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Prognostic Indicators and Short Term Outcomes for Operated Patients with Peritonitis: Prospective Cohort Hospital Based Study in Northern Tanzania

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Abstract

Background: Peritonitis is one of the most common surgical emergencies all over the world and is associated with significant complications and mortality. The spectrum of aetiology of peritonitis differs between high income countries and low income countries. Majority of the patients present late with purulent peritonitis and septiceamia. Surgical treatment of peritonitis is highly demanding and very complex, however, if the outcome in these patients can be correctly predicted, then better management can be instituted in order to achieve optimal patient's care and hence improve treatment outcome.

Methods: Prospective cohort hospital based study was conducted among patients admitted due to peritonitis at Kilimanjaro Christian Medical Center (KCMC) from October 2018 to March 2019. Documentary review and interview methods were employed to obtain data using electronic structured questionnaire. Data was summarized using median, Inter-Quartile Range (IQR), frequency and percentage. Both bivariate and multivariate logistic regression analyses were used to identify prognostic indicators for post-operative complications and mortality. A 95% CI and P <0.05 used for significance test.

Results: The study enrolled 70 patients with predominance of male, giving a male to female ratio of 4.1:1. A total number of 33(47.1%) developed complications and 16(22.9%) died. Only 1(1.43%) patient presented to the hospital within 24 hours since the onset of illness. Delay in care, longer duration of operation, and low potassium were the prognostic indicators noted to have influence on short term complications. The major influence for mortality were comorbidity (AOR=3.02; 95%CI: 2.25-42.90) and postoperative complications (dyselectrolaemia) with (AOR=9.27; 95%CI: 1.21-70.83).

Conclusion: Mortality and complications resulted from peritonitis is unacceptably high. Delay in care, longer duration of operation and preoperative low serum potassium levels were the prognostic indicators for the post-operative complications. Comorbidity and postoperative complications such as dyselectrolaemia had influence for the mortality. Correct prediction of these adverse outcomes will help to institute better management for the patients with peritonitis.

Keywords: Peritonitis; Prognostic indicators; Short term outcomes

Abbreviations: AOR: Adjusted Odds Ratio; APACHE: Acute Physiology And Chronic Health Evaluation; ARDS: Acute Respiratory Distress Syndrome; ASA: American Society of Anaesthesia; CI: Confidence Interval; COR: Crude Odds Ratio; GIT: Gastrointestinal Tract; Hb: Haemogobin; Hct: Haematocrit; HIV: Human Immunodeficiency Virus; ICU: Intensive Care Unit; IQR: Inter-quartile range; KCMC: Kilimanjaro Christian Medical Center; KCMUCo: Kilimanjaro Christian Medical University College; MOSF: Multiple Organ System Failure; PI: Principal Investigator; PR: Pulse Rate; PUD: Peptic Ulcer Disease; RR: Respiratory Rate; SIRS: Systematic Inflammatory Response Syndrome; SPSS: Statistical Package for Social Sciences; TLC: Total Leucocyte Counts.

Background

Peritonitis is defined as an inflammatory process of the peritoneum caused by introduction of infections into the otherwise sterile peritoneal environment which might be chemical irritants/agents such as bacteria, fungi, virus, talc, drugs, granulomas, and foreign bodies [1,2]. Peritonitis is a frequently encountered emergence and remains a significant cause of postoperative complications and mortality which usually requires emergency surgery. Risk evaluation in peritonitis can predict outcomes, direct treatment planning and aid in the conduct of surgical audits; ultimately leads to improved results

in terms of reducing complications and mortality. Peritonitis is one of the most common surgical emergencies all over the world and is associated with significantly morbidity and mortality [3,4].

Currently in developing countries the mortality due to peritonitis is reported to be between 13-43%, thus becoming the dominant cause of death due to surgical infections despite the great progress in intensive care support, antimicrobial therapy and surgical techniques. Timely prognostic evaluation of peritonitis will not only provide desirable categorization of disease severity but also correctly predict the outcome hence more aggressive and better therapeutic management can be instituted [5,6]. In Tanzania a study done at Bugando Medical Centre (BMC) in 2015 showed the overall mortality was 15.46% with overall postoperative complications of 36.08% [5,6].

