

Addis Ababa University
College of Health Sciences

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Pattern and predictors of Outcome in patients with secondary
Generalized peritonitis in two referral hospitals in Addis Ababa,
Ethiopia

A research submitted by

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June 2024

Abstract

Background – Peritonitis is defined as irritation and inflammation of the peritoneum covering the abdominal wall. This usually occurs due to microbial contamination of the peritoneum.

Etiologically it is further classified as primary, secondary, and potentially tertiary. The diagnosis of generalized peritonitis is mainly clinical. Patients can also present late with signs and symptoms of organ failure. Surgery is the sole and effective measure to manage patients with secondary generalized peritonitis.

Objective: - To study the pattern and predictors of outcome for patients operated for secondary Generalized peritonitis

Method: - A retrospective cross-sectional study will be conducted by reviewing medical record of patient operated at Tikur Anbessa Comprehensive Specialized Hospital and Zewditu Memorial Hospital. Data will be collected through structured questionnaire. The variable will be analyzed using SPSS version 26

Result; -The result of the study will be presented as well as published

Budget; ETB(29,265 Ethiopian Birr) is required for this research

Acknowledgment

I want to give credit for department of surgery for creating this learning opportunity. It is worth mentioning that being assigned to senior Hepatobiliary surgeon as an advisor is also a great privilege.

I would also like to acknowledge Dr. Zeki Abdurahman for giving supportive criticisms and comments thorough out the writing process

I would like to thank my advisors from Addis Ababa Health Bureau for critically reviewing my research proposal and adding their inputs.

Acronyms/Abbreviations

BPM= beats per minute

CBC= complete blood count

CLD = chronic liver disease

ER= emergency room

ESRD= end stage renal disease

g/dl= gram per deciliter

GI= gastrointestinal

Hgb= Haemoglobin

ICU= Intensive care unit

mmHg= millimeter of mercury

PTE= pulmonary thromboembolism

PUD= peptic ulcer disease

SSI= surgical site infection

TASH= Tikur Anbessa Specialized Hospital

WBC= white blood count

ZMH= Zewditu Memorial Hospital

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Introduction

Background

Peritonitis is defined as irritation and inflammation of the peritoneum covering the abdominal wall. This usually occurs due to microbial contamination of the peritoneum. Generalized peritonitis occurs when inflammation of the infection is not localized and diffuse. It is one of the most common encountered cases in the practice of general surgery in emergency setting. It is diagnosed clinically patients having diffuse tenderness and rebound tenderness with guarding and rigidity. This is lethal illness with extremely high mortality and morbidity in untreated cases.

Etiologically it is further classified as primary, secondary, and potentially tertiary. (1)

Primary peritonitis is infection of the peritoneum usually with hematologic spread of microorganism from other areas of the body. This kind of peritonitis occurs in patients who already have ascites as in patients with decompensated chronic liver disease. Other commonly diagnosed patients are patients undergoing peritoneal dialysis. The other unique feature of primary peritonitis is that usually a single bacteria is isolated such as Gram negative and enterococci in chronic liver disease patients and staphylococcus and pseudomonas in end stage renal disease patients undergoing Peritoneal dialysis. (2)

Whereas *secondary peritonitis* is due direct contamination through perforation or severe inflammation of intra-abdominal organs. Patients with complicated appendicitis and perforated peptic ulcer disease are common examples in Ethiopian context. It occurs most commonly from a physical or functional disruption of gastrointestinal tract integrity and is typically polymicrobial.

Tertiary peritonitis poorly understood phenomenon occurs after the host fails to clear secondary peritonitis despite adequate treatment. The international sepsis forum defines it as peritonitis persisting >48hrs after appropriate treatment of secondary peritonitis. The common offending organisms are Candida Albicans, Psudomonas, Enterococci and Enterobacter. (3)The prognosis of this group of patients is grim.

The diagnosis of generalized peritonitis is mainly clinical. Up on presentation patients will complain of severe abdominal pain, fever and so on. Patients are acutely sick looking due to the pain. They will also be tachycardic, tachypneic and febrile. On abdominal examination patients will have diffuse direct and rebound tenderness all over the abdomen. The abdominal muscles became rigid in response to the irritation of the peritoneum. This phenomenon is called peritonism and is mediated by Nociceptive stimuli located in the visceral peritoneum. (1) This sign is an important clue though the sensitivity and specificity is lower. (1)

Patients can also present late with signs and symptoms of organ failure. Patients can be hypotensive despite fluid resuscitation. Respiratory failure can also be there with altered and depressed mentation indicating CNS failure. Patients urine output can also be affected indicating of acute kidney injury.

