS in this study was- FBS=96.3±12.7mg/d, 2HPP=108.4±13.4mg/dl; while the mean peri-operative RBS was- FBS=96.1±13.4mg/dl, RBS at induction of anaesthesia=105.9±27.4mg/dl, RBS at wound closure=123.3±54.6mg/dl and the mean post-operative RBS was- POD1=147.4+72.4mg/dl, POD2=127.6+36.7mg/dl and POD5=105.5+18.5mg/dl. There was a consistent increase in mean RBS from pre-operative phase, through the peri/intraoperative phase, to the first post-operative day. The highest peri-operative RBS was attained on POD1. Subsequently, there was a decline in the mean random blood glucose from POD 2 to POD 5. There was statistically significant difference in the group mean RBS of the pre-, peri- and post-operative groups as illustrated in Figure 1. One-way anova (Table 3) showed significance difference (F= 75.454; p= 0.000) among the means of the pre-operative, peri-operative and post-operative blood glucose. Post hoc analysis of variance (Table 4) of the mean blood glucose of the pre-operative, peri-operative and post-operative groups consistently showed significance difference (p- 0.000) among the groups. Similar difference was observed between the pre-operative group and post-operative group mean blood glucose. Significant difference (p=0.001) was also found between the intra-operative and post-operative mean blood glucose levels.

The Mean RBS for SSI risk is 112.8±22.1mg/dl in this study. Two (40%) out of the five SIH cases developed SSI. This is comparable to 37.8% of the normoglycaemic cases that developed SSI. This is due to the lower mean RBS level for the risk of SSI observed in this study. Moreso we found a positive correlation of r=1,000, p=0.000 between SIH and SSI in this study; whereas there was low but still positive correlation- r = 0.278, p= 0.279, that was not statistically significant between RBS in normoglycaemic group and SSI. This strong correlation may be due to the small size of SIH in this study and the higher cut-off of RBS for SIH. Hence, we did a binary logistic regression analysis which showed that odd ratio of SIH causing SSI was 1.02 with (95% CI: 1.00 – 1.04) and likelihood ratio of 23.90. The relationship was statistically significant (P= 0.042).

DISCUSSION

Stress-induced hyperglycaemia (SIH) refers to transient elevation of blood glucose in patients undergoing acute physiological stress (e.g., trauma, surgery, or sepsis) who have no prior diagnosis or symptoms of diabetes mellitus. SIH is associated with increased post-operative complications, including surgical site infections (SSI), making its identification and control critically important during peri-operative care [1]. This hospital-based prospective cohort study examined 50 adult orthopaedic patients (age ≥18 years) undergoing elective long bone fracture fixation at a tertiary care center. None had a prior diabetes diagnosis or symptomatic hyperglycaemia. SIH was observed in 10% of patients, highlighting a significant clinical concern. Males accounted for 70%, and females 30% in the study. (Table 1). This aligns with earlier findings by Babalola et al. [16] who reported a male-female ratio of 2.8:1 in trauma-related fractures [16]. Interestingly, 80% of patients who developed SIH were male, consistent with Rau et al., findings that males had a higher prevalence of SIH than their female counterparts [17]. In contrast, Hossain et al., found 2:1 male to female ratio of SIH in their study [18], and Al-Hassani et al., found a nearly even distribution of gender in their study [19].

Most of the study participants were within the productive working-age group bracket, as also reported by Onuoha et al., and Hossain et al., [9,18]. Despite theoretical models suggesting greater SIH susceptibility in younger patients due to higher metabolic response to trauma [19], our study found a higher mean age among SIH patients compared to normoglycaemic ones, though the difference was not statistically significant. Plummer et al., and Al-Hassani et al., similarly observed older SIH patients (mean 61.8 ± 17.6 years vs. 56.7 ± 20.0 in normoglycaemics), as did Rau CS et al. [17,19,20]. Belmonte et al., despite reporting overall younger ages (48.8 ± 16.6 in SIH vs. 41.9 ± 16.7 in normoglycaemics), still found that SIH is more frequent in older individuals [4]. Our findings corroborate previous reports from Elsaman et al. [4,10,21], which noted higher SIH prevalence among the 46–60 years age group. The broad sample age range [18–99 years] likely contributed to the relatively higher SIH mean age in comparison with other studies [6,20].