Regardless of advancement in various supportive and therapeutic interventions such as intensive care support, antimicrobial therapy and surgical techniques, the management of peritonitis is still difficult and puts a big challenge to clinicians [7].

Early prognostic evaluation of peritonitis is desirable to provide objective classification of the severity of the disease and hence select high risk patients for more aggressive therapeutic procedures. Therefore this study aimed at exploring the wide range of prognostic indicators which determine the short term outcome for operated patients with peritonitis so as to identify factors responsible for the poor outcome and specifically address them in the context of reducing poor outcomes among operated patients with peritonitis.

Methods

Study design and setting

This was a prospective cohort study conducted from October 2018 to March 2019 at the department of General Surgery at KCMC in Moshi in the Kilimanjaro region. KCMC is a Northern Zone Consultant Hospital in Tanzania. The hospital receives referred patients from northern and central regions namely Arusha, Manyara, Tanga, Dodoma, Singida and districts from the Kilimanjaro region. The population served is more than 15 million people.

Study population

All patients admitted at KCMC due to peritonitis at surgical department who met inclusion criteria were enrolled in the study.

Sample size and sampling procedure

A minimum sample size of 70 was estimated using Fischer's formula based on the study which was done at Bugando Medical centre in Tanzania in 2015 found 36.1% of short term complication among patients with peritonitis [6].

Consecutive sampling procedure was employed to obtain 70 study participants; where one case was enrolled after the other consecutively until the required sample size met.

Data collection tool, methods and study procedures

Electronic structured questionnaire was used for data collection from the patient files. Pre-testing was done among 10 patients, the findings from pre-testing was used to test the validity and reliability of the study tool whereby adjustment was done accordingly.

This study employed documentary review and interview methods to obtain data from patient files and patients respectively, hence filling structured questionnaires. Principal investigator of the study and one trained research assistant used the structured questionnaire for data abstraction.

Patients were admitted to general surgical ward and Surgical Intensive Care Unit (SICU) through outpatient clinic, emergency department and other departments. On arrival to the wards based on history, physical examination, laboratory tests and radiological findings; a provisional diagnosis of peritonitis was reached. After resuscitation and stabilization, patients were taken to theatre for laparotomy.

The vital signs were taken and clinical examination was conducted regularly every day following the initial visit to look for complications until patient discharge or death. Complications during the follow up period were determined by identification of one or more of the following complications: Surgical site infections, Postoperative septiceamia, enterocutaneous fistula, surgical site infections, dyselectrolaemia, burst abdomen and reoperation. Patients were followed up till their discharge and then weekly during the outpatient visits. An appointment was made by phone. The study end point was reached at the 30th day postoperatively following the first operation or death. Variables for the study were obtained from patient data and case notes as in the data sheet.

Data management and analysis

The collected data were crosschecked for completeness and validity following study eligibility. The valid cases were entered into Statistical Packed for the Social Science (SPSS Version 23.0) with help of a trained data clerk. Data backup was maintained daily and secured with password for unauthorized person. The data was then cleaned by checking for entry errors and categorization of the study variables following the standardized approach for clinical parameters' classifications including haemoglobin, urea, creatinine, sodium, potassium and Total Leucocyte Counts (TLC).

Descriptive analysis was done to summarize the numerical data using median and Inter-Quartile Range (IQR), while categorical variables were summarized using frequency and percentage. Bivariate Logistic regression analysis for crude odds ratios was applied to determine the strength of association between outcome variables (Complications and mortality) and the prognostic indicators. Multivariate logistic analysis was applied to control confounders and effects modifiers towards development of post-operative complications and mortality among patients with peritonitis. A 95% confidence interval and $p<0.05$ was used to identify significant prognostic indicators. The findings were presented using figures and tables.

Results

A total of 83 patients were managed for peritonitis during the study period. Thirteen (13 cases) did not meet the study criteria and were excluded from the study. Thus, a total 70 participants were enrolled in the study. Of which 49 (70%) developed post operative complications (Figure 1).