It's not necessary and unethical to delay surgery for such patients investigating them. Emergent laparotomy should be done without delay.

As of its treatment primary peritonitis is primarily treated by antibiotics targeting the offending organism. Whereas the treatment of secondary peritonitis is it is mainly surgical which is done in emergency basis. To this day Surgery is the sole and effective means of treatment of secondary peritonitis. Organ support and antibiotics also play pivotal role in curing these patients.

Statement of the Problem

Generalized peritonitis accounts for most cases of surgical emergency visits. A study done in one state of United States found that generalized peritonitis accounts for 9.3 of 1000 admissions (1) whereas figures are higher in sub-Saharan Africa. (1) A study done in Malawi showed that patients with generalized peritonitis accounted for 21.9% of patients presenting to surgical emergency department. (1)Evidences showing the exact statistical incidence and the proportion accounted by Acute generalized peritonitis is lacking in Ethiopia. But from observation during surgical practice many patients with generalized peritonitis are treated on a daily basis.

Acute Generalized peritonitis is associated with significant morbidity and mortality of patients. There is a study done in South India which enrolled 100 patients in the study and found to have a mortality of 4% which is significant. (2) The mortality gravely increased if it evolves to severe sepsis. There is also another African study which was done in Tanzania in 2015 G.C. The study is cross sectional one involving 97 patients with Generalized peritonitis and mortality is found to be 15% and 36 % had complications. Most of our patients present to the emergency lately making the outcome worse and different than the western counterparts.

The disease is also associated with higher cost of treatment since most patients require preparation, surgery and intensive specialized care after they are operated. The economic burden on the health care system of developing countries is huge by itself.

Secondary Generalized peritonitis has variable etiologies, prognosis and outcome in different areas of the world. In addition, there is considerable facility gap in developing counties. Keeping in mind peculiarities of the illness, there is paucity of researches done in this areas especially in our country. The research will also help to determine modifiable factors determining the patient outcome and will help to reduce treatment cost in a setup with limited resources

Significance of the problem

By studying the general pattern and the factors that predict the outcome of the patients the final outcome can be significantly improved and the morbidity and mortality reduced. This can also help to properly utilize our health resources for the best outcome. This study will be helpful for developing countries especially for sub-Saharan countries because there is handful of researches are done and have limited resources that should be properly allocated.

Literature Review

It was Kirchner who first described the basic surgical principles that greatly improved the outcome of patients who presented with generalized peritonitis in 1926 G.C. These were early intervention with eliminating the source of infection, peritoneal toilet and proper antibiotics. (1) Eliminating the source of infection or source control emphasizes on surgical closure of the defect or resection. For instance a person presenting with generalized peritonitis secondary to perforated acute appendicitis, which is a common etiology of peritonitis in our setup, emergency laparotomy with surgical removal of the appendix should be done. The peritoneal abscess should be drained and adequate lavage is mandatory for optimal outcome. Subsequently post operative antibiotics are instilled. After Kirchner the treatment of peritonitis has been standardized for many etiologies and many authors tried to determine factors affecting the morbidity and mortality of these patients.

Worldwide the mortality of secondary generalized peritonitis ranges between 10-30% and the mortality from anastomotic leak can reach up to 70% (2). This figure varies greatly among different regions of the world also considering the etiologic and epidemiologic variations.

A French study which enrolled 66 hospitals involving 841 patients showed that the commonest etiology of peritonitis to be appendicitis accounting for 31.4 of total cases. The study also depicted the mortality based on etiology and was 1.5 % for patients with appendicitis, 23% for colonic and 27% for small bowel peritonitis. (3)

A multicenter prospective study involving 2,152 patients suffering from intra-abdominal infections from 68 medical institutions throughout Europe has found the cumulative mortality to be 7.5%. Among the total patients 36.5% of has developed generalized peritonitis. (4)

Another study done in Serbia in a time period of 2009 to 2010 G.C. enrolled 204 patients with generalized peritonitis. They found out that perforated PUD and perforated appendicitis are commonest etiologies accounting for 29.4% and 22% of total cases respectively. The total mortality was found to be 8.8%. (5)

Ghosh et al done a study at the regional institute of the northeastern part of India as a cross sectional study for two years (2018-2020 G.C). One hundred and ten patients enrolled who underwent exploratory laparotomy within the study period. In the study they found that the mortality to be around 32%. (6) The study also found out an increased death rate (11-33%) in patients group with age >50 years and there was a significant association between increased duration of hospital stay for patients greater than 50 years of age. Increased death rates were found for patients with intraoperative finding of fecal contamination of the peritoneum. And also delayed admission of patients results in sepsis and eventual organ failures in cases of peritonitis with worse outcome. Thus the mortality is increased for those kind of patients.

