



Original Article

Causes of Death in Postoperative Patients: An Autopsy-Based Study from a Tertiary Care Centre in Eastern India

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ABSTRACT

Background: Postoperative mortality remains an important indicator of the quality and safety of surgical care.¹ Despite advances in surgical techniques, anaesthesia, and perioperative management, deaths continue to occur due to both preventable and non-preventable causes. Medico-legal autopsy provides an opportunity to establish the precise cause of death, identify hidden complications, and facilitate surgical audit and quality improvement.

Objective: To determine the causes of death in postoperative patients undergoing medico-legal autopsy, assess clinicopathological correlation, and identify factors associated with postoperative mortality.

Materials and Methods: A descriptive observational study was conducted on 75 postoperative death cases subjected to medico-legal autopsy at an anonymous tertiary care teaching hospital in Eastern India from January 2025 to December 2025. Demographic characteristics, clinical records, operative details, wound classification, postoperative complications, and autopsy findings were analysed. Statistical analysis was performed using descriptive statistics and Chi-square testing, with a p-value of <0.05 considered significant.

Results: The mean age of the deceased was 42.35 years, and males constituted 74.7% of the study population. Sepsis was the leading cause of postoperative death (28.0%), followed by progression of the primary disease (22.7%) and lung infection (20.0%). Surgical site infection was identified in 38.7% of cases and showed a significant association with wound contamination (p=0.003). Causes of death differed significantly according to surgical specialty and sex. Autopsy findings demonstrated substantial concordance with ante-mortem clinical diagnoses and aided in identifying immediate causes of death.

Conclusion: Sepsis and pulmonary infections remain major contributors to postoperative mortality and represent potentially preventable causes of death. Autopsy continues to play a pivotal role in determining the cause of postoperative death, supporting medicolegal investigations, and informing strategies aimed at improving surgical outcomes.

Keywords: Postoperative mortality; Medico-legal autopsy; Sepsis; Surgical site infection; Clinicopathological correlation; Forensic pathology.

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INTRODUCTION

Postoperative mortality remains a major concern in contemporary surgical practice and is widely regarded as an important indicator of the quality and safety of healthcare delivery.^{1,2} Although advances in surgical techniques, anaesthetic practices,

antimicrobial therapy, and intensive care have substantially improved patient outcomes, deaths following operative procedures continue to occur across all surgical specialties. The causes of postoperative death are often multifactorial and may result from progression of the underlying disease, surgical complications, infections, anaesthetic factors, or deterioration of pre-existing comorbid conditions.

Globally, millions of surgical procedures are performed annually^{1, 18}, and while the majority are successful, a significant proportion of patients experience serious postoperative complications. Sepsis, haemorrhage, pulmonary complications, renal dysfunction, and cardiovascular events remain among the leading contributors to postoperative mortality.^{2, 6, 11} The burden of these complications is particularly pronounced in low- and middle-income countries, where delayed presentation, emergency surgical interventions, limited resources, and variations in perioperative care may adversely influence outcomes.

Determining the precise cause of postoperative death has important clinical, administrative, and medicolegal implications. From a clinical perspective, identification of preventable factors contributes to quality improvement initiatives and refinement of perioperative management strategies. From a medicolegal standpoint, postoperative deaths frequently raise concerns regarding the adequacy of treatment and allegations of negligence, necessitating objective evaluation of the circumstances surrounding death.

Medico-legal autopsy remains the gold standard for establishing the cause of death.¹³⁻¹⁵ Correlation of ante-mortem clinical findings with postmortem observations not only validates clinical diagnoses but also identifies occult complications that may have remained undetected during treatment. Autopsy-based studies therefore provide valuable insights into the patterns and determinants of postoperative mortality and serve as an important component of surgical audit.

Contemporary autopsy-based analyses of postoperative mortality from Eastern India remain scarce. The present study is among the few regional investigations integrating clinicopathological correlation with medico-legal autopsy findings to identify potentially preventable causes of postoperative death and their medicolegal implications.

MATERIALS AND METHODS

Study Design and Setting

A descriptive observational study incorporating retrospective and prospective components was conducted in the Department of Forensic Medicine and Toxicology of a tertiary care teaching hospital in Eastern India.

Study Period

The study was carried out over a one-year period from **January 2025 to December 2025**.

Study Population

The study included all postoperative death cases referred for medico-legal autopsy during the study period that fulfilled the eligibility criteria. A total of **75 cases** were analysed.

Inclusion Criteria

- Postoperative deaths subjected to medico-legal autopsy during the study period.
- Patients who had undergone surgical procedures irrespective of specialty or urgency.
- Cases with adequate clinical documentation and complete autopsy findings.

Exclusion Criteria

- Cases with incomplete hospital records.
- Advanced decomposition interfering with determination of cause of death.
- Cases lacking essential operative information.

