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Identifying Risk Factors for In-Hospital Mortality among Patients who Undergo Exploratory Laparotomy at Kamuzu Central Hospital

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Abstract

Introduction: Emergency exploratory laparatomy carries significant risk in morbidity and mortality, especially in sub-Saharan Africa with mortality reports of 10 – 25%. This dual burden is mainly due to and delayed access to surgical care due to late presentation, comorbidities, fatal perioperative complications and lack of enough skilled personnel. Preoperative risk stratification scores like ASA and MFI scores are useful tools in predict mortality and morbidity among patients undergoing these surgical procedures.

Despite the high surgical disease burden in Malawi, there is a paucity of local data characterizing the burden, outcomes, and risk factors for in-hospital mortality including utilisation of risk stratification scores. We identified risk factors associated with in hospital mortality and assessed the utilization of risk stratification scores following emergency laparotomies at Kamuzu Central Hospital.

Methods: We conducted a health facility based Retrospective quantitative study conducted at KCH. We sampled 285 records of surgical cases who underwent emergency exploratory laparatomy between January and December 2024. The primary outcome was in hospital mortality, and secondary outcomes included surgical complications and ICU or HDU admission. The data was collected by using kobo collect tool derived form. Analysis was done using multivariate logistic regression and fischers exact test.

Results: Significantly, 85% of patients presented after 48 hours of onset of their symptoms. The overall mortalitywas6.0%. The most common postoperative complications were surgical site infections (11%), re-exploration (11%), and anaemia (8.8%). Septicaemia as a complication showed the strongest association with mortality (OR = 6.93, 95% CI: 0.73–61.4, p = 0.079) with seven times increased likelihood of mortality. ASA III had significantly higher odds of mortality (OR =0.01; 95% CI: 0.00–0.17; p = 0.007). Higher MFI scores had significant association to mortality with Fisher's Exact $p < 0.05$.

Conclusion: Emergency exploratory laparotomy remains to be associated with considerable high postoperative morbidity and mortality in our setting. The high burden of surgical site infections and septicemia contributes significantly to perioperative mortality. Routine use of simple preoperative risk assessment tools of ASA and MFI should be emphasized, alongside improved perioperative management and early identification of complications to improve surgical outcomes in our setting.

Introduction

Exploratory laparotomy is a surgical manoeuvre that involves accessing the abdominal cavity through an incision in its wall to gain diagnostic information and solve adverse problems in an operating room [1]. Its indications encompass both elective and emergency situations, including conditions such as malignancy, intra-abdominal trauma, bowel obstruction, acute abdominal pain, and peritonitis [2].

Emergency exploratory laparatomy accounts for a large proportion of surgeries performed in African hospitals, with a frequency varying between 20 and 22.7% [3, 4]. The goal in emergency laparatomy is the prompt identification and management of life-threatening or potentially life-threatening conditions [[1, 2]. It carries significant mortality and morbidity with up to five fold increase in mortality times compared to elective procedures [5]. Evidence highlights multiple interrelated factors influencing postoperative mortality following emergency laparotomy categorized[6] into patient-related factors, indications for surgery, intraoperative (surgical) factors, and hospital-related factors [6, 7]. Patient factors such as older ages, comorbidities (e.g., HIV, diabetes, hypertension), nutritional status, and physiological derangement are associated with poor postoperative outcomes [[8, 9]. Indications for emergency laparotomy such as bowel perforation, intestinal obstruction, or peritonitis also contribute significantly to poor prognosis of patients.the timing of surgery, the surgical approach, The intraoperative findings, surgical approach and the experience level of the operating surgeon also influence the outcomes of the patients[2, 7]. Hospital related factors such as delays in preoperative resuscitation, limited access to imaging and laboratory services, operating room availability, intensive care unit (ICU) capacity, and postoperative monitoring are particularly relevant in resource constrained settings like Malawi [10].