Another prospective study done in subcontinent India showed perforated PUD and typhoidal perforation each accounted for 52% and 20% of the total cases. The mortality of these patients was found to be 6% only. (1)

Ahmer et al studies 311 patients in Pakistan retrospectively with in a period of 2008 to 2010 G.C and ileal perforation due to typhoid is the commonest followed by perforated PUD. (2)

Whereas in Africa, Mabewa et al did a descriptive cross sectional study involving patients with secondary peritonitis admitted to a single center from May 2014 to April 2015. It was conducted on 97 patients and found mortality rate to be around 15% (9). Presence of comorbid illness and post-operative complications were found to be significantly associated with mortality. The common etiologies of secondary peritonitis were perforated appendicitis in 23.71 %, Perforated PUD in 18.56 %, ischemia of bowel in 18.56 % and typhoidal perforation 15.46 %

Nuhu et al studied 153 patients with non-traumatic secondary peritonitis in Northern Nigeria In a retrospective study, 4-year period (March 2006–April 2009) were studied. In the study ninety-eight (64.0%) of the patients had peritonitis secondary to typhoid ileal perforation, 13 patients from perforated gastric ulcer, 12 from perforated duodenal ulcer, 22 due to ruptured appendix and four due to perforated gall bladder. The mortality of these patients is calculated to be 26.1%. Among the mortalities 75% are due to typhoid perforation, 15.0% due to perforated gastric ulcer, 7.5% from perforated duodenal ulcer and 2.5% from ruptured appendix. The deaths were mainly due to overwhelming sepsis and severe electrolyte derangement. (10)

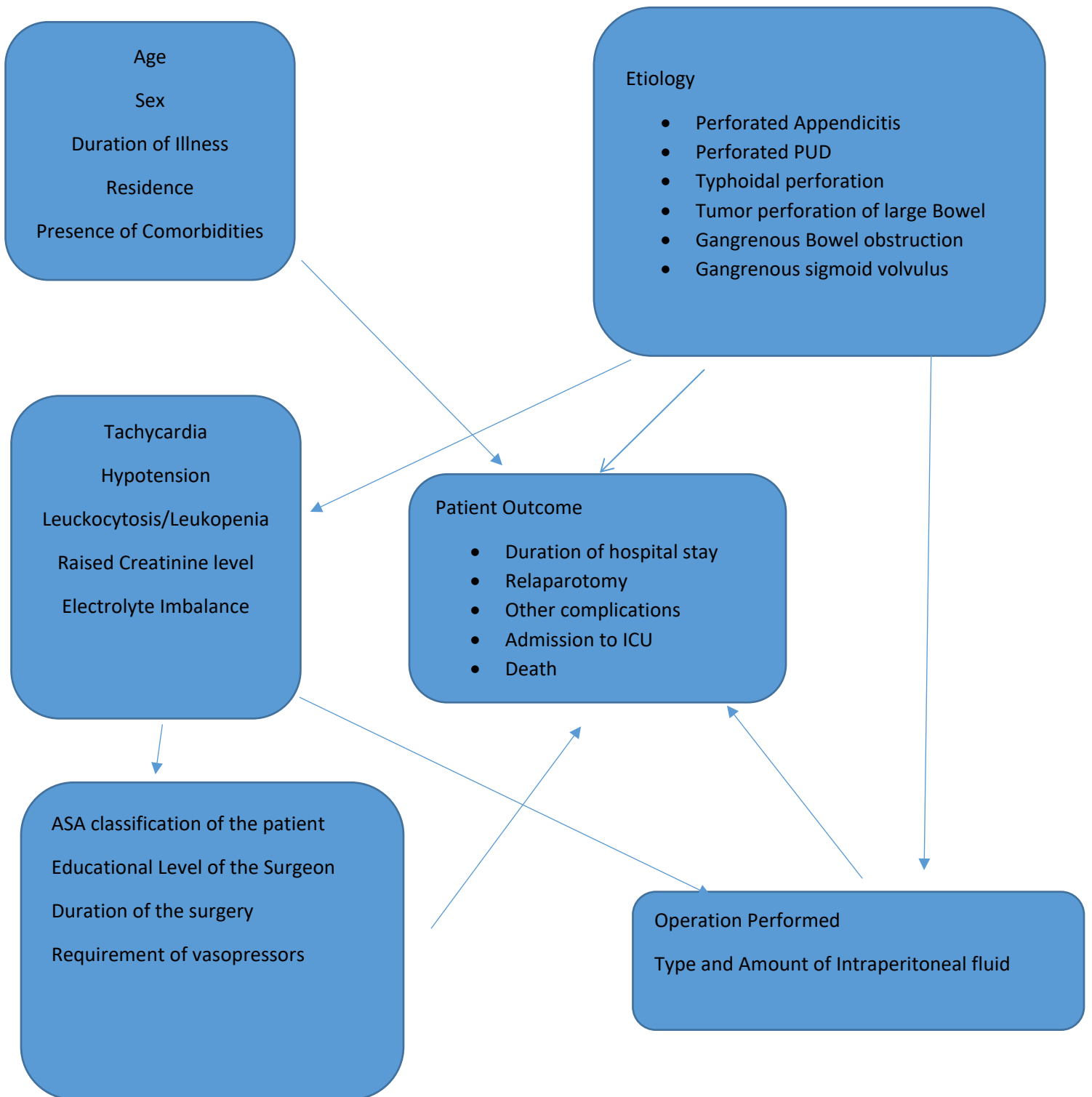
As of the pattern of generalized peritonitis varies greatly among different geographical areas. Most western researches show the common causes of Secondary generalized peritonitis to be acute appendicitis and complicated colon diverticulitis. (6) Secondary peritonitis that is caused by complicated appendicitis is associated with a lower mortality, shorter duration of hospital stay, and lower morbidity than other etiologies.

