AUDIT ARTICLE

Postoperative mortality in orthopaedic and trauma service: a retrospective trend analysis from a developing nation

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Abstract

Objective: To evaluate postoperative mortality trends and contributing factors in patients undergoing orthopaedic and trauma surgeries in a tertiary care setting.

Method: The retrospective audit was conducted from January to March 2021 at Aga Khan University Hospital, Karachi, and comprised data from January 1, 2016, to December 31, 2020, of patients who underwent any orthopaedic or trauma-related surgical procedure and died either during hospital stay or within 30 days post-surgery. Mortality was categorised into early (≤5 postoperative days) and late (>5 days) deaths to identify patterns and contributing factors. Data was analysed using SPSS 23.

Results: Among the 14,917 orthopaedic and trauma surgeries performed, there were 85(0.56%) postoperative deaths with the mean age of patients being 58.35±23.52 years. There were 52(61.18%) males and 48(56.47%) were aged >60 years. Emergency admissions accounted for 66(77.65%) cases. Infections 29(34.12%) and fragility fractures 24(28.24%) were the most common diagnoses, and cardiopulmonary complications occurred in 82(96.43%) cases. Mortality was categorised as early in 39(45.88%) cases and late in 46(54.12%). Most deaths occurred in intensive care settings 48(56.47%).

Conclusion: Postoperative mortality in orthopaedic and trauma surgeries was found to be low. Perioperative care, risk stratification and targetted interventions for high-risk groups are recommended.

Key Words: Orthopaedic procedures, Trauma, Mortality, Postoperative complications, Risk factors, Developing countries.

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Introduction

Surgery is considered a core aspect of healthcare systems worldwide, addressing a considerable fraction of global disease burden, with surgical conditions accounting for 30% of it.[1] Globally, 313 million surgical procedures are performed annually, yet operative mortality remains a perilous concern. Operative mortality is defined as any death, regardless of cause, that occurs within 30 days after surgery, whether inside or outside the hospital, as well as any death occurring beyond 30 days during the same hospitalisation related to the surgery.[2]

Postoperative mortality serves as a critical indicator of the effectiveness of surgical care systems, making its improvement a key global objective.[3] The quality of surgical care worldwide remains poorly understood, as reliable data on postoperative mortality rates are available for only 29 countries. Worldwide, there are about 4.2 million deaths reported within the first 30 days of surgery each year, accounting for 7.7% of all global deaths. The alarming situation is that nearly half of these deaths occur in low- and middle-income countries (LMICs).[3] In these countries, factors such as delayed diagnosis and treatment, late patient presentation, inadequate healthcare facilities and insufficient infrastructure likely play a substantial role in surgical care mortality.

While surgical care has the potential to enhance quality of life (QOL)) and prevent loss of life or limb, it carries significant risks of complications and mortality. The absence of quality and safety in surgical and anaesthesia systems contributes to higher rates of surgical complications, including mortality. In orthopaedic and trauma surgery, the stakes are particularly high due to the complexity of cases, the severity of injuries, and the potential for complications. This is particularly relevant in regions where resources are limited, emphasising the need for ongoing assessment and improvement in surgical care.

The Aga Khan University Hospital (AKUH) in Karachi is a leading multidisciplinary tertiary care facility in Pakistan,

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providing specialised care in various disciplines, including orthopaedic and trauma surgery. Over the past decades, AKUH has experienced a substantial increase in bed occupancy and patient turnover in high-dependence units (HDUs) and intensive care units (ICUs), and the expansion of emergency care services. The annual inpatient and outpatient flow at AKUH is approximately 50,000 and 600,000 people, respectively.[4] Compared to a decade ago, AKUH is now managing more complex and critically ill patients. Considering the hospital's role as a referral centre for complex cases, the trends in these services are of particular interest. Understanding this changing trend is essential for better planning and resource allocation.

Surgical mortality is a key indicator of the quality of care, and auditing it provides an overview of the leading cause of death in surgical patients, helping to identify care deficiencies and systematic errors. This, in turn, delivers constructive feedback to surgeons, hospitals and other healthcare professionals, ultimately aiding in developing strategies to reduce mortality.[5] Numerous studies from developed nations have explored various facets of surgical mortality, particularly focussing on mortality rates associated with specific diseases and procedures.[6] However, to our knowledge, there is a paucity of data specifically focussing on postoperative mortality trends in orthopaedic and trauma services in South Asian countries, like Pakistan. Clinical audits help detect and facilitate change and improve the quality of practice. Such audits deliver constructive feedback to the surgeons, hospitals and other professionals across the healthcare sector.[7]The current study was planned to evaluate postoperative mortality trends and contributing factors in patients undergoing orthopaedic and trauma surgeries in a tertiary care setting.