Regarding co-morbidities, about a fifth of our study participants had hypertensive heart disease [HHD] which was significantly lower than 73.8% observed by Hossain et al. [18] whereas Mitiku et al. [21] did not find a significant difference in the contribution of cardiothoracic procedure to post-operative hyperglycaemia in a study conducted in Ethiopia [18,21]. Just about a third of these cohorts developed SIH and SSI respectively in our study. Therefore, HHD was not established as an independent risk factor for SSI in this study. Although, this may be adduced to the optimization of blood pressure prior to surgical intervention in the study, eliminating any confounder effect of HHD on the research outcome. Elsaman, [10] reported SIH in 9.1% of cardiovascular patients, with neurological disease patients facing even higher SIH risk (31.1%), [10]. However, our study did not find a statistically significant association between any co-morbidity and SIH development and this affirms the observation of Hossain et al., and Mitiku et al., who founds no significant difference in co-morbidity in the two groups of patient with or without SIH [18,21].

The mean pre-operative mean fasting blood sugar (FBS) and 2-hour postprandial glucose were within WHO-defined normoglycaemic limits (FBS ≤110 mg/dl; 2HPP ≤140 mg/dl)(22). However, there was a steady rise in peri-operative blood glucose from induction of anaesthesia to POD1 and subsequent decline from POD 2 back to normal glycaemic level by POD 5. Our findings was corroborated by that of Hossain et al., Onuoha et al., and Mansour et al. [3,9,18]. Moreover, we observed persistence of hyperglycaemia in patient who developed SSI.

A significant difference (Tables 2 and 3) existed among pre-, peri- and post-operative RBS groups, reinforcing the need for SIH monitoring. These results validate the postulation of Belmonte and other authors [3,4,12,23], that peri-operative glucose monitoring reduces morbidity and mortality risks. Furthermore, Polytrauma and surgical fixation of multiple fractures increases the risk and magnitude of SIH and SSI in this study. Comparably, Oluwadare Esan et al. [24], Al-Hassani et al. [19] and Onuoha et al. [9], noted that increased surgical stress magnitude correlates with a heightened metabolic response and SIH risk.

Interestingly, all SIH cases in this study were among patients who received subarachnoid block (spinal anaesthesia), with none occurring in those who received general or regional anaesthesia. Mansour et al., Mitiku et al., and Dejen et al., reported lower glucose elevation with local or regional anaesthesia, due to reduced metabolic responses and lower gluconeogenesis [3,8,21]. The extent of tissue dissection and blood loss, alongside tropical climate-induced metabolic adaptation, may explain observed patterns.

Prolonged surgeries (>3 hours) were associated with worsened SIH, supporting Duggan et al. and Knaak et al., who found durations over 134 minutes to be independent SIH risk factors [25,26]. Likewise, Dejen et al. and others [8,21,27], observed a similar association between duration of surgery and SIH, the longer the surgery time the higher and more severe is the SIH.

Surgical site infections occurred in 38% of our study population, exceeding Liang et al., and Morgan-Jones et al., 1.5 -10% benchmark [28,29]. However, Hossain et al., recorded higher incidence [54.55%] in a similar study conducted in Bangladesh [18] Notably, majority of SSI cases in our study belong to the Normoglycaemic group. This may reflect the higher SIH threshold (≥200 mg/dl) adopted for the study. Mansour et al., and Mafinezhad et al. [3,30] showed persistent peri-operative glucose ≥150 mg/dl significantly increases SSI risk. In our study, lower mean RBS cut-off for SIH and consequently SSI was observed, indicating potentially lower SIH thresholds sub-Saharan African population compared to Caucasian populations [4,6].