Another retrospective, descriptive, observational study was conducted from 1st January to 31st December 2019 in Democratic republic of Congo. This research depicted that typhoid ileal perforation is the commonest cause followed by complicated acute appendicitis. (11)

In a developing country like Ethiopia, this area is not well studied and there are limited number of researches done on the topic making it difficult know the exact etiology and mortality in Ethiopian context.

A retrospective study done by Eden et al at the Eastern province of Ethiopia, 650 patients were enrolled in the research and perforated peptic ulcer disease accounted for 34.6% of the total, Perforated appendix 31.1%, gangrenous small bowel obstruction 25.8 %, and lower gastrointestinal perforation 8.5%. 29.8% of the patients had a complicated course. Pneumonia accounted for 8.6% of the total complications making it is the most common, post op collection 4.2%, surgical site infection 4%, septic shock 2.9 %, wound dehiscence 2.2%, Ileus 0.6 %, Anastomosis leak 0.5%. (12)

Conceptual Framework



Objective of this study

General Objectives

To study the pattern and predictors of Outcome in patients with secondary Generalized peritonitis in two referral hospitals in AddisAbaba. Those are Tikur Anbessa Specialized Hospital and Zewditu Memorial Hospital

Specific Objectives

- To study patients' clinical presentation
- To identify the specific etiologies of Generalized peritonitis
- To study the morbidity and mortality of patients treated for secondary peritonitis.
- To study for patient factors that determine patients' morbidity and mortality
- To discover specific interactions among with determinant factors

Methodology

The study design is retrospective cross sectional study spanning between Jan 1, 2020 to May 30, 2024 GC. The study will be conducted on adult patients with secondary generalized peritonitis presenting to emergency department of Tikur Anbessa and also Zewditu Memorial hospital.

Study setting

The study will be conducted in Tikur Anbessa Specialized Hospital and Zewditu Memorial Hospital. Tikur Anbessa Specialized Hospital is the only tertiary treatment center of the country and patients are referred from every corner of the country for treatment. The surgical department is one of the oldest department currently organized in sub-specialty.

Zewditu Memorial Hospital is also one of the biggest referral hospital in the country located in the heart of the city. It is a hospital accepting and treating quite significant number of patients from the city. The hospital is affiliated with AddisAbaba university school of medicine and surgical residents are the primary physicians responsible for diagnosing and managing emergency surgical cases. The surgical department is composed of general surgeons and also subspecialists.