Data Collection

Relevant information was obtained from hospital records, operative notes, anaesthesia records, laboratory investigations, police inquest reports, and medico-legal autopsy reports using a predesigned proforma. Variables analysed included demographic characteristics, type and urgency of surgery, wound classification, postoperative complications, surgical site infection, and final cause of death.

Autopsy Examination

Standard medico-legal autopsies were performed in all cases. External and internal examinations were undertaken with particular attention to operative sites, evidence of infection, haemorrhage, pulmonary pathology, renal abnormalities, and integrity of surgical repairs. Histopathological examination was performed whenever indicated.

Statistical Analysis

Data were compiled and analysed using appropriate statistical software. Descriptive statistics were expressed as frequencies, percentages, means, and standard deviations. Associations between categorical variables were assessed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 75 postoperative deaths subjected to medico-legal autopsy were analysed during the study period. The demographic profile, causes of death, postoperative complications, and clinicopathological correlations were evaluated.

The age of the deceased ranged widely, with a mean age of 42.35 years. Male patients constituted the majority of the study population (56/75; 74.7%), whereas females accounted for 19 cases (25.3%). Most fatalities occurred following emergency surgical procedures, reflecting the increased risk associated with urgent interventions and delayed presentation.

Sepsis emerged as the leading cause of postoperative death, accounting for 21 cases (28.0%). Progression of the primary disease or injury was responsible for 17 deaths (22.7%), while lung infections contributed to 15 deaths (20.0%). Acute renal failure was identified in seven cases (9.3%). Less frequent causes included primary haemorrhage, coagulopathy, meningitis, acute myocardial infarction, and uncertain causes.

Table 1. Distribution of Causes of Postoperative Death (n = 75)

Cause of Death	Number of Cases	Percentage (%)
Sepsis	21	28.0
Primary disease/injury	17	22.7
Lung infection	15	20.0
Acute renal failure	7	9.3
Primary haemorrhage	5	6.7
Coagulopathy	3	4.0
Meningitis	3	4.0
Acute myocardial infarction	2	2.7
Uncertain	2	2.6
Total	75	100.0

Surgical site infection (SSI) was identified in 29 cases (38.7%). The frequency of SSI increased progressively with increasing wound contamination. Dirty wounds demonstrated the highest incidence of infection, followed by contaminated wounds. The association between wound classification and SSI was statistically significant ($\chi^2 = 13.862$, $p = 0.003$).

Table 2. Surgical Site Infection According to Wound Classification

Wound Classification	SSI Present	SSI Absent	SSI Rate (%)
Clean (n=25)	6	19	24.0
Clean-contaminated (n=9)	0	9	0.0
Contaminated (n=37)	20	17	54.1
Dirty (n=4)	3	1	75.0
Total	29	46	38.7

Distinct patterns of mortality were observed across surgical specialties. Sepsis predominated among abdominal surgical cases, whereas pulmonary infections and progression of the primary pathology were frequently encountered among neurosurgical and orthopaedic patients. Obstetric and gynaecological deaths were more commonly associated with haemorrhagic complications. In addition, the causes of death differed significantly according to sex. Sepsis was the commonest cause of death among males, whereas lung infection predominated among females.

Table 3. Causes of Death According to Sex

Cause of Death	Male (n=56)	Female (n=19)
Primary disease/injury	16	1
Sepsis	18	4
Lung infection	7	8
Primary haemorrhage	2	3

Cause of Death	Male (n=56)	Female (n=19)
Acute renal failure	7	0
Acute myocardial infarction	2	0
Coagulopathy	0	3
Meningitis	3	0
Uncertain	1	0

Autopsy findings showed substantial concordance with ante-mortem clinical diagnoses. In several instances, postmortem examination identified contributory factors such as occult infective foci, pulmonary pathology, and renal abnormalities, thereby refining the determination of the immediate cause of death. The clinicopathological correlation obtained through medico-legal autopsy reinforced its role in surgical audit and medicolegal evaluation.

DISCUSSION

The present autopsy-based study evaluated the causes of death among 75 postoperative patients and provides valuable insights into the determinants of postoperative mortality in a tertiary care setting in Eastern India. The findings highlight the continuing contribution of potentially preventable complications to postoperative deaths and underscore the importance of clinicopathological correlation through medico-legal autopsy.

The mean age of the deceased in this study was 42.35 years, indicating that postoperative mortality affected relatively younger individuals than those reported from many high-income countries, where deaths are predominantly observed among elderly patients with multiple comorbidities. This difference may reflect the younger demographic profile of the Indian population, the substantial burden of trauma-related emergencies, delayed healthcare seeking, and limited opportunities for preoperative optimisation in emergency settings.

The predominance of male patients in the present series is consistent with previous reports and may reflect greater exposure to trauma and emergency surgical interventions.