Materials and Methods

The retrospective clinical audit was conducted from January to March 2021 at AKUH, Karachi, and comprised data from January 1, 2016, to December 31, 2020. After exemption from the institutional ethics review committee, data was extracted. Data of all patients who underwent any orthopaedic or trauma-related surgical procedure and died either during their stay at the hospital or within 30 days of surgery was reviewed. Data of patients who underwent non-orthopaedic or non-trauma surgical procedures, those who died >30 days post-surgery, or had incomplete medical or surgical records was excluded.

Data was obtained from multiple sources to ensure comprehensive coverage of postoperative mortalities within the specified timeframe. Summaries from monthly Quality of Care (QC) meetings were reviewed to identify cases in which postoperative mortality was discussed, providing verified information on deaths occurring within 30 days of surgery as well as insights into the contributing factors. Departmental mortality records maintained by the Orthopaedic and Trauma Service (OTS) were also reviewed to capture all relevant cases, ensuring accurate inclusion of any postoperative deaths within the department. Additionally, operating room (OR) logs were examined to identify cases of on-table deaths or any death occurring during or immediately following surgery in the OTS operating suites. Data from hospital admission, discharge, and death registers was also reviewed to ensure that no postoperative mortality cases was overlooked. The process included capturing data of patients admitted to the OTS who may have later been transferred to, or managed by, other services, providing a comprehensive view of all relevant mortalities.

The collected data included patient demographics, such as age, gender and place of residence, along with admission details, surgical diagnoses and the clinical causes of death. Key variables documented from the records involved the type of admission (elective, emergency, or transfer), length of hospital stay (LOS), preoperative diagnoses, surgical procedures with their classification (elective or emergency), coexisting medical conditions, malignancies, American Society of Anaesthesiologits (ASA) scores, and the documented cause of death. Data on the total number of surgeries and admissions to the OTS over the study period were also obtained from administrative records to contextualise mortality trends relative to the volume of cases.

Data was analysed using SPSS 23. Continuous variables were expressed as means and standard deviations, whereas categorical variables were expressed as frequencies and percentages. Descriptive statistics were generated to summarise patient demographics, types of surgical procedures, and timing of postoperative deaths. $P<0.05$ was considered significant.

Results

Among the 14,917 orthopaedic and trauma surgeries performed, there were 87(0.58%) postoperative deaths. Data of 2(2.3%) patients was excluded owing to incomplete records, the final cohort had 85(97.7%) patients with mean age 58.35±23.52 years. There were 52(61.18%) males and 48(56.47%) were aged >60 years. Emergency admissions accounted for 66(77.65%) cases. Infections 29(34.12%) and fragility fractures 24(28.24%) were the most common diagnoses. Internal fixation

25(29.41%) and wound debridement 21(24.71%) were the most frequently performed procedures, with 43(50.59%) cases of multiple procedures. Cardiopulmonary complications occurred in 82(96.43%) cases and infections in 42(49.41%). Most deaths occurred in intensive care settings 48(56.47%) (Table 1).

Table-1: Demographic and clinical characteristics related to the mortalities analysed.

