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Clinical Profile and 30-Day Outcomes of Perforated Peptic Ulcer Surgery at a Tertiary Hospital in Ghana: A Prospective Cohort Study

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Abstract

Background

Perforated peptic ulcer (PPU) is a common surgical emergency in low- and middle-income countries (LMICs). Factors contributing to post-operative morbidity and mortality have been scarcely studied in developing contexts such as Ghana. This study aimed to investigate the contributions of perioperative risk factors to morbidity and mortality after PPU surgery.

Methods

Between December 2018 and November 2019, 48 patients had surgery for PPU in our hospital. Data was described with descriptive statistics. Associations between outcome variables and predictor variables were examined with the Chi-square test, and regression analysis was done to determine the predictors of morbidity and mortality.

Results

Median age was 52 years (range 15–82), 40/48 (83.3%) were male, and 35/48 (72.9%) had gastric perforations. Overall, 30-day morbidity was 43.8%, and mortality was 12.5%. Surgical site infection was the commonest complication (18.7%), followed by pneumonia (12.5%) and intra-abdominal abscess (8.3%). On bivariable analysis, purulent peritoneal aspirate was associated with 30-day morbidity ($p = 0.005$), while age > 60 years ($p = 0.006$) and hypertension ($p = 0.001$) were associated with 30-day mortality. In multivariable analysis, hypertension was associated with increased likelihood of 30-day mortality (adjusted OR 8.8, 95% CI 1.1–70.4; $p = 0.040$). Purulent aspirate was also associated with 30-day morbidity (OR 7.3, 95% CI 1.7–31.8; $p = 0.008$).

Conclusion

PPU in this setting predominantly affected middle-aged men and was associated with substantial postoperative morbidity and mortality. Purulent intraperitoneal contamination was associated with increased odds of postoperative complications, while hypertension was associated with 30-day mortality. Early presentation, aggressive resuscitation, and closer perioperative monitoring of high-risk patients are essential.

INTRODUCTION

Peptic ulcer disease (PUD) remains a significant global health burden despite advances in medical therapy. It affects roughly 4 million people annually, with a lifetime prevalence approaching 5% and an estimated incidence of 1.5-3%.[1–3] The wider use of proton pump inhibitors and Helicobacter pylori

eradication regimens has indeed reduced overall ulcer incidence and the need for elective ulcer surgery, yet the epidemiology of ulcer complications has not shifted to the same degree.[4] Perforation is the second most common complication of PUD after bleeding,[2] occurring in approximately 2–10% of ulcer patients.[5] It accounts for more than 35–70% of ulcer-related deaths and remains the single most lethal complication of the disease.[6–9] Mortality ranges from 1.3% to as high as 30% within 30–90 days, depending on delays in presentation, sepsis, and patient comorbidity.[3, 10, 11] Morbidity may reach 50% due to secondary peritonitis and septic complications.[12] The high global toll is illustrated by an estimated 120,000 annual deaths attributable to PUD complications, with 85% occurring in LMICs.[13]

Patterns of presentation differ considerably across regions. In much of the developing world, patients are typically young males with strong associations with smoking, H. pylori infection, and delayed presentation.[5, 14] In contrast, perforations in developed countries often occur in elderly patients with multiple comorbidities, frequently linked to NSAID use.[15] These geographical shifts reflect socioeconomic variation in risk exposure.[12, 16] Established risk factors include NSAID use, smoking, chronic stress, H. pylori infection, and advanced age, as well as ulcer size ≥ 1 cm.[17, 18]

Ghanaian data also suggest that perforated peptic ulcer remains a significant contributor to acute generalized peritonitis and emergency laparotomy. In Kumasi, Ohene-Yeboah and Togbe prospectively studied 331 adult patients with gastric and duodenal perforations, and found a marked male predominance, a median age of 55 years, and a higher frequency of gastric than duodenal perforations. Their study also highlighted locally relevant risk exposures including NSAID use, herbal medicine ingestion, and prolonged religious fasting. Postoperative complications included acute renal failure, persistent peritonitis, wound infection, and chest infection, with an overall mortality of 22.1%.[19] Another major Ghanaian study from Korle Bu Teaching Hospital in Accra reported 326 cases of perforated peptic ulcer, with a male-to-female ratio of 4.5:1 and a mean age of 40.9 years. In that cohort, peptic ulcer perforation accounted for 4.6% of acute abdomen cases, postoperative complications occurred in 19%, and overall mortality was 11%. The study identified age ≥ 60 years, duration of perforation greater than 24 hours before admission, alcohol intake, and resectional surgery as important factors associated with postoperative morbidity and/or mortality. [20]