Socio-demographic characteristics of the study participants

Of 70 patients took place in the study, the median age was 41 years with inter-quartile range between 22 to 56 years old. Majority 81.4% (n=57) were male and 18.6% (n=13) female. About 61.4% (n=43) had primary education and nearly two third 65.7% (n=46) were unemployed. More than half 52.9% (n=37) of the patients were residing in other Districts of Kilimanjaro region. Ten 14.3% reported to have been smoking and 24.3% (n=17) drinking alcohol (Table 1).

The short term outcomes for operated patients with peritonitis at KCMC

Regarding the distribution of short term outcome for operated patients with peritonitis 30% had successful operation without presented with short term complications, 47.1% had complications and 22.9% died. The most common complication presented was septicemia 55.7% followed by dyselectrolaemia 21.4%, surgical infection 18.6%, enterocutaneous fistula, reoperation 10% and burst abdomen 5.7%. Having mortality of 22.9% implies about 2 patients in 10 patients with peritonitis die after operation (Figure 2).

Prognostic indicators for complications among operated patients with peritonitis

Complications comprised of septicemia, dyselectrolaemia, surgical infection, enterocutaneous fistula, reoperation, and burst abdomen. Prognostic indicators for complications were categorized into non-laboratory and laboratory parameters as follows:

Table 2 shows non-laboratory indicators for complications. Complications were more common among patients aged 50 years or below 57.4% when compared to above 50 years with 26.1%. The indicators with significant increase in complications was delay in care (pre-operative duration of symptoms) more than 48 hours 56% (Odds ratio (OR)=3.56; 95% Confidence Interval (CI):1.06-12.02; P=0.02), the longer duration of operation 61.3% (0R=3.80, 95%CI: 1.01-14.61, p=0.04). In relation to sex of patient, complications were more prevalent to female 61.5% (OR=2.05; 95%CI: 0.58-7.18), but this was not statistically significant. Other parameters with positive

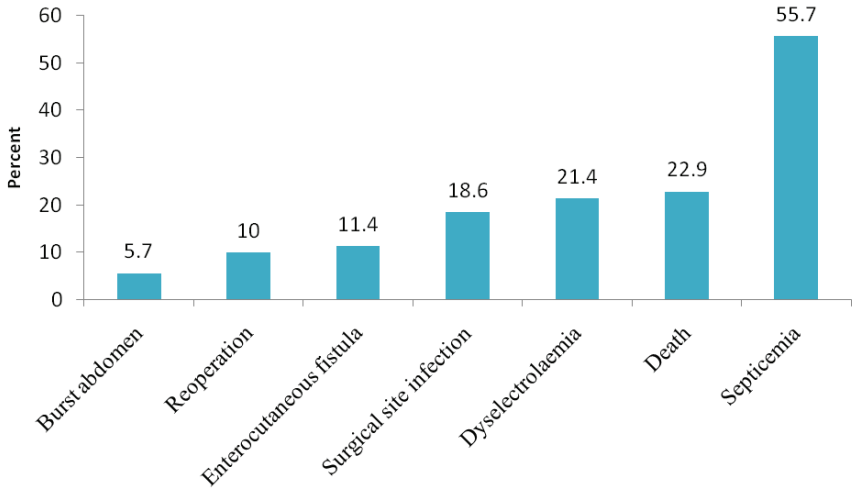

Figure 1: The short term outcomes for operated patients with peritonitis at KCMC (n=70).