Demographics	All mortality n=85 (100%)
Mean Age	58.35 ± 23.52
Age Categories	
<18	9 (10.59)
18-29	6 (7.06)
30-44	17 (20.00)
45-60	5 (5.88)
>60	48 (56.47)
Gender	
Male	52 (61.18)
Female	33 (38.82)
Comorbidities	
None	24 (28.24)
1	13 (15.29)
2	23 (27.06)
3	20 (23.53)
4	5 (5.88)
Route of Admission	
Elective	19 (22.35)
Emergency	66 (77.65)
Diagnosis	
Degenerative Joint Disease	5 (5.88)
Fragility Fracture	24 (28.24)
Infection	29 (34.12)
Malignancy	6 (7.06)
Trauma	21 (24.71)
ASA level	
1	0 (0)
2	8 (9.41)
3	58 (68.24)
4	18 (21.17)
5	1 (1.18)
Procedure Type	
Amputation	18 (21.18)
Arthroplasty	17 (20.00)
External Fixation	3 (3.53)
Internal Fixation	25 (29.41)
Open Biopsy	1 (1.18)
Wound Debridement	21 (24.71)
Multiple Procedures	
Yes	43 (50.59)
No	42 (49.41)
Complication	
Infection	42 (49.41)
Haemorrhage	3 (3.53)
Thrombosis	3 (3.53)
Cardiopulmonary event	82 (96.43)
Cause of Death	
Cardiopulmonary Event	29 (34.12)
Iatrogenic	11 (12.94)
Nosocomial Infection	10 (11.76)
Severity of Primary Disease	35 (41.18)
Place of Death	
On Table Death	2 (2.35)
ICU/PICU	48 (56.47)
SCU	30 (35.29)
Ward	5 (5.88)

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ASA: American Society of Anaesthesiologits, SD: Standard deviaiton, ICU: Intensive care unit, PICU: Paediatirc intensive care unit, SCU: Surgical care unit.

Mortality was categorised as early in 39(45.88%) cases and late in 46(54.12%). Cause of death and place of death were significantly different between the groups (p<0.05),

Table-2: Comparison between early and late mortality cases.

Demographics	Early mortality n= 39 (45.88%)	Late mortality n= 46 (54.12%)	P-Value
Mean Age	58.53 ± 21.74	58.20 (25.17)	0.9471
Age Categories			0.089
<18	7 (17.95)	2 (4.35)	
18-29	3 (7.69)	3 (6.52)	
30-44	8 (20.51)	9 19.57)	
45-60	0 (0)	5 (10.87)	
>60	21 (53.85)	27 (58.70)	
Gender			0.064
Male	28 (71.79)	24 (52.17)	
Female	11 (28.21)	22 (47.83)	
Comorbidities			0.081
None	16 (41.03)	8 (17.39)	
1	3 (7.69)	10 (21.74)	
2	10 (25.64)	13 (28.26)	
3	9 (23.08)	11 (23.91)	
4	1 (2.56)	4 (8.70)	
Route of Admission			0.708
Elective	8 (20.51)	11 (23.91)	
Emergency	31 (79.49)	35 (76.09)	
Diagnosis			0.503
Degenerative Joint Disease	3 (7.69)	2 (4.35)	
Fragility Fracture	8 (20.51)	16 (34.78)	
Infection	13 (33.33)	16 (34.78)	
Malignancy	4 (10.26)	2 (4.35)	
Trauma	11 (28.21)	10 (21.74)	
ASA level			0.156
1	0 (0)	0 (0)	
2	5 (12.82)	3 (6.52)	
3	22 (56.41)	36 (78.26)	
4	11 (28.21)	7 (15.22)	
5	1 (2.56)	0 (0)	

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Procedure Type			0.559
Amputation	11 (28.21)	7 (15.22)	
Arthroplasty	6 (15.38)	11 (23.91)	
External Fixation	2 (5.13)	1 (2.17)	
Internal Fixation	11 (28.21)	14 (30.43)	
Open Biopsy	0 (0)	1 (2.17)	
Wound Debridement	9 (23.08)	12 (26.09)	
Multiple Procedures			0.751
Yes	20 (51.28)	22 (47.83)	
No	19 (48.72)	24 (52.17)	
Complication			
Infection	17 (43.59)	25 (54.35)	0.323
Haemorrhage	1 (2.56)	2 (4.35)	0.657
Thrombosis	2 (5.13)	1 (2.17)	0.462
Cardiopulmonary event	38 (97.44)	44 (95.65)	0.657
Cause of Death			0.028
Cardiopulmonary Event	8 (20.51)	21 (45.65)	
Iatrogenic	7 (17.95)	4 (8.70)	
Nosocomial Infection	3 (7.69)	7 (15.21)	
Severity of Primary Disease	21 (53.85)	14 (30.43)	
Place of Death			0.015
On Table Death	2 (5.13)	0 (0)	
ICU/PICU	27 (69.23)	21 (45.65)	
SCU	7 (17.95)	23 (50.00)	
Ward	3 (7.69)	2 (4.35)	

ASA: American Society of Anaesthesiologits, SD: Standard deviaiton, ICU: Intensive care unit, PICU: Paediatirc intensive care unit, SCU: Surgical care unit.

while the rest of the variables were not different significantly (Table 2, Figure 1).