Despite the continued burden of perforated peptic ulcer in Ghanaian emergency surgical practice, contemporary prospective data on postoperative morbidity, mortality, and locally relevant predictors of adverse outcomes remain limited. Existing Ghanaian and regional studies have largely described presentation patterns and operative management, with fewer studies focusing on short-term risk stratification after surgery. In resource-constrained settings where access to high-dependency care, intensive monitoring, and timely reoperation may be limited, identifying simple perioperative markers of poor outcome may help prioritize patients for closer surveillance. This study, therefore, aimed to describe the clinical profile of patients undergoing emergency surgery for perforated peptic ulcer at Komfo Anokye Teaching Hospital and to identify factors associated with 30-day morbidity and mortality.

METHODS

This was a hospital-based prospective cohort study conducted in the Department of Surgery at Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana, from December 1, 2018, to November 30, 2019. KATH is a major tertiary referral centre with a 24/7 emergency department and access to intensive care. Ethical clearance was obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology (Ref No. CHRPE/AP/301/18), and the Ethical Review Committee of Komfo Anokye Teaching Hospital. Consecutive patients aged 15 years and above who underwent emergency laparotomy and modified Graham's patch repair for perforated peptic ulcer were enrolled after consent. Diagnosis was based on clinical history, physical examination, and imaging, and was confirmed intraoperatively. Patients with malignant perforation on histology, traumatic and iatrogenic perforations, other causes of peritonitis found at operation, non-operatively managed perforation, or refusal to participate were excluded.

Initial resuscitation included intravenous fluids, nasogastric decompression, urinary catheterization, broad-spectrum antibiotics, proton pump inhibitors, and correction of physiological derangements, particularly electrolyte abnormalities. Definitive surgery consisted of laparotomy and repair of the perforation using the Modified Graham's Omental Patch repair; gastric perforations also had a biopsy to exclude malignancy.

Data collected included demographic characteristics, symptom history, risk exposures, comorbidities, admission vital signs, hemoglobin and albumin levels, ulcer site and size, nature of peritoneal contamination, postoperative complications, length of hospital stay, and 30-day mortality. Morbidity was defined as any postoperative complication within 30 days of surgery. These included surgical site infection, wound dehiscence, intra-abdominal abscesses, enterocutaneous fistula, or pneumonia.

Data were cleaned in Excel and analyzed in STATA version 17. Continuous variables were summarized as means with standard deviations or medians with ranges, while categorical variables were presented as frequencies and percentages. Bivariate analyses using Chi-square or Fisher's Exact tests assessed associations with 30-day morbidity and mortality, and logistic regression was used to examine selected predictors. Statistical significance was set at $p < 0.05$.

For regression analyses, candidate predictors were selected a priori based on clinical plausibility and prior literature, and bivariable screening guided parsimonious multivariable models. Given the small number of deaths (n = 6), the multivariable mortality model was deliberately restricted to limit overfitting; estimates should be interpreted as exploratory with wide confidence intervals.

RESULTS

Forty-eight patients underwent surgery for a perforated peptic ulcer during the study period. The median age was 52 years (range, 15–82), and 11 patients (22.9%) were older than 60 years. Men predominated

(83.3%). Educational attainment was generally low, with almost half having no formal education (Table 1). All eligible patients during the study period were enrolled and included in the analysis.

Table 1
Socio-Demographic Characteristics of Study Participants (N = 48)

Variable	Median (range) or n (%)
Age	
Median (range), *years*	52 (15–82)
≤ 60 years	37 (77.1)
> 60 years	11 (22.9)
Gender	
Female	8 (16.7)
Male	40 (83.3)
Educational status	
None	23 (47.9)
Primary	16 (33.3)
Secondary	7 (14.6)
Tertiary	2 (4.2)
Marital status	
Divorced	4 (8.3)
Married	28 (58.3)
Single	13 (27.1)
Widowed	3 (6.3)
Occupation	
Artisan	4 (8.3)
Driver	2 (4.2)
Farming	16 (33.3)
Laborer	3 (6.3)
Retired	1 (2.1)
Student	5 (10.4)
Trading	4 (8.3)
Unemployed	13 (27.1)