Risk stratification scores are used to predict mortality and morbidity among patients undergoing these procedures [11]. Patient frailty and ASA scores are implicated as predictors of perioperative patient outcomes. These scores are appropriate in our limited but unfortunately, little is known in low-income

countries concerning the risk factors for mortality, morbidity and the sensitivity and specificity of the risk stratification scores [12]. This study served as a bridge to identify variables that increase mortality and morbidity and tested the ability of risk stratification scores ASA and MFI in predicting mortality in surgical patients. Understanding these factors in the local context is essential for guiding clinical practice, resource allocation, and surgical quality improvement initiatives.

Methods

Study Design and Setting

This study was a retrospective quantitative study conducted at the surgical department of Kamuzu Central Hospital (KCH) in Lilongwe, Malawi. KCH is a tertiary referral hospital in the central region with a bed capacity of approximately 1,000 and serves a catchment population of more than 7 million people across nine districts.

Study Population

The study included adult patients who underwent emergency exploratory laparotomy at KCH between January 1, 2024 and December 31, 2024. Eligible participants were patients aged 18 years and above who underwent emergency non-trauma exploratory laparotomy.

Patients were excluded if their medical records had missing key variables required for analysis, if they died intraoperatively, or if the laparotomy was related to obstetric or gynecological procedures such as Caesarean section or other gynecological laparotomies.

Sample Size and Sampling

A sample size of 285 patients was calculated using the Yamane formula based on an estimated proportion of surgical cases in Malawi. All eligible patient records during the study period were reviewed to meet the required sample size.

Data Collection

Data were retrospectively collected from patient medical records and theatre logbooks. A structured data extraction form was used to systematically capture relevant variables. Data was collected electronically using the Kobo Collect data management platform.

Study Variables

Independent variables included patient demographics, preoperative clinical characteristics, and risk stratification scores including the American Society of Anesthesiologists (ASA) physical status classification and Modified Frailty Index (mFI). The primary outcome variable was in-hospital mortality. Secondary outcomes included postoperative complications and length of hospital stay.

Data Analysis

Descriptive statistics were used to summarize baseline characteristics, intraoperative findings, and postoperative outcomes. Associations between preoperative risk factors and mortality were assessed using Fisher's Exact Test due to the low frequency of mortality events. Multivariate logistic regression analysis was conducted to identify independent predictors of in-hospital mortality. Statistical significance was set at a p-value of <0.05.

Results

Patient Demographics and Baseline Characteristics

A total of 285 patient files were sampled. The median age of the study population was 38 years with 149 (52%) females and 136 (48%) males. 60% of the patients resided in rural areas and 71% were referred from secondary-level healthcare facilities. Clinical presentation was predominantly delayed, with 85% of patients presenting more than 48 hours after the onset of symptoms.

Table 1: Baseline Age Characteristics of the Study Population

Total number of patients	Median (age)	Min(age)	Q1	Q3	Max
285	38 years	13 years	27 years	49 years	92 years

Table 2: Clinical Profile of the Patients Preoperatively (N=285)

Characteristic	N = 285[1]
Female	149 (52%)
Male	136 (48%)
Residency	
Rural	172 (60%)
Urban	113 (40%)
Hospital level	
Kamuzu Central Hospital interdepartmental	3 (1.1%)
Primary level	40 (14%)
Secondary level	201 (71%)
Self-referral	41 (14%)
Duration of symptoms	
<48 Hours	43 (15%)
>48 Hours	242 (85%)
Blood pressure	
Systolic <90 mmHg	6 (2.1%)
Systolic >90 mmHg	235 (98%)
Unknown	44
Pulse rate	
<100 bpm	143 (59%)
>100 bpm	98 (41%)
Unknown	44
Comorbidities	
None	256 (90%)
Hypertension	14 (4.9%)
HIV	6 (2.1%)
Diabetes Mellitus	2 (0.7%)
Other comorbidities	5 (2%)
Unknown	2 (0.7%)

Intraoperative Findings and Procedures

The most frequent intraoperative diagnoses were appendicitis, sigmoid volvulus, and adhesions. The most performed surgical procedures included stoma formation (36%), bowel resection and anastomosis (25%), and appendectomy (18%). Most surgeries were performed by senior residents (84%) and occurred during evening hours (61%).