Most deaths occurred within the first 5 days postoperatively, while mortality rates decreased steadily in subsequent intervals (Figure 2), with a sharp decline between the first and second f-day intervals (Figure 3).

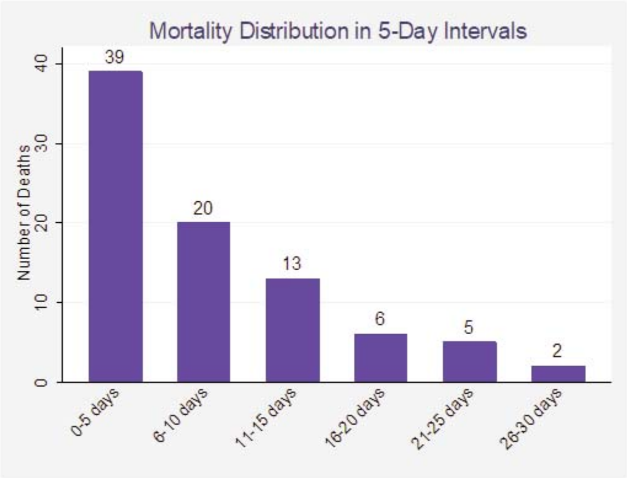

Figure-2: Mortality distribution across 5-day intervals.

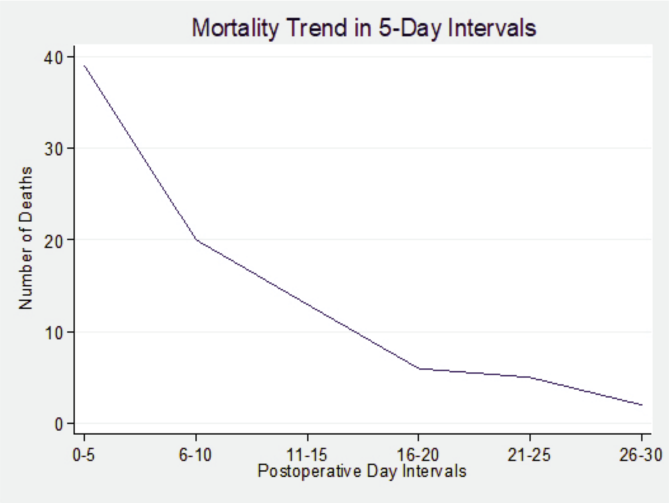

Figure-3: Mortality trend across 5-day intervals.

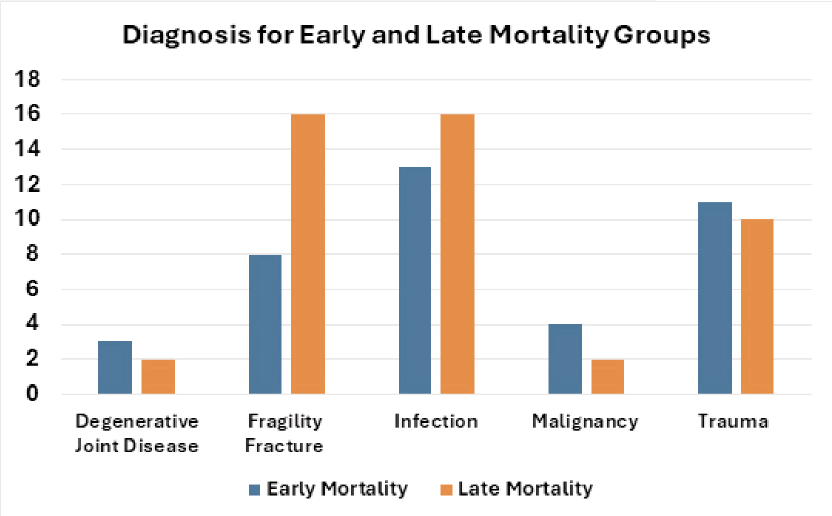

Figure-1: Comparison of preoperative diagnosis between early and late mortality cases..

There was a significant difference in survival by cause of death among the patients (p=0.0377). Observed versus expected deaths were also noted, and the pattern indicated variations in survival across groups (Table 3).