Strong correlation existed between SIH and SSI in this study. Patients with SIH are 23 times more likely to develop SSI, affirming previous studies [3,18,30].

In conclusion, this study demonstrates that SIH in non-diabetic orthopaedic patients is associated with increased peri-operative blood glucose levels and higher surgical morbidity, particularly SSIs. The magnitude of surgical intervention, type of anaesthesia, duration of surgery, and patient age are contributing factors. These findings highlight the importance of early identification and strict glycaemic control during peri-operative care, especially in resource-limited settings.

Limitations of the study

The study assesses the impact of SIH on early wound infection, hence late wound infection and peri-implant infections were not assessed. We were also, unable to fix a uniform duration for the surgeries performed on recruited patients due to difference in severity of and anatomical location of the injuries. We did not consider other complications of SIH in peri-operative non-diabetic patients in this study. This complications could secondarily increase the risk of SSI in the peri-operative period by increasing length of hospital stay, and / or delaying early patient's mobilization.

Conclusion

This prospective cohort study demonstrates that SIH is a clinically relevant phenomenon in non-diabetic patients undergoing elective long bone fracture fixation, with an observed incidence of 10%. Peri-operative blood glucose rose significantly from the pre-operative period, peaked within the two post-operative days, and declined thereafter. Importantly, even modest elevation in RBS, well below the traditionally accepted SIH thresholds, were associated with an increased risk of SSI. A mean RBS of 112.8mg/dl was identified as a critical level at which SSI increased risk. It therefore suggests that currently used hyperglycaemia cut-offs may underestimate risk in this population. The study further established SIH as a significant predictor of SSI, with strong positive correlation and a significant odds on logistic regression analysis. Factors such as advanced age, longer duration of surgery, greater surgical stress, and type of anaesthesia appeared to influence glycaemic responses. These findings highlight SIH as an under-recognised yet modifiable risk factor for post-operative morbidity in elective orthopaedic practice, particularly in resource-limited settings. Routine peri-operative glucose monitoring and timely glycaemic control are essential for reducing SSI rates and improving surgical outcomes in non-diabetic patients, especially in resource-constrained settings.

Recommendations

1. Routine peri-operative blood glucose monitoring should be adopted for non-diabetic orthopaedics patients. Beginning from admission to at least Pod 2, but extension to POD 5 will yield a better care.
2. Lower glycaemic thresholds for intervention should be considered in elective orthopaedic surgery, especially in non-diabetic patients.
3. Targeted glycaemic control strategies should be integrated into peri-operative care to ameliorate the metabolic response to trauma and consequently prevent or limit the severity of SIH.
4. Future multicentre research with larger sample size to evaluate cost-effective glucose control and its safety in non-diabetic orthopaedic patients.

Conflict of interest

All authors declare no conflict of interest.

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REFERENCES

[1] Bellaver P, Schaeffer AF, Dullius DP, Crispim D, Leitão CB, Rech TH. Association between diabetes and stress-induced hyperglycemia with skeletal muscle gene expression of INSR in critically ill patients: a prospective cohort study. Diabetes Metab. 2023;49(6):101485.

[2] Corbett SA., Brunicardi FC, Andersen DK, Billiar TR, ., Dunn DL, Hunter JG, et al. Systemic response to injury and metabolic support. In: Schwartz's principles of surgery. In: 9th Edition. New York: McGraw-Hills Company Incorporated; 2015. p. p14-23, 49.

[3] Mansour EZ, Alkhouri S, Baur A, Mousad AD. Glycemic thresholds for surgical site infection risk in orthopaedic trauma: Insights from patients with diabetes mellitus and stress-induced hyperglycemia. J Orthop Rep. 2025 Dec;100863.

[4] Belmonte A, Roebke L, Shaikh HS. Hyperglycemia in Orthopaedic Trauma Patients: Implications, Management, and Future Directions. Oper Tech Orthop. 2024;34(3):101132.