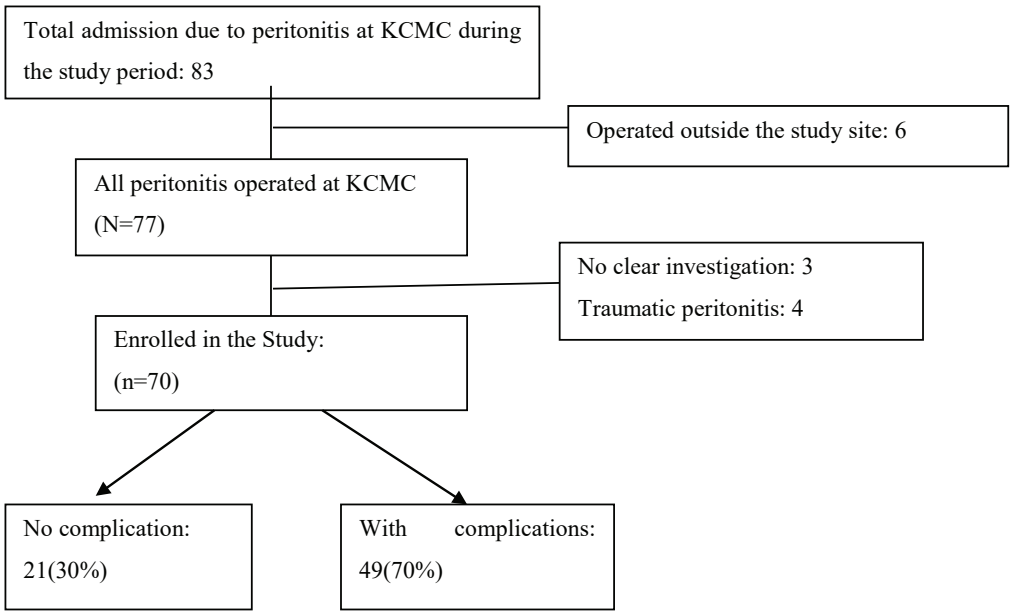

Figure 2: The short term outcomes for operated patients with peritonitis at KCMC (n=70).

Table 1: Socio-demographic characteristics of the study participants (n=70).

Variables	Categories	n	%
Age in years	[Median, IQR]	[41,22-56]	
	≥ 50	47	67.1
	>50	23	32.9
Sex of the participant	Male	57	81.4
	Female	13	18.6
Education background	Informal	9	12.9
	Primary	43	61.4
	Secondary	12	17.1
	College/university	6	8.6
Employment status	Employed	9	12.9
	Unemployed	46	65.7
	Child	15	21.4
Place of residence	Moshi urban	18	25.7
	Other Districts of Kilimanjaro	37	52.9
	Outside Kilimanjaro	15	21.4
Smoke cigarette	No	60	85.7
	Yes	10	14.3
Alcohol drink	No	53	75.7
	Yes	17	24.3

association with complications but were not statistically significant includes generalized peritonitis 47.6% (OR=1.21; 95%CI: 0.25-5.94), character of peritoneal fluid including purulent 51.2%, faecal 42.9%, and haemorrhagic 60%; Gastrointestinal (GIT) perforation 51.3% (OR=1.46; 95%CI: 0.56-3.81), and gangrenous bowel 71.4% (OR=3.13; 95%CI: 0.54-17.97).

Regarding laboratory parameters associated with complications table 3 is concerned. Low potassium was a significant parameter associated with complications 65.2% (OR=3.08, 95%CI: 1.02-9.59, P=0.04). Other laboratory indicators for complications included low Hb48.6% (OR=1.14; 95%CI: 0.44-2.93), low sodium 50% (OR=1.13; 95%CI: 0.42-3.03), and TLC less than 4×10^9 units per liter 66.7% (OR=1.90; 95%CI: 0.15-23.68).

Prognostic indicators for mortality among operated patients with peritonitis

Considering the associated parameters, we categorized these into non-laboratory and laboratory indicators as described in tables 4 and 5.

Non-laboratory prognostic indicators for mortality among patients operated due to peritonitis, are shown in table 4. The significant presented indicators for mortality were comorbidity with 7.80 folds in increase of mortality in the crude odds ratio, the comorbidity remained significant even after adjusting other indicators in the multivariate model (Adjusted Odds Ratio (AOR)=3.02; 95%CI: 2.25-42.90). Other indicators with positive association included high Pulse Rates (PR)>100bpm (Crude Odds Ratio (COR)=4.04; 95%CI: 1.09-15.02), but this indicated weak association after adjusting with other indicators (AOR=3.32, 95%CI: 0.91-12.08), high Respiratory Rates (RR) above 30 beats per minutes (bpm) (COR=5.67; 95%CI: 1.04-

Table 2: Prognostic indicators (Non-laboratory parameters) for complications among operated patients with peritonitis (N=70).