Kaplan-Meier survival curve showed the worst survival outcomes for patients with severe primary disease, followed by those with iatrogenic complications, both of which declined sharply within the first 10 days. Nosocomial infections led to moderate survival declines, while cardiopulmonary events showed the best survival rates with a gradual decline over time (Figure 4).

Table-3: Log-rank test for equality of survivor function.

Cause of Death	Events Observed	Events Expected
Cardiopulmonary event	29	37.87
Iatrogenic	11	9.00
Nosocomial infection	10	13.07
Severity of primary disease	35	25.06
Total	85	85.00

5.07% in general surgery patients.[9] Additionally, a study from the Department of Ear-Nose-Throat (ENT)-Head and Neck Surgery at the Pakistan Institute of Medical Sciences (PIMS) in Islamabad reported a five-year overall mortality rate of 1.4%,[10] further contextualising the current findings within the broader surgical landscape of Pakistan. A similar study on orthopaedic and trauma mortality conducted in India, a neighbouring South Asian country, reported an overall mortality rate of 1.64%.[11] In contrast, audit reports from developed countries reveal comparable surgical mortality rates despite significant differences in healthcare infrastructure and resources. Karayiannis et al. reported an overall mortality rate of 1.9% among patients undergoing orthopaedic and trauma surgeries at a hospital in Northern Ireland.[12] Semel et al., in a nationwide survey of all surgical deaths in the United States, documented a decline in inpatient surgical mortality from 1.68% in 1996 to 1.32% in 2006, reflecting improvements in healthcare delivery and perioperative care over time.[13]