[5] Rodriguez-Buitrago A, Basem A, Okwumabua E, Enata N, Evans A, Pennings J, et al. Hyperglycaemia as a risk factor for post-operative early wound infection after bicondylar tibial plateau fractures: Determining a predictive model based on four methods. Inj-Int J Care Inj. 2019;50:2097-2102.

[6] Cianni L, Caredda M, De Fazio A, Basilico M, Greco T, Cazzato G, et al. Stress-Induced Hyperglycemia is a Risk Factor for Surgical-Site Infections in Nondiabetic Patients with Open Leg Fractures. Carl AL, editor. Adv Orthop. 2023 Oct 25;2023:1–8.

[7] CDC. Surgical site infection (SSI) event. [Cited 2019]. CDC WEBSITE [Internet].

2019; Available from: http://www.cdc.gov/nhsn/PDFs/pscManual/9pscSSIcurrent.pdf.

[8] Dejen ET, Workie MM, Zeleke TG, Admass BA, Melesse DY, Melkie TB. Postoperative hyperglycemia among adult non-diabetic surgical patients at University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia. BMC Anesthesiol. 2024 Jul 1;24(1):217.

[9] Onuoha KM, Esan O, Orimolade EA, Ikem IC, Onuoha CEO. Comparing the random blood glucose level in patients with single and multiple long bone fractures. Niger J Med. 2019;28(3):247-252.

[10] Elsaman SEA. Risk determinants of hyperglycaemia among critically ill inpatients without diabetes. J Diabetes Nurs. 2020;24(6):164-170.

[11] Suetens C, Latour K, Karki T, et al. "Prevalence of healthcare-associated infections, estimated incidence and composite antimicrobial resistance index in acute care hospitals and long-term care facilities: results from two European point prevalence surveys, 2016 to 2017,". Euro Surveill. 2018;23(46).

[12] Ji X, Zhao D, Xin Z, Feng H, Huang Z. The predictive value of stress-induced hyperglycemia parameters for delayed healing after tibial fracture post-surgery. J Orthop Surg. 2024 Oct 16;19(1):666.

[13] Di Luzio R, Dusi R, Marzzotti A, Petroni ML, Marchesini G, Bianchi G. Stress hyperglycaemia and complications following traumatic injuries in individuals with or without diabetes: the case of orthopaedic surgery. Diabetes Metab Syndr Obes Targets Ther. 2020;13:9–17.

[14] World Health Organization. Global guidelines for the prevention of surgical site infection [Internet]. 2018 [cited 2026 Feb 2]. Available from: https://www.who.int/publications/i/item/9789241550475

[15] Bailey IS, Karran SE, Toyn K, Brough P, Ranaboldo C, Karran SJ. Community surveillance of complications after hernia surgery. BMJ. 1992 Feb 22;304(6825):469-71.(6825):469-71.

[16] Babalola O, Ibraheem G, Ahmed B, Olawepo A, Agaja S, Adeniyi A. Open intramedullary nailing for segmental long bone fractures: An effective alternative in a resource-restricted environment. Niger J Surg. 2016;22(2):90.

[17] Rau CS,., Wu SC, Chen YC, Chien PC, Hsieh HY, Kuo PJ, et al. Higher mortality in trauma patients is associated with stress-induced hyperglycaemia, but not diabetic hyperglycaemia: a cross-sectional analysis based on a propensity-score matching approach. Int J Environ Res Public Health. 2017;14,(1161):1-10.

[18] Hossain MdS, Das RK, Bose SK. The Role of Admission Hyperglycaemia as a Risk Factor for Surgical Site Infection in Orthopaedic Trauma Patients. East Afr Sch J Med Sci. 2023 May 23;6(05):178–85.

[19] Al-Hassani I, Khan NA, Elmenyar E, Al-Hassani A, Rizoli S, Al-Thani H, et al. The Interaction and Implication of Stress-Induced Hyperglycemia and Cytokine Release Following Traumatic Injury: A Structured Scoping Review. Diagnostics. 2024 Nov 24;14(23):2649.