As seen in Table 2 below, the median admission systolic blood pressure was 121 mmHg (range 80–199 mmHg), mean hemoglobin was 12.2 g/dL (SD 3.2), and median preoperative albumin was 31.8 g/L (range 18.2–66.2). Gastric perforations accounted for 72.9% of cases, and the median perforation size was 10 mm. Purulent peritoneal aspirate was present in 27.1% of patients. Overall postoperative morbidity was 43.8% (21/48), while 30-day mortality was 12.5% (6/48). The most frequent postoperative complication was surgical site infection (42.8%), followed by pneumonia (28.6%) and intra-abdominal abscess (19.0%). The mean hospital stay in the original case series was approximately 10.9 days.

Table 2
Perioperative Clinical Characteristics

Variable	Mean (sd)/Median (range) or n (%)
Admitting SBP, median (range), *mmHg*	121 (80–199)
Pre-op Hemoglobin, mean (SD), *g/dl*	12.2 (3.2)
Pre-op albumin, median (range), g/L	31.8 (18.2–66.2)
Location of ulcer	
Duodenum	13 (27.1)
Gastric	35 (72.9)
Nature of peritoneal aspirate	
Bilious	35 (72.9)
Purulent	13 (27.1)
Size of ulcer, median (range), *mm*	10 (1–40)
Post-op complications	
Burst Abdomen	1/21 (4.8)
Enterocutaneous Fistula	1/21 (4.8)
Intra-abdominal Abscess	4/21 (19.0)
Postoperative pneumonia	6/21 (28.6)
SSI	9/21 (42.8)
Length of Hospital Stay	
Mean (SD), *days*	10.9 (2.7)
< 7 days	5 (10.4)
7–14 days	31 (64.6)
> 14 days	6 (12.5)
30-day mortality	
Yes	6 (12.5)
No	42 (87.5)

On bivariable analysis (Table 3), the nature of the peritoneal aspirate was significantly associated with 30-day morbidity. Patients with purulent contamination contributed 10 of the 21 morbidity events despite representing only 13 of the 48 patients in the cohort. For 30-day mortality, age above 60 years and

hypertension were significantly associated with death. Lower admission systolic blood pressure and smoking showed adverse trends but did not reach statistical significance.

Table 3
Association between demographic, clinical, and operative characteristics with 30-day morbidity and mortality

Variable	30-day morbidity, n/N (%)	p-value	30-day mortality, n/N (%)	p-value
Age				
≤ 60yrs	15/37 (40.5)	0.411	2/37 (5.4)	**0.006**
> 60yrs	6/11 (54.6)		4/11 (36.4)	
Gender				
Female	3/8 (37.5)	0.696	0/8 (0.0)	0.242
Male	18/40 (45.0)		6/40 (15.0)	
History of dyspepsia, *Yes*	6/13 (46.2)	0.838	1/13 (7.7)	0.539
History of PUD, *Yes*	5/8 (62.5)	0.272	0/8 (0.0)	0.242
History of alcohol intake, *Yes*	6/11 (54.6)	0.498	2/11 (18.2)	0.516
History of prolonged fasting, *Yes*	1/4 (25.0)	0.621	1/4 (25.0)	0.430
History of herbal drug use, *Yes*	4/5 (80.0)	0.153	0/5 (0.0)	0.372
History of smoking, *Yes*	4/10 (40.0)	1.000	3/10 (30.0)	0.060
History of chronic steroid use, *Yes*	1/1 (100.0)	0.438	0/1 (0.0)	0.702
history of NSAID use, *Yes*	6/12 (50.0)	0.614	1/12 (8.3)	0.614
Hypertension, *Yes*	3/9 (33.3)	0.712	4/9 (44.4)	**0.001**
Diabetes mellitus, *Yes*	1/2 (50.0)	1.000	0/2 (0.0)	0.585
Time to presentation				
≤24hrs	3/9 (33.3)	0.485	1/9 (11.1)	0.889
> 24hrs	18/39 (46.2)		5/39 (12.8)	
Admitting SBP				
≤120mmHg	10/24 (41.7)	0.771	5/24 (12.8)	0.081
> 120mmHg	11/24 (45.8)		1/24 (4.2)	
Pre-op Hemoglobin				

Note: Percentages in outcome columns are row percentages (morbidity n = 21; mortality n = 6).