Prognostic indicators	All patients	With complication (n=33)	Statistical estimate	
	N	n (%)	OR(95%CI)	P-value
Age group years				
≥ 50	47	27(57.4)	1.00	
>50	23	6(26.1)	0.26(0.08-0.83)	0.014
Sex				
Male	57	25(43.9)	1.00	
Female	13	8(61.5)	2.05(0.58-7.18)	0.252
Peritonitis				
Localized	7	3(42.9)	-	
Generalized	63	30(47.6)	1.21(0.25-5.94)	0.812
Character of peritoneal fluid				
Clear	13	4(30.8)	1.00	
Purulent/turbid	43	22(51.2)	2.36(0.61-9.12)	0.200
Faecal	7	3(42.9)	1.69(0.24-12.08)	0.598
Haemorrhagic	5	3(60.0)	3.38(0.34-33.27)	0.268
Others	2	1(50.0)	2.25(0.10-52.39)	0.603
Pre-operative duration of symptoms				
Less than 24	1	0(0.0)		
24 to 48	19	5(26.3)	1.00	
More than 48	50	28(56.0)	3.56(1.06-12.02)	0.028
GIT perforation				
No	31	13(41.9)	1.00	
Yes	39	20(51.3)	1.46(0.56-3.81)	0.439
Gangrenous bowel				
No	57	28(49.1)	1.00	
Yes	13	5(38.5)	3.13(0.54-17.97)	0.178
Duration of operation				
Less than 2	17	5(29.4)	1.00	
2 to 3	31	19(61.3)	3.80(1.01-14.61)	0.045
More than 3	22	9(40.9)	1.66(0.42-6.56)	0.463
Co-morbidity				
No	43	23(53.5)	1.00	
Yes	27	10(37.0)	0.51(0.19-1.40)	0.182

Table 3: Prognostic indicators (Laboratory parameters) for complications among operated patients with peritonitis (N=70).

Prognostic indicators	All patients	With Complication (n=33)	Statistical estimate	
	N	n(%)	OR(95%CI)	P-value
Hb level				
Normal	33	15(45.5)	1.00	
Low	37	18(48.6)	1.14(0.44-2.93)	0.791
Haematocrit (%)				
Less than 25	5	2(40.0)	0.63(0.09-4.33)	0.638
25 to 40	39	20(51.3)	1.00	
More than 40	26	11(42.3)	0.70(0.25-1.92)	0.481
TLC(× 10^9/L)				
Less than 4	3	2(66.7)	1.90(0.15-23.68)	0.613
4 to 11	37	19(51.4)	1.00	
More than 11	30	12(40.0)	0.33(0.025-4.40)	0.357
Sodium (mmol/L)				
Less than 135	30	15(50.0)	1.13(0.42-3.030	0.815
136 to 150	34	16(47.1)	1.00	
More than 150	6	2(33.3)	0.56(0.09-3.61)	0.538
Potassium (mmol/L)				
Less than 3.8	23	15(65.2)	3.08(1.02-9.59)	0.040
3.8-5.10	37	14(37.8)	1.00	
Above 5.10	10	4(40.0)	1.10(0.26-4.64)	0.901
Creatinine(μ mol/L)				
less than 62	14	6(42.9)	0.59(0.16-2.13)	0.416
62-106	34	19(55.9)	1.00	
More than 106	22	8(36.4)	0.45(0.15-1.40)	0.157

31.01), this also remained not significant in the multivariate model (AOR=3.93, 0.73-21.21). Patients aged more than 50 years had 2.6 times increased risk for mortality when compared to patients aged 50 years and below (COR=2.60; 95%CI: 0.80-8.45). Abdominal tumor, malignant had 7.04 folds increase in mortality but this was lacking statistical evidence in the multivariate model (AOR=7.04; 95%CI: 0.32-156.78).

Laboratory prognostic indicators for mortality are presented in table 5. High Creatinine above 106 micromol per litre and low Haemoglobin (Hb) were the significant laboratory prognostic indicator for mortality (COR=6.25; 95%CI: 1.45-26.92) and COR=5.42; 95%CI: 1.28-23.01), even after adjusting with possible interactions we found powerful association in both high creatinine and low Hb, however, these were not statistically significant (AOR=4.53; 95%CI: 0.90-22.77) and (AOR=4.20; 95%CI: 0.93-19.02) respectively. Other parameters including Sodium, Potassium, TLC, and haematocrit had positive association with mortality though these were lacking statistical evidence.