One of the most important findings of the present study was the predominance of emergency procedures among fatal cases. Emergency surgery is consistently associated with increased morbidity and mortality^{2,17} because patients frequently present with advanced disease, haemodynamic instability, contamination of operative fields, and inadequate time for comprehensive preoperative evaluation. International studies have shown that postoperative mortality following emergency surgery is substantially higher than that observed after elective procedures. The present findings reinforce the need for meticulous perioperative management and enhanced postoperative surveillance in this high-risk group.

Sepsis emerged as the leading cause of postoperative death, accounting for 28.0% of fatalities. This observation is clinically significant because infection-related deaths are often preventable through adherence to evidence-based infection prevention practices. In the present study, sepsis was particularly common among abdominal surgical cases, many of which involved perforation, contamination, or delayed presentation. Persistent infective foci, intra-abdominal collections, and overwhelming systemic inflammatory responses remain major determinants of adverse outcomes following major surgery. The prominence of sepsis in this study parallels contemporary evidence demonstrating that sepsis remains a leading contributor to postoperative mortality worldwide. Rudd et al. estimated that sepsis accounted for approximately one-fifth of all global deaths⁶, emphasizing its substantial public health impact. The findings also support the observations of Torgersen and colleagues, who demonstrated the value of postmortem examination in identifying persistent septic foci and occult pathological changes in patients who died following severe infections.⁷

Progression of the primary disease or injury constituted the second most common cause of death. This finding indicates that mortality cannot always be attributed solely to surgical complications. Patients presenting with advanced malignancies, extensive trauma, severe intracranial lesions, or irreversible physiological compromise may succumb despite technically successful operative interventions. Recognition of this fact is particularly important in medicolegal contexts where adverse outcomes are sometimes interpreted as evidence of substandard care.

Pulmonary infections represented the third leading cause of postoperative mortality. Autopsy findings frequently demonstrated bronchopneumonia, pulmonary consolidation, and pleural inflammatory changes. Several factors may contribute to postoperative pulmonary complications, including prolonged immobilisation, aspiration, mechanical ventilation, ineffective cough, inadequate analgesia, and impaired consciousness. Strategies such as early mobilisation, respiratory physiotherapy, incentive spirometry, and meticulous airway management may reduce the incidence of these complications.

Acute renal failure accounted for 9.3% of deaths in the present study. Postoperative renal dysfunction often develops secondary to sepsis, hypotension, haemorrhage, nephrotoxic drug exposure, or pre-existing renal impairment. Early

recognition and appropriate supportive care are therefore essential. Monitoring of renal function should remain an integral component of postoperative management, particularly among critically ill patients.⁸

An important observation was the significant association between wound contamination and surgical site infection. Surgical site infection was identified in 38.7% of cases and occurred most frequently among contaminated and dirty wounds. This finding validates the utility of surgical wound classification systems in predicting postoperative infective complications and supports the implementation of preventive strategies, including timely antibiotic prophylaxis, meticulous operative technique, adequate debridement, and postoperative wound surveillance.^{4,5,9}

The causes of death varied significantly according to surgical specialty. Sepsis predominated among abdominal surgical procedures, whereas pulmonary complications were common among neurosurgical and orthopaedic patients. Haemorrhage contributed substantially to mortality in obstetric and gynaecological cases. These observations suggest that specialty-specific protocols directed toward anticipated complications may improve postoperative outcomes.

Sex-specific variations in mortality patterns were observed; however, the underlying mechanisms require further investigation.

The major strength of this investigation lies in its autopsy-based design. Medico-legal autopsy continues to provide objective evidence regarding the immediate and underlying causes of death and remains invaluable in clarifying diagnostic uncertainties. In the current era of declining autopsy rates, postmortem examination retains immense relevance in surgical audit, quality assurance, medical education, and medicolegal practice.¹³⁻¹⁵ The substantial concordance observed between clinical diagnoses and autopsy findings in the present study further supports its utility.

The single-centre design and modest sample size may limit generalisability of the findings. Despite these limitations, the study contributes important regional data regarding postoperative mortality and highlights preventable causes of death that warrant attention.

Overall, the present study demonstrates that a considerable proportion of postoperative deaths are attributable to potentially modifiable factors, particularly sepsis and pulmonary infections. Strengthening infection control measures, improving perioperative monitoring, encouraging multidisciplinary postoperative care, and incorporating autopsy findings into routine mortality reviews may reduce preventable postoperative fatalities and improve patient safety.^{10,12}

The findings of this study support the incorporation of autopsy data into institutional mortality review systems. Regular clinicopathological audits involving surgeons, anaesthesiologists, intensivists, and forensic specialists may facilitate identification of preventable factors and improve patient safety. In resource-constrained settings, such multidisciplinary approaches may represent cost-effective strategies for reducing postoperative mortality.