Variable	30-day morbidity, n/N (%)	p-value	30-day mortality, n/N (%)	p-value
Age				
< 10g/dl	4/11 (36.4)	0.574	2/11 (18.2)	0.516
≥10g/dl	17/37 (45.9)		4/37 (10.8)	
Pre-op albumin level				
≤ 25 g/L	6/8 (75.0)	0.051	0/8 (0.0)	0.242
> 25 g/L	15/40 (37.5)		6/40 (15.0)	
Size of the ulcer				
≤10mm	16/35 (45.7)	0.653	3/35 (8.6)	0.177
> 10mm	5/13 (38.5)		3/13 (23.1)	
Nature of peritoneal aspirate				
Bilious	11/35 (31.4)	**0.005**	5/35 (14.3)	0.539
Purulent	10/13 (76.9)		1/13 (7.7)	
Note: Percentages in outcome columns are row percentages (morbidity n = 21; mortality n = 6).				

Regression analysis further refined these findings. The mortality model was a multivariable model that adjusted for age > 60 years and the presence of hypertension, while the morbidity model was a univariate model involving the presence of purulent peritoneal aspirate only. As depicted in Table 4, hypertension remained associated with 30-day mortality after adjustment (adjusted OR 8.8, 95% CI 1.1–70.4; p = 0.040), whereas the effect of age above 60 years attenuated after adjustment (adjusted OR 5.4, 95% CI 0.7–42.8; p = 0.113). For morbidity, purulent peritoneal aspirate remained significantly associated (OR 7.3, 95% CI 1.7–31.8; p = 0.008).

Table 4
Logistic regression results showing significant predictors of 30-day morbidity and mortality

Outcome	Predictor/Category	Crude OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
30-day mortality	Age > 60 years (vs ≤ 60)	9.9 (1.5–65.6)	0.016	5.4 (0.7–42.8)	0.113
30-day mortality	Hypertension (Yes vs No)	14.8 (2.1–102.7)	0.006	8.8 (1.1–70.4)	0.040
30-day morbidity	Purulent aspirate (vs bilious)	7.3 (1.7–31.8)	0.008		

DISCUSSION

Perforated peptic ulcer remains a severe emergency in our setting, with postoperative morbidity in nearly one out of two patients and death in one out of eight. These figures fall within the broad range reported across African and international series, [1, 5, 21, 22, 23, 25] but they are still high for a condition in which many adverse outcomes are potentially preventable with timely presentation, resuscitation, and source control.

The demographic pattern in this cohort - predominantly male, mostly 60 years or younger, and with a high proportion of gastric perforations - is broadly similar to several African reports [5, 19, 20, 25, 26] and contrasts with many high-income settings where the typical patient is older and more comorbid.[22, 27] The strong male predominance probably reflects behavioral and social exposures, including higher rates of smoking, alcohol use, self-medication with NSAIDs, and delayed health-seeking among men. The predominance of gastric perforation is also noteworthy because other Ghanaian and regional studies have described more duodenal perforations. [20] This may reflect geographic variation, referral bias, patterns of medication use, or differences in underlying ulcer epidemiology.

The complication profile deserves attention. Surgical site infection was the most common postoperative event, followed by pneumonia and intra-abdominal abscess. This pattern is consistent with the expected consequences of diffuse peritoneal contamination, emergency laparotomy, and perioperative sepsis. In low-resource settings, wound complications may also be amplified by delayed presentation, [7, 10] malnutrition, anemia,[8] microbial burden,[9] and limited access to higher-level postoperative monitoring.[6] Of these complications, wound infection (42.8%) emerged as the most common post-operative complication and was subsequently succeeded by pulmonary infection (28.6%). Vinod and colleagues also identified wound infection (41.8%) and pulmonary complications (31.8%) as the leading issues.[28] Across the continent, wound infection tends to dominate the postoperative profile, a pattern echoed in studies from Tanzania and Nigeria.[5, 25, 26] The observed mean hospital stay of about 11 days further highlights the substantial use of hospital resources imposed by PPU.