Study design

Institution based retrospective cross-sectional study

Source population

Patients presenting to the surgical emergency department in the specified time period

Study Population

Patients who are treated for secondary Generalized peritonitis presenting in the time period between Jan 1, 2020 to May 30, 2024 GC.

Sample size is calculated by using P value of 19% the sample size will be =236

Inclusion criteria

- all patients of age and greater than 14yrs old and treated for secondary peritonitis in the study period.

Exclusion criteria

- primary peritonitis
- traumatic peritonitis,
- localized peritonitis
- pancreatitis
- TB peritonitis
- Complicated Pelvic Inflammatory Disease

- Mesenteric Ischemia

- **Study variables**

- Independent variables**

- Sociodemographic factors
 - Age
 - Sex
 - Residence= Urban or Rural area
 -
 - Clinical factors
 - Duration of illness
 - Duration from triage to Surgery
 - Pulse rate at presentation
 - Systolic Blood pressure
 - Respiratory rate
 - Presence and absence of dehydration
 - Presence and absence of comorbidities
 - Total white blood cell count with neutrophil percentage
 - Haemoglobin
 - Serum creatinine and urea
 - American Society of Anesthesiologists class of the patient
 - Serum electrolytes
 - Serum glucose level
 - Presence of retroviral infection and CD4 and VL level
 - Nature of the peritoneal fluid= Serous, hemorrhagic, pus, bile, Fecal matter
 - Etiology of the Generalized Peritonitis

- **Dependent Variables**

Morbidities=

- Surgical site infection,
- wound dehiscence,
- Entero-cutaneous fistula formation,
- chest infections,
- anastomotic leak
- new onset of organ failure
- Prolonged hospital stay
- Intensive Care Unit admission
- Re-laparotomies

Mortality

Operational Definition

- primary peritonitis=peritonitis which occurs when microbes invade the normally sterile confines of the peritoneal cavity via hematogenous dissemination from a distant source of infection or direct inoculation
- traumatic peritonitis= peritonitis caused by contamination from after GI tract secondary to traumatic injury
- localized peritonitis= peritoneal inflammation and contamination localized to specific area and not generalized
- Acute pancreatitis= Acute pancreatitis is an inflammatory disorder of the pancreas that is characterized by edema and, when severe necrosis of the pancreas
- TB peritonitis= peritoneal inflammation and contamination due to Mycobacterium Tuberculae which is treated medically
- Complicated Pelvic Inflammatory Disease= Pelvic inflammatory disease (PID) is an inflammatory disorder of the upper female genital tract, including any combination of endometritis, salpingitis, tubo-ovarian abscess, and pelvic peritonitis
- ASA class of the patient= American Society of Anesthesiologists classification of preoperative patient

- Surgical site infection= infection occurring in the part of the body where surgery took places
- wound dehiscence, =surgical complication in which two sides of surgical incision separate and rupture along the incision
- Entero-cutaneous fistula formation, = an abnormal communication between gastrointestinal tract and skin epithelial surfaces
- Post op pneumonia= infection and inflammation of the lung parenchyma
- anastomotic leak= defect of intestinal wall at anastomotic site leading to a communication between intra and extra luminal compartments.
- new onset of organ failure= organ dysfunction to such degree that normal homeostasis cannot be maintained without clinical intervention or life support
- Prolonged hospital stays= staying greater than 75th Percentile from admission to discharge or death
- Re-laparotomies= is a planned or an unplanned re-operation carried out within 60 days after laparotomy for reasons related to first operation
- Morbidity= complications that are associated and arises with a particular illness.
- Mortality= death of a patient

Data collection tool

The dependent and independent variables are listed out. A standardized google form is developed based on the variables. Most questions are a type in which Principal investigator enters data by choosing. The answer portion of the form contains all the possible scenarios and involves blank space for writing additional information. The google form is tested with some patient charts for completeness.