Complications and comorbidity associated with postoperative mortality among patients with peritonitis

The sub-analysis was done to associate complications and comorbidity that associated with mortality among patients operated due to peritonitis. In the sub-analysis, patients presented with severe anaemia pre-operatively had 5.88 folds in increase of mortality, and this remained most significant indicators for mortality in the multivariate analysis (AOR=9.89, 95%CI: 1.12-87.51). Patients who developed dyselectrolaemia after operation had 6.71 high increases in risk of mortality when compared to the counterpart (COR=6.71, 1.70-26.50); and this continued to be significant indicator for mortality in the multivariate analysis (AOR=9.27; 95%CI: 1.21-70.83). Patients who were re-operated had 5.67 folds in increase of mortality when compared to non re-operated patients and this was significant in the crude analysis (COR=5.67, 95%CI: 1.03-31.00) though in the multivariate analysis this was not significant (AOR=4.16, 95%CI: 0.25-69.53), (Table 6).

Discussion

The total number of 70 participants was recruited, with predominance of male observed giving a male to female ratio of 4.4:1. The predominance of male sex for general surgical pathology was even documented by other studies [6,8]. The majority were patients aged <50 years similar to study in Kenya [4]. Out of 70 patients, 33 (47.1%) developed postoperative complications and 16(22.9%) patients died.

In this study, the major influence of mortality was comorbidity and postoperative complications similar to study in Tanzania [6].

The overall complication in this study was 47.1%. This is consistency to study conducted in neighboring country in Kenya [4]. Having similar proportion of complications can be explained due to nature of the clients enrolled in the study who shared common lifestyle. However, other study in middle income countries in India also reported similar findings 36.0% [5]. The different can be explained due to early presentation to care and management; in the current study majority of the clients delayed in seeking care in which about 56% of patients presented after 48 hours since the onset of the symptoms, a situation that resulted an increase in risk of complications as reported in this study.

Table 4: Logistic regression analysis of the prognostic indicators (Non laboratory parameters) for mortality among operated patients with peritonitis (N=70).

Prognostic Indicators	All patients	Complication (n=16)	Statistical estimate	
	N	n(%)	COR(95%CI)	AOR(95%CI)
Age group(years)				
≥ 50	47	3(17.0)	1.00	
>50	23	3(34.8)	2.60(0.80-8.45)	
Character of peritoneal fluid				
Clear	13	1(7.7)	1.00	
Purulent/turbid	43	9(20.9)	3.18(0.35-29.00)	3.46(0.14-8.51)
Faecal	7	4(57.1)	16.0(0.72-35.60)	2.84(1.21-9.8)
Haemorrhagic	5	1(20.0)	3.00(0.13-68.69)	1.64(0.04-71.33)
Others	2	1(50.0)	12.00(0.23-611.85)	5.41(0.02-37.93)
PR(bpm)				
<100	35	4(11.4)	1.00	
>100	35	12(34.3)	4.04(1.09-15.02)	3.32(0.91-12.08)
RR(bpm)				
Below 30	63	12(19.0)	1.00	
Above 30b	7	4(57.1)	5.67(1.04-31.01)	3.93(0.73-21.21)
Shock				
Yes	11	4(36.4)	2.25(0.55-9.13)	1.63(0.47-24.86)
No	59	12(20.3)	1.00	
Duration of operation(hrs)				
Less than 2	17	4(23.5)	1.00	
2 to 3	31	6(19.4)	0.78(0.18-3.32)	0.22(0.01-3.88)
More than 3	22	6(27.3)	1.22(0.28-5.36)	0.12(0.01-2.55)
Co-morbidity				
No	43	4(9.3)	1.00	
Yes	27	12(44.4)	7.80(1.90-31.96)	3.02(2.25-42.90)
Abdominal tumour				
Non-malignant	65	13(20.0)	1.00	
Malignant	5	3(60.0)	6.00(0.84-42.73)	7.04(0.32-156.78)

The most reported complications in the current study comprised of septicemia, dyselectrolemia, surgical site infection, enterocutaneous fistula, re-operation and burst abdomen. The nature of complications in this study is almost similar to that reported in Pakistan, India and Kenya [3-5]. This implies that varieties of complications due to peritonitis after operation may not be influenced by environmental exposures or ethnicity rather the patient's altitude and the quality of care that may help to reduce the magnitude of the pertained problem.