CONCLUSION

Postoperative mortality remains a significant challenge despite advances in surgical and anaesthetic care. Sepsis was the leading cause of death in this study, followed by progression of the primary disease and pulmonary infections. Surgical site infection was strongly associated with wound contamination, highlighting the importance of preventive strategies. Medico-legal autopsy proved invaluable in establishing the final cause of death and identifying contributory factors. Incorporation of autopsy findings into surgical audit and quality improvement programmes may facilitate targeted interventions aimed at reducing preventable postoperative deaths.

STRENGTHS AND LIMITATIONS

Strengths

- Autopsy-based determination of causes of death enhanced diagnostic accuracy.
- Clinicopathological correlation strengthened the validity of findings.
- Inclusion of multiple surgical specialties permitted comparative analysis.
- The study provides contemporary regional data from Eastern India.

Limitations

- Single-centre design may limit generalisability.
- Only medico-legal autopsy cases were included.
- Relatively small sample size.
- Observational design precludes causal inference.

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Conflict Of Interest

The authors declare that there are no conflicts of interest related to this work.

REFERENCES

1. Meara JG, Leather AJM, Hagander L, Alkire BC, Alonso N, Ameh EA, et al. Global surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet*. 2015;386:569–624.
2. Pearse RM, Moreno RP, Bauer P, Pelosi P, Metnitz P, Spies C, et al. Mortality after surgery in Europe: a 7-day cohort study. *Lancet*. 2012;380:1059–65.
3. Fowler AJ, Abbott TEF, Prowle J, Pearse RM. Age of patients undergoing surgery. *Br J Surg*. 2019;106:1012–8.
4. World Health Organization. Global Guidelines for the Prevention of Surgical Site Infection. Geneva: WHO; 2018.
5. Allegranzi B, Bischoff P, de Jonge S, Kubilay NZ, Zayed B, Gomes SM, et al. New WHO recommendations on preoperative measures for surgical site infection prevention. *Lancet Infect Dis*. 2016;16:e276–87.
6. Rudd KE, Johnson SC, Agesa KM, Shackelford KA, Tsoi D, Kievlan DR, et al. Global, regional, and national sepsis incidence and mortality, 1990–2017. *Lancet*. 2020;395:200–11.
7. Torgersen C, Moser P, Luckner G, Mayr V, Jochberger S, Hasibeder WR, et al. Macroscopic postmortem findings in surgical intensive care patients with sepsis. *Intensive Care Med*. 2009;35:1487–96.
8. Grams ME, Sang Y, Coresh J, Ballew SH, Matsushita K, Molnar MZ, et al. Acute kidney injury after major surgery: a retrospective analysis of Veterans Health Administration data. *Kidney Int*. 2016;90:129–39.
9. O'Brien WJ, Gupta K, Itani KMF. Association of postoperative infection with risk of long-term infection and mortality. *JAMA Surg*. 2019;154:391–7.
10. Haynes AB, Weiser TG, Berry WR, Lipsitz SR, Breizat AHS, Dellinger EP, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med*. 2009;360:491–9.
11. Devereaux PJ, Sessler DI. Cardiac complications in patients undergoing major noncardiac surgery. *N Engl J Med*. 2015;373:2258–69.
12. VISION Study Investigators. Association between complications and death within 30 days after noncardiac surgery. *CMAJ*. 2019;191:E830–7.
13. Shojania KG, Burton EC, McDonald KM, Goldman L. The autopsy as an outcome and performance measure. *Evid Rep Technol Assess (Summ)*. 2002;(58):1–5.
14. Burton EC, Troxclair DA, Newman WP III. Autopsy diagnoses of malignant neoplasms: how often are clinical diagnoses incorrect? *JAMA*. 1998;280:1245–8.
15. Goldman L, Sayson R, Robbins S, Cohn LH, Bettmann M, Weisberg M. The value of the autopsy in three medical eras. *N Engl J Med*. 1983;308:1000–5.
16. Nepogodiev D, Bhangu A. Elective surgery cancellations due to the COVID-19 pandemic: global predictive modelling to inform surgical recovery plans. *Br J Surg*. 2020;107(11):1440–1449.
17. Abbott TEF, Fowler AJ, Dobbs TD, Harrison EM, Gillies MA, Pearse RM. Frequency of surgical treatment and related hospital procedures in the UK: a national ecological study using hospital episode statistics. *Br J Anaesth*. 2017;119(2):249–257.
18. Weiser TG, Haynes AB, Molina G, Lipsitz SR, Esquivel MM, Uribe-Leitz T, et al. Estimate of the global volume of surgery in 2012: an assessment supporting improved health outcomes. *Lancet*. 2015;385 Suppl 2:S11.