Data collection procedure

Log book of patients operated for Secondary Generalized peritonitis from Jan 1, 2020 to May 30, 2024 GC is obtained from emergency operating room and their medical record number is recorded. All patients who are treated for Secondary Generalized Peritonitis were enrolled to the study. The patients' charts were obtained from Medical record department and online electronic record system. The developed google form was used to extract the data and was stored online. The patients' medical records were immediately returned to the department. All data was collected only by the principal investigator. The entered data was extracted from google forms to Microsoft Excel 2016 then finally to SPSS v 26

Data analysis

The collected data was entered to SPSS version 26, and analyzed. Descriptive statistics like mean, mode, median and percentiles and standard deviation was calculated. Initially each independent variable is checked for association with the dependent variable with multivariate logistic regression, Those having significant relation are analyzed together in three groups to find out the significance of their relation and adjusted odds ratio. The group was factors of patients clinical presentation the second being laboratory values and finally surgical factors. Significant association was considered if p value is 0.05 at 95% confidence interval.

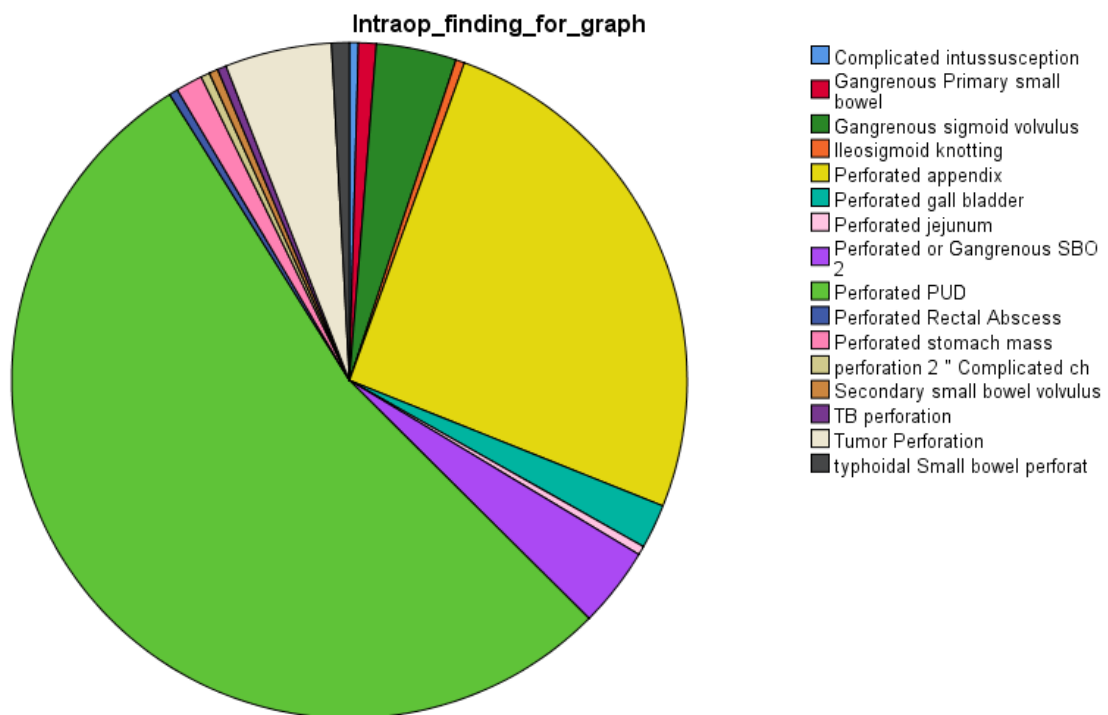
Ethical clearance

The study was conducted after ethical approval is granted from the research committee of the department of surgery of Addis Ababa University and Addis Ababa City Health Bureau. The data was collected from medical records and was accessed by the principal investigator and was held anonymous and confidential.

Result

A total of 235 patients were enrolled in to the study, 69 patients are from TASH and the rest 166 patients are from ZMH. From the total patients 21.7% are females and 78.3% are males.

The graph presented below shows the etiology of patients operated for generalized peritonitis. Perforated PUD is the most common cause accounting for about 53.6 % of cases and among this duodenal perforation accounted for 87.3 from the total cases of perforated PUD the rest being perforated stomach ulcer. Its followed by perforated appendicitis accounting for 25.5 % of cases. Tumor perforation accounts for 5.1 % of the total cases followed by Gangrenous SBO secondary to Adhesions. The rest accounts for 12% of the cases ileo-sigmoid knotting being the least common.