[20] Plummer MP, Finnis ME, Phillips LK, Kar P, Bihari S, Biradar V, et al. Stress induced hyperglycaemia and the risk of type 2 diabetes in survivors of critical illness. Plos One. 2016;11(11):e0165923.

[21] Mitiku D, Tewoderos S, Mulualem S, Lemlem G. Magnitude and associated factors of postoperative hyperglycemia

among an adult nondiabetic patient who underwent surgery at 2 tertiary hospitals in Ethiopia. Int J Surg Glob Health. 2022 Sep;5(5):p e86, September 2022.(5):e86.

[22] World Health Organization, International Diabetes federation. Definition and diagnosis of diabetes mellitus and intermediate hyperglycaemia: report of a WHO/IDF consultation. WHO. 2006;13–5.

[23] Chen JY, Nassereldine H, Cook SB, Thornblade LW, Dellinger EP, Flum DR. Paradoxical Association of Hyperglycemia and Surgical Complications Among Patients With and Without Diabetes. JAMA Surg. 2022 Sep 1;157(9):765–70.

[24] Esan O, Toluse AM, Esan OT, Oluwadiya KS. Risk factors of surgical site infection following multiple implants surgeries in a single individual patients managed at a tertiary health facility, South West Nigeria. Niger Q J Hosp Med. 2014;24(2):102-106.

[25] Duggan EW, Carlson K, Umpierrez GE. Peri-operative hyperglycemia management: An update. Anaesthesiology. 2017;126(3):547-560.

[26] Knaak C, Wollersheim T, Morgeli R, Spies C, Volderwulbecke G, Windmann V, et al. Risk factors of intraoperative dysglycaemia in elderly surgical patients. Int J Med Sci. 2019;16(5):665-674.

[27] Shah NJ, Leis A, Kheterpal S, Englesbe MJ, Kumar SS. Association of intraoperative hyperglycaemia and post-operative outcomes in patients undergoing non-cardiac surgery: A multicenter retrospective study. BMC Anaesthesiol. 2020;20(106):1-9.

[28] Liang Z, Rong K, Gu W, Yu X, Fang R, Deng Y, et al. Surgical site infection following elective orthopaedic surgeries in geriatric patients: Incidence and associated risk factors. Int Wound J. 2019;16(3):773-780.

[29] Morgan-Jones R, McLaughlin N, Briggs D, Styche T. The Burden of Surgical Site Infection in Orthopedic Surgery: A Multi-Site Prevalence Day Exercise in the United Kingdom and Ireland |. Surg Infect. 2025;26(9):639–45.

[30] Mafinezhad D, Taheri R, Nezhad HSE, Motie M. Evaluation of the effect of peri-operative blood sugar level on surgical site infections in patients undergoing total mastectomy. Int J Cancer Manag. 2019;12(12):1–5.

Table 1: Participants' Demography

Demographics	Frequency (n)	Percentage (%)
Gender		
Female	15	30
Male	35	70
Total	**50**	**100**
Age		
Young Adults	22	44
Middle Age	20	40
Elderly	8	16
Total	**50**	**100**
Occupation		
Student/unemployed	6	12
Retiree	3	6

Artisan	5	10
Farmer	7	14
Civil servant	8	16
Entrepreneur	21	42
Total	**50**	**100**

Patients' demography were presented as frequencies and percentages.

Table 2: Distribution of Patients' Site(s) of Injury

Fractured Limbs	Right	Left	Bilateral
Upper Limb			
Humerus	2	-	1
Radius	2	2	-
Lower Limb			
Femur	12	17	1
Tibia	8	10	-
Fibular	2	2	-

Values represent numbers/frequency of fractures.