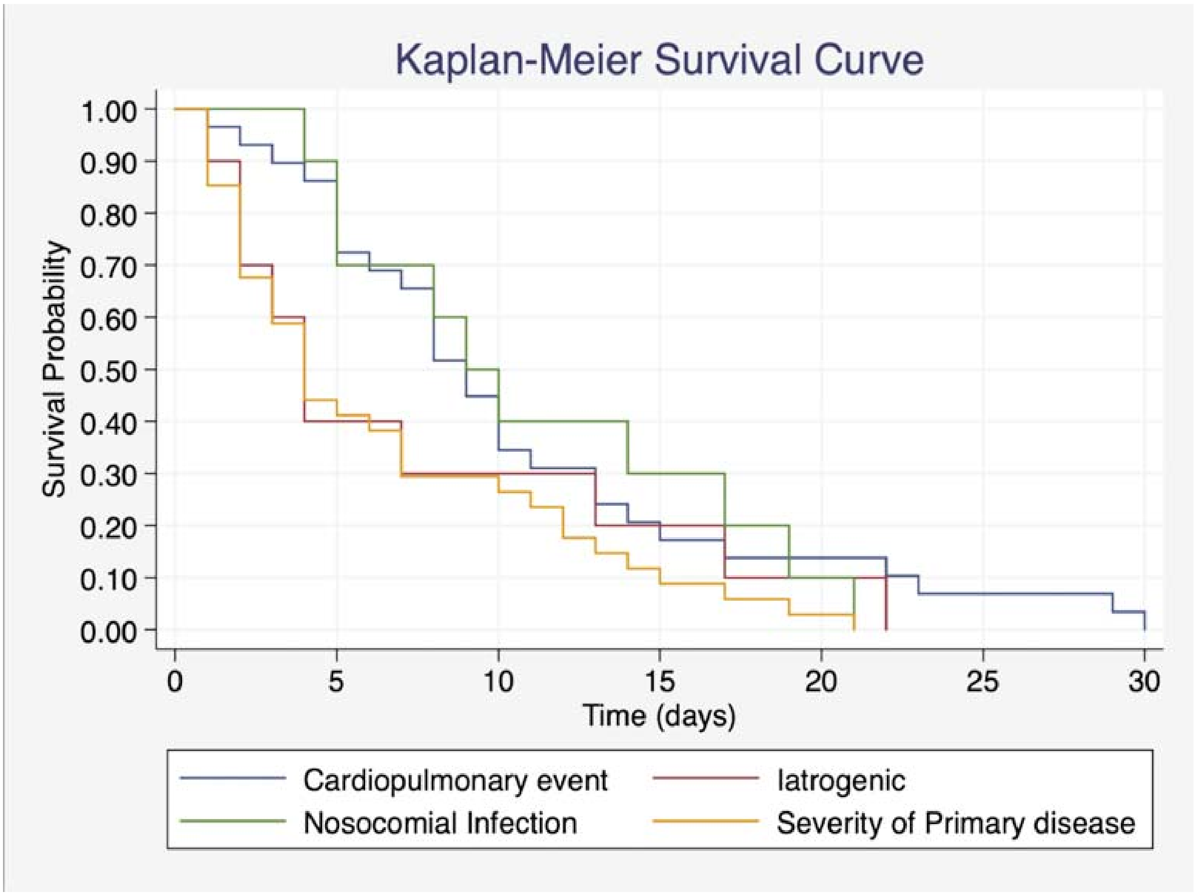

Figure-4: Kaplan-Meier Survival Probabilities for Each Cause of Death.

Discussion

In the rural areas of Pakistan, the annual incidence of trauma-related surgeries has been reported to be 1,531 per 100,000 population, underscoring the substantial burden of trauma care in the country.[8] This high incidence provides critical context to the current findings, particularly the observed mortality rate of 0.58% in AKUH OTS between 2016 and 2020. In comparison, earlier studies conducted at AKUH showed a mortality rate of 0.96% from 1997 to 2000, which subsequently increased to 1.31% between 2011 and 2014, encompassing all surgical specialties. In contrast, a study conducted at Jinnah Postgraduate Medical Centre (JPMC) in Karachi reported a significantly higher overall mortality rate of

A subgroup analysis in the current study revealed distinct patterns between early and late mortality groups, emphasising the multifactorial nature of postoperative outcomes. Early mortality was defined as death within the first five postoperative days, while late mortality referred to deaths occurring after postoperative day 5, up to day 30. Nearly half of the mortality cases (45.88%) occurred within the first five days. This highlights the severity of trauma among such patients and underscores the need to identify failure modes and errors contributing to high early mortality. Addressing these preventable factors through targeted interventions could significantly improve patient outcomes.

The mean age of patients in both early and late mortality groups was similar, at 58.5 and 58.2 years, respectively. Comparatively, Ramsay et al. reported a lower mean age of 53 years for emergency general surgery patients in Scotland, a developed nation.[14] In a similar study by Orimolade EA et al. in Nigeria, the median age of deceased orthopaedic and trauma surgery patients was 45.7 years, while in a study by H.B. Tan et al. in the United Kingdom, the median age was 82.14 years.[15,16] Male predominance in mortality was also observed from the studies conducted in Nigeria and India.[11,15] Conversely, studies conducted in developed nations, such as the UK, reported a female predominance in surgical mortality among orthopaedic and trauma surgery patients, highlighting regional and socioeconomic differences in demographic patterns associated with surgical outcomes.[16] The current study also reports a higher mortality rate in patients with a higher prevalence of multiple comorbidities. Supporting this observation, Chikuda H et al.[16] in Japan demonstrated that higher comorbidity scores, as measured by the Charlson Comorbidity Index, significantly increased postoperative mortality and complication rates.[17]

In the current study, the preoperative diagnosis associated with the highest mortality was infection (34.12%). Among the 29 patients who were diagnosed with infection, 13(33.33%) had early mortality, while 16(34.78%) had late mortality. Elderly patients more prone to infection often present with multiple comorbidities, increasing their risk of perioperative and postoperative complications, including mortality. Bhattacharya et al. identified hip fractures as one of the most common causes of morality particularly in patients aged >70 years.[18] In contrast, H.B. Tan et al. reported tumours as the leading cause of mortality.[16]

The current study has limitations as it was conducted at a single tertiary care centre. The facility serves as a referral centre for complex cases from across the region. While this allows for the inclusion of critically ill and high-risk patients, it may limit the generalisability of the findings to other healthcare settings or community hospitals that handle less severe cases. Additionally, the study primarily focussed on in-hospital and early postoperative mortality, potentially overlooking deaths occurring outside the hospital in the late postoperative period. This could lead to an underestimation of the true mortality burden associated with surgical interventions.

Conclusion

Trauma patients undergoing surgical interventions were found to carry an increased risk of mortality during the immediate postoperative period, highlighting the critical need of strict monitoring and care in the early postoperative phase, particularly for high-risk patients with fragility fractures and multiple comorbidities. Targetted efforts should be directed towards identifying and addressing factors contributing to early mortality to enhance patient outcomes and reduce preventable deaths.

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Conflict of Interest: None.

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