Postoperative Complications and Outcomes

The overall post-operative mortality rate was 6.0% (n=17), with no recorded preoperative and intraoperative mortality. The most common postoperative complications were surgical site infections (11%), re-exploration (11%), and anaemia (8.8%). Other significant complications included burst abdomen (4.6%), anastomotic leaks (4.2%), and septicemia (2.1%).

Table 3: Post Operative Characteristics, Complications and Outcomes

Characteristic	N = 285[1]
Patients transfused before or after procedure	50 (18%)
Unknown	4
Admitted to ICU or HDU	34 (12%)
Days spent in ICU or HDU	
0	252 (88%)
2-7 days	22 (7.7%)
Less than 48 hours	7 (2.5%)
more than 7 days	4 (1.4%)
COMPLICATIONS	
Surgical site infection	32 (11%)
Anastomotic leak	12 (4.2%)
Acute Kidney Injury	2 (0.7%)
Septicemia	6 (2.1%)
Burst abdomen	13 (4.6%)
Anaemia	25 (8.8%)
Re-exploration	31 (11%)
Length of hospital stay	
< 7 days	166 (59%)
> 7 days	117 (41%)
Unknown	2
Final Patient Outcome	
Alive	268 (94%)
Dead	17 (6.0%)
1n (%)	

Analysis of Factors Associated with In-Hospital Mortality
Risk Stratification Scores
Multivariate logistic regression analysis of ASA grading demonstrated a significant association with mortality. Compared to ASA I (reference group), patients classified as ASA III and IV had significantly higher odds of mortality (OR = 0.01; 95% CI: 0.00–0.17; p = 0.007). ASA II was associated with lower odds of survival as well (OR = 0.07; 95% CI: 0.00–1.00; p = 0.10), although this was not statistically significant.

Due to the low frequency of mortality events (n=17), Fisher's Exact Test was also utilized to determine the association between preoperative clinical scores and patient outcomes. A significant association was found between higher ASA grades and mortality (Fisher's Exact $p < 0.05$). Patients with an ASA grade of 3 or 4 faced a substantially higher risk of death compared to those in lower categories. Higher mFI scores were also significantly associated with mortality (Fisher's Exact $p < 0.05$). Patients with an mFI score 2 showed an increased likelihood of postoperative mortality.

Postoperative Complications
Table 4: Multivariate Logistic Regression Analysis of Postoperative Complications Associated with In-Hospital Mortality Following Emergency Exploratory Laparotomy

Anaemia	2.95	(0.62 – 11.6)	0.14
Surgical Site Infection	1.27	(0.23 – 5.37)	0.80
Postoperative Complication	Adjusted Odds Ratio (aOR)	95% Confidence Interval	p-value
Acute Kidney Injury	0.45	(0.01 – 23.3)	0.70
Anastomotic Leak	1.13	(0.12 – 9.23)	>0.90
Burst Abdomen	0.24	(0.01 – 2.33)	0.30
Septicaemia	6.93	(0.73 – 61.4)	0.079

Multivariate logistic regression analysis showed that septicaemia had the strongest association with mortality (OR = 6.93, 95% CI: 0.73–61.4, p = 0.079), indicating that patients who developed septicaemia were nearly seven times more likely to die compared to those without septicaemia, although this did not reach statistical significance. Anaemia was also associated with increased odds of mortality (OR = 2.95, 95% CI: 0.62–11.6, p = 0.14). Other postoperative complications, including surgical site infection and anastomotic leak, showed minimal association with mortality.

Discussion
This study evaluated the clinical profiles, outcomes, and predictors of hospital mortality following emergency exploratory laparotomy at Kamuzu Central Hospital. The patient population had a mean age of 39 years, reflecting a younger demographic profile observed in many Sub-Saharan African surgical cases [13]. 85% of the patients had late presentations with more than 48 hours of onset of symptoms. Delayed presentation remains a major challenge in low resource settings and it associated with increased morbidity and mortality by worsening disease process and perioperative outcomes.[14]