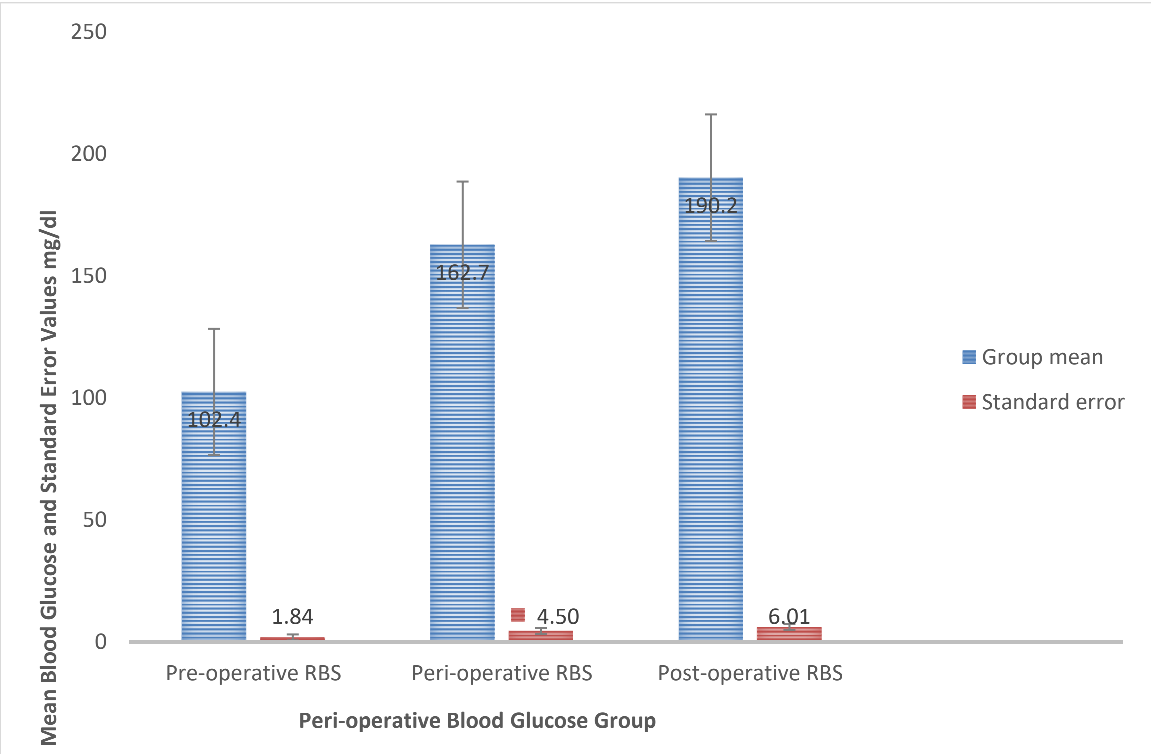

Figure 1: Analysis of Variance of the Pre-operative, Peri-operative and Post-operative Groups Blood Glucose values

Table 3: One-way Analysis of Variance of Pre-operative, Peri-operative and Post-Operative Blood Glucose

	Sum of squares	Df	Mean square	F-test	P value
Between groups	813584.653	2	406792.327	75.454	0.000*
Within groups	792516.680	147	5391.270		
Total	1606101.333	149			

Df= difference, F-test= Anova, *=P-value<0.05

Table 4: Multiple Comparisons (Post Hoc) of the Pre-, Peri- and Post-operative Blood Glucose

Mean RBS		Mean Diff (I-J)	Std. Error	P-value	95% Confidence Interval	
					Lower Bound	Upper Bound
1.00	2.00	-121.26	14.68	0.000*	-157.57	-84.94
	3.00	-176.30	14.68	0.000*	-212.61	-139.98
2.00	1.00	121.26	14.68	0.000*	84.94	157.57
	3.00	-55.04	14.68	0.001*	-91.35	-18.72
3.00	1.00	176.30	14.68	0.000*	139.98	212.61
	2.00	55.04	14.68	0.001*	18.72	91.35

Legend: 1.00= Pre-operative blood glucose, 2.00= Peri-operative blood glucose, 3.00= Post-operative blood glucose, *= P<0.05, RBS= Random blood sugar, Std error= **Standard error.**