In regards to mortality; we found the mortality rate of 22.9%. This was high when compared to other studies in Tanzania [6] and India [9] which reported the overall mortality of 15.46% and 10% respectively. This difference could be explained by the presence of well-equipped established modern accident and emergency department in the study centers as reported by the previous studies where emergency service is provided. Our finding is consistency with other studies in India which found mortality of 25% [8].

Higher complications and mortality in the current study could be explained by late presentation to the health facility by majority of patients and presence of co-morbid illness, a situation which further complicates effective management. In this study, patients with preoperative duration of symptoms for more than 48 hours had increased risk of complications compared to the counterpart. Similarly, studies in India and Tanzania which found that majority of patients who presented late in care were more likely to increase risk of complications [6,9]. Ideally, patients who delayed in presentation for treatment fared the worst, a situation which further complicates effective management.

The current study found the time of surgery was associated with complications. The complications were significantly high in the group of patients where surgery lasted more than 2 hours, and this was statistically significant similar to the finding India [5].

In this study, preoperative serum Potassium levels had affected the complications. Hypokaelemia of less than 3.8 mmol/L was significantly related to complications contrary to findings by Khan PS, et al., in India where Potassium levels had no relation at all to complications [5]. However, despite the difference in finding between the current and that reported by Khan PS, et al. Potassium is still one of the parameters in the Acute Physiology and Chronic Health Evaluation (APACHE) scoring system to predict the outcome.

The study showed that, age more than 50 years had complications of 26.1%, however, this is contrary to other studies that concluded age more than 50 years is related to high overall complications of 47.1% and 50% like studies done in Kenya and in India respectively [4,9].

Table 5: Logistic regression analysis of the prognostic indicators (Laboratory parameters) for mortality among operated patients with peritonitis (N=70).

Prognostic Indicators	All patients	Mortality (n=16)	Statistical estimate	
	N	n(%)	COR(95%CI)	AOR(95%CI)
Hb (g/dl)				
Normal	33	3(9.1)	1.00	
Low	37	13(35.1)	5.42(1.28-23.01)	4.20(0.93-19.02)
Haematocrit (%)				
Less than 25	5	3(60.0)	4.35(0.58-32.42)	
25 to 40	39	10(25.6)	1.00	
More than 40	26	3(11.5)	0.38(0.09-1.58)	
TLC(x10^9/L)				
Less than 4	3	0(0.0)	-	
4 to 11	37	8(21.6)	1.00	
More than 11	30	8(26.7)	1.32(0.42-4.11)	
Sodium (mmol/L)				
Less than 135	30	8(26.7)	2.11(0.59-7.52)	1.35(0.31-5.92)
136 to 150	34	5(14.7)	1.00	
More than 150	6	3(50.0)	5.80(0.80-42.23)	3.58(0.42-30.50)
Potassium(mmol/L)				
Less than 3.8	23	3(13.0)	0.47(0.11-2.00)	0.34(0.07-1.82)
3.8-5.10	37	9(24.3)	1.00	
Above 5.10	10	4(40.0)	2.07(0.46-9.32)	1.12(0.18-7.10)
Creatinine(μ mol/L)				
less than 62	14	2(14.3)	1.25(0.20-7.91)	1.28(0.20-8.20)
62-106	34	4(11.8)	1.00	
106-212	22	10(45.5)	6.25(1.45-26.92)	4.53(0.90-22.77)

But in this study the lower complications in the elderly probably was affected by small number of participants in the elderly group.

This study found other indicators for complications include female 61.5%, high PR 48.6%, purulent peritoneal fluid 51.2%, GIT perforation 51.3%, gangrenous bowel 71.4%, TLC (less than 4 × 109/L) 66.7%, sodium less than 135mmol/L (50%), all these were not statistically significant when compared to previous study done by Khan et al., which reported significant association with low Hb 36%, Sodium level less than 135mmol/L (42.9%) and purulent peritoneal fluid 38.7% [5].