The most important morbidity was a purulent peritoneal aspirate. This finding is clinically plausible because purulent contamination is a direct marker of advanced bacterial peritonitis and delayed control of intra-abdominal sepsis. Patients with this intraoperative finding are likely to have a greater inflammatory burden,[1] more tissue edema,[12] increased risk of wound infection and abscess formation, [10] and possibly greater postoperative pulmonary compromise.[14] The result suggests that the operative note itself can serve as an immediate triage tool: once purulent contamination is encountered, clinicians should anticipate a more complicated recovery.

For mortality, hypertension emerged as being significantly associated. Age above 60 years was strongly associated with death on bivariable analysis, but the effect weakened in the multivariable model, probably because the sample was small and because age and comorbidity overlap clinically. Hypertension may have served as a marker of limited cardiovascular reserve,[10, 12] but this may be

hypothetical given the small sample size and the dearth of preoperative cardiovascular data. In practical terms, a history of hypertension should alert the team to the possibility of rapid decompensation, even where blood pressure at presentation appears acceptable.

Some variables commonly associated with poor outcomes in the literature - such as delayed presentation,[10] low hemoglobin and low albumin,[12] larger ulcer size,[15] and lower systolic blood pressure [16] - did not remain statistically significant in this dataset. This should be interpreted cautiously. The absence of statistical significance does not mean the absence of clinical importance. With relatively few outcome events, the analysis is best viewed as highlighting the strongest local signals rather than definitively ruling out other prognostic variables. In many settings, delay to surgery is a critical determinant of survival,[11] and time-sensitive systems interventions (rapid triage, resuscitation bundles, early antibiotics, and expedited laparotomy) remain central to improving outcomes.[3]

The study has several limitations. It was conducted at a single tertiary center, which limits generalizability. Confidence intervals were wide, reflecting the modest sample size and small number of mortality events. The analysis also lacked several variables that are often useful for prognostication, including ASA grade, lactate, renal dysfunction indices beyond routine chemistry, and validated PPU scores such as Boey or PULP. The lack of validated prognostic scores limits the comparison of the study's findings with those in the international literature. Even so, the prospective design, the use of consecutive cases, and the incorporation of operative findings make the data clinically valuable. Complications were also not objectively graded, limiting their comparison with existing literature. Finally, the dichotomization of continuous variables may reduce the power of the study.

The implications are practical. Patients presenting with perforated peptic ulcer should not all be considered equal risk after surgery. Those with purulent intraperitoneal contamination and those with hypertension deserve closer postoperative surveillance, earlier recognition of deterioration, and, where feasible, higher-dependency care. Future multicenter work in Ghana should validate these predictors in larger cohorts and test whether structured sepsis pathways or standardized risk scores can reduce postoperative complications and deaths.

CONCLUSION

Perforated peptic ulcer at Komfo Anokye Teaching Hospital predominantly affected men and was associated with substantial short-term morbidity and mortality. Purulent peritoneal aspirate was the clearest predictor of 30-day morbidity, while hypertension independently predicted 30-day mortality. Older age was also associated with death on bivariable analysis. These findings emphasize the need for early presentation, prompt operative source control, aggressive resuscitation, and intensified postoperative monitoring for patients with major intra-abdominal contamination or important cardiovascular comorbidity.

Abbreviations

ASA – American Society of Anesthesiologists

KATH – Komfo Anokye Teaching Hospital

LMICs – Low-to-middle income countries

NSAIDs – Non-steroidal anti-inflammatory drugs

PPU – Perforated peptic ulcer

PUD – Peptic ulcer disease

Declarations

Ethical Approval and Consent to Participate

This study was conducted in line with the principles outlined in the Declaration of Helsinki. Ethical clearance was obtained from the Committee on Human Research, Publication and Ethics of Kwame Nkrumah University of Science and Technology (Ref No. CHRPE/AP/301/18), and the Ethical Review Committee of Komfo Anokye Teaching Hospital. All study participants provided written consent after being provided with all relevant information. Participants aged less than 18 years provided assent to participate while their guardians provided consents to participation.

Consent for Publication

Not applicable.

Availability of data and materials

All data used in this study is available on reasonable request to the corresponding author.

Competing Interests

The authors declare that they have no competing interests.

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Author Contributions

KA conceptualised the study, helped with data collection and analysis, and drafted the study. SGB helped with data collection and statistical analysis and jointly drafted the manuscript. AB helped with data analysis and manuscript writing. CKD assisted in data collection, analysis, and manuscript writing. AG helped with statistical analysis and manuscript writing. All authors read and approved the final draft.

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