The overall hospital mortality rate was 6%, which is comparable to findings from other studies conducted in Sub-Saharan Africa. A systematic review examining abdominal surgical emergencies in the region reported a pooled mortality rate of 7.4% (95% CI: 6.0–8.8). Similar mortality rates have also been reported in studies from South Africa (6.4%), the United Kingdom (9.6%), and Ireland (7.7%) [1]. However, the mortality observed in our study was lower than the 14.8% perioperative mortality rate previously reported at Kamuzu Central Hospital in 2019–2020 [15]. This reduction may reflect improvements in access to emergency surgical services, increased availability of trained surgeons and residents resulting in overall efficient and effective surgical services over the past five years [16]. Additional factors such as differences in study design, sample size, and study inclusion criteria may also account for these variations.

The most common intraoperative diagnoses were acute appendicitis, sigmoid volvulus, and small bowel obstruction secondary to adhesions. These findings are consistent with previous studies conducted in Sub-Saharan Africa, where appendicitis, bowel obstruction, and perforated peptic ulcer disease are the top causes of emergency abdominal surgery. Particularly acute appendicitis which is the leading cause of abdominal surgical emergencies in the Sub Saharan africa, accounting for approximately 30% of cases [1].

The study demonstrated that higher ASA physical status grades were significantly associated with mortality. Patients classified as ASA III–IV had a substantially higher risk of death compared with those classified as ASA I–II. The ASA score is widely recognized as an important predictor of perioperative mortality, as it reflects the patient's overall physiological reserve and burden of systemic disease. Similar associations between higher ASA scores and increased mortality have been reported in studies conducted in Malawi and Zambia [17]. Due to its simplicity, the ASA classification remains a practical and valuable tool for perioperative risk stratification in resource limited settings [17, 18].

Higher Modified Frailty Index (mFI) scores were also associated with increased mortality in our study (Fisher's Exact $p < 0.05$). Although most patients had low frailty scores, those with mFI ≥ 2 demonstrated a higher likelihood of postoperative death. The mFI is a validated preoperative risk stratification tool that evaluates frailty based on comorbid conditions and functional status.[19] Previous studies have shown that higher mFI scores are associated with increased postoperative complications, readmission rates, and mortality across various surgical specialties. Given its simplicity and minimal data requirements, the mFI may serve as a useful adjunct for identifying high risk patients in resource constrained environments [19] To our knowledge, this is among the first studies to examine the role of the mFI in predicting outcomes following emergency laparotomy in our setting.

The most prevalent post-operative complications were surgical site infection (11%), re-exploration (11%), and anaemia (8.8%), followed by burst abdomen and anastomotic leak. Surgical site infection remains one of the most common postoperative complications following abdominal surgery, particularly in low-income countries [[20]. Several factors may contribute to the high burden of surgical site infections in Sub-Saharan Africa, including delayed presentation, contaminated surgical fields, limited infection prevention resources, and antimicrobial resistance. Our results reflect a similar pattern of complication rates in the region with surgical site infection being the most prevalent [20, 21].

Septicaemia specifically demonstrated the strongest association with mortality, although statistical significance was limited by the small number of mortality events. Patients with abdominal sepsis often develop circulatory and respiratory dysfunction due to systemic inflammatory responses and severe infection. Abdominal infections are among the leading causes of sepsis in critically ill patients and may rapidly progress to septic shock if not promptly managed. Early recognition, prompt surgical source control, and aggressive resuscitation remain essential components of improving outcomes in these patients [20, 21].

Conclusion

Clinical Implications

The findings of this study highlight the importance of early risk stratification and perioperative optimization in patients undergoing emergency laparotomy. Routine use of simple and readily available tools such as the ASA classification and the Modified Frailty Index may help clinicians identify high risk patients who may benefit from closer monitoring, early critical care involvement, and more aggressive perioperative management strategies.

Study Limitations

This study had several limitations. A retrospective design limited the ability to establish a causal relationship and we were subject to missing or incomplete clinical documentation. Being a single center study conducted at a tertiary referral hospital, the findings may not be fully generalizable to district hospitals or other healthcare settings with different resources and expertise. However, this study provides us a platform to conduct more further studies with different control variables to improve surgical outcomes in Malawi.

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