In this study, presence of comorbidity was shown to have a significant effect on the mortality where 44.4% of patients with comorbidity died. A similar influence of comorbidity on the mortality was reported by Mabewa A, et al. with mortality of 60% [6]. This may be due to less attention that is given to comorbidity in the setting of surgical emergency and therefore co-morbidity may be overlooked leading to increased risk of mortality. The current study again found high creatinine, low Hb, high PR and high RR were significantly associated with mortality, corresponding to findings in India [5].

Looking into age of patients, this study showed patients with age less than 30 years was significantly associated with mortality of 25% than elderly group aged >50 years (15.8%) different from previous study in Karnataka where they found patients aged >50 years were significantly associated with mortality [10]. The difference in mortality may be explained by small number of participants in elderly group aged >50 years in the present study.

In this study mortality was also seen in patients with faecal peritoneal soakage and presence of abdominal malignancy, similar to the findings in India [8]. However, both findings were not conclusive due to small number of patients with malignancy.

Conclusion

Delays in care, longer duration of operation and low serum Potassium are the prognostic indicators for the post-operative complications. Comorbidity and postoperative complications such as dyselectrolaemia had influence for the mortality. Correct prediction of these adverse outcomes will help to institute better management for the patients with peritonitis. Moreover, further prospective study is required to validate the individual factors identified in this study.

Ethical Consideration

Ethical clearance and approval with certificate number 2361 was obtained from Kilimanjaro Christian Medical College Research Ethics and Review Committee (CRERC). The study observed confidentiality and privacy of the subjects. No participant's name was used. Instead, unique identifiers were used. Also, no participant incurred either laboratory or radiological investigations expenses.

Informed consent process was provided to all participants and clear information was given following written consent. The document was prepared in Swahili for convenience.

Consent for Publication

Not applicable

Availability of Data and Materials

All data and materials concerning this research article are available for sharing if needed.

Table 6: Complications and co-morbidity associated with post-operative mortality among patients with peritonitis (N=70).

Factors	All patients	Post-operative outcome		Estimated Odds Ratio	
		Survivor (n=54)	Died (n=16)	COR (95%CI)	AOR (95%CI)
Surgical site infection					
No	57	44(77.2)	13(22.8)		
Yes	13	10(76.9)	3(23.1)	1.02(0.24-4.29)	0.96(0.11-8.60)
Septiceamia					
No	31	26(83.9)	5(16.1)		
Yes	39	28(71.8)	11(28.2)	2.04(0.61-6.82)	0.75(0.15-3.90)
Burst abdomen					
No	66	51(77.3)	15(22.7)		
Yes	4	3(75.0)	1(25.0)	1.13(0.11-11.91)	0.09(0.01-7.08)
Fistula, enterocutaneous fistula					
No	62	50(80.6)	12(19.4)		
Yes	8	4(50.0)	4(50.0)	4.17(0.86-20.16)	2.72(0.23-32.56)
Re-operated					
No	63	51(81.0)	12(19.0)		
Yes	7	3(42.9)	4(57.1)	5.67(1.03-31.00)	4.16(0.25-69.53)
Dyselectrolemia					
No	55	47(85.5)	8(14.5)		
Yes	15	7(46.7)	8(53.3)	6.71(1.70-26.50)	9.27(1.21-70.83)
Hypertension					
No	64	50(78.1)	14(21.9)		
Yes	6	4(66.7)	2(33.3)	1.79(0.29-10.98)	9.14(0.56-150.63)
Diabetes mellitus					
No	68	52(76.5)	16(23.5)	1.00	
Yes	2	2(100)	0(0.0)	-	
Renal failure					
No	66	53(80.3)	13(19.7)		
Yes	4	1(25.0)	3(75.0)	12.23(1.03-145.85)	4.84(0.22-106.52)
Severe anaemia					
No	59	49(83.1)	10(16.9)		
Yes	11	5(45.5)	6(54.5)	5.88(1.37-25.25)	9.89(1.12-87.51)
Heart failure					
No	67	54(80.6)	13(19.4)	1.00	
Yes	3	0(0.0)	3(100.0)	-	

Competing Interests

There are no conflicts of interest regarding this paper to be disclosed.

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Author's Contribution

NM designed the study, wrote the manuscript, collected samples from patients and participated in data collection. DM, KC, AH and SC participated in designing of the study and editing the manuscript. JA compiled and analyzed final data. All authors have read and approved the manuscript.

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