Intraoperative finding of patients

Intraoperative Finding_		Sex		Total
		Female	Male	
	Complicated intussusception	0	1	1
	Gangrenous Primary small bowel Volvulus	0	2	2
	Gangrenous sigmoid volvulus	1	8	9
	Ileo-sigmoid knotting	1	0	1
	Perforated Appendicitis	17	43	60
	Perforated gall bladder secondary to Gangrenous Cholecystitis	2	3	5
	Perforated Jejunum	0	1	1
	Gangrenous SBO 2 Adhesions	6	3	9
	Perforated PUD	17	109	126
	Perforated Rectal Abscess	0	1	1
	Perforated stomach mass	1	2	3
	Large Bowel Perforation 2 ' Complicated Chron's Disease	1	0	1
	Secondary small bowel volvulus	1	0	1
	TB perforation	1	0	1
	Large Bowel Tumor Perforation	2	10	12
	Typhoidal Small bowel perforation	1	1	2
Total		51	184	235

Where as the procedures done are depicted in the table below.

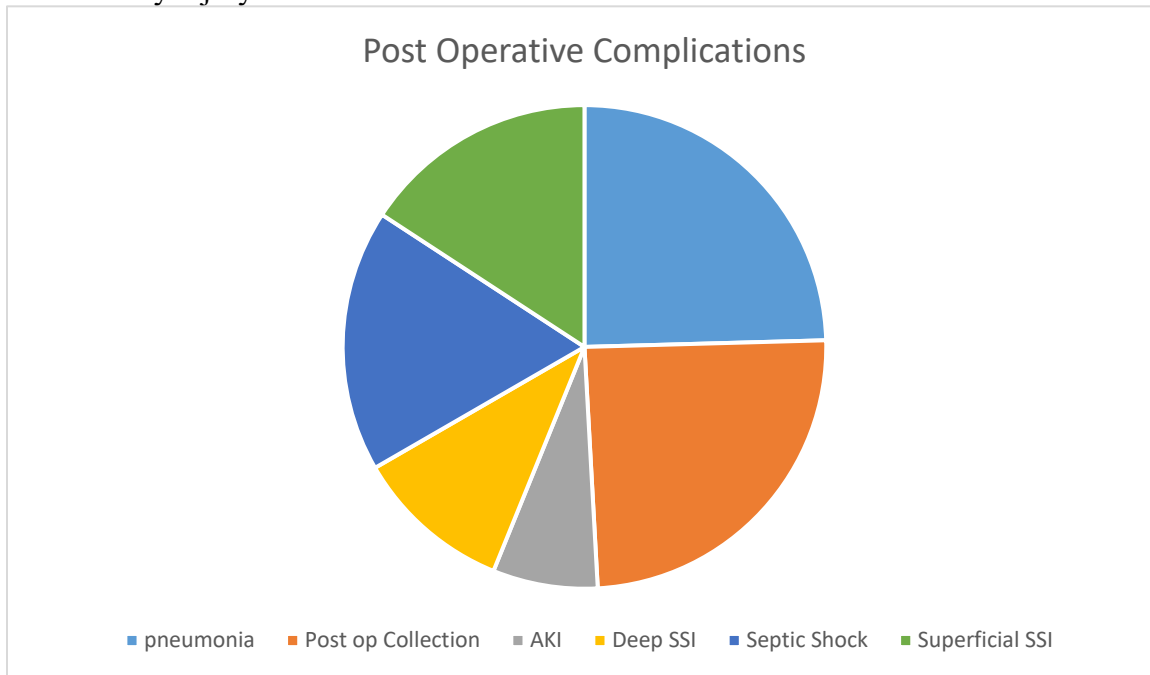
		Frequency	Percent
Valid	Abscess drainage only	1	.4
	appendectomy	59	25.1
	Bypass of the mass	1	.4
	cholecystectomy	5	2.1
	colostomy only	2	.9
	Diverting colostomy + rectal repair	1	.4
	ileostomy only	1	.4
	Laparotomy + lavage	1	.4
	None	2	.9
	Patch repair	126	53.6
	Resection and anastomosis	18	7.7
	Resection and colostomy	13	5.5
	Resection and ileostomy	3	1.3
	wedge resection of the stomach	2	.9
	Total	235	100.0

At presentation 97.9 % of patients' main complaint was abdominal pain and 17.4 % of patients complained of abdominal distension. 78.7% of patients had vomiting of ingested matter and 8.1% had vomiting of bilious matter. 39% of the total patients had failure to pass feces and flatus and only 3% had failure to pass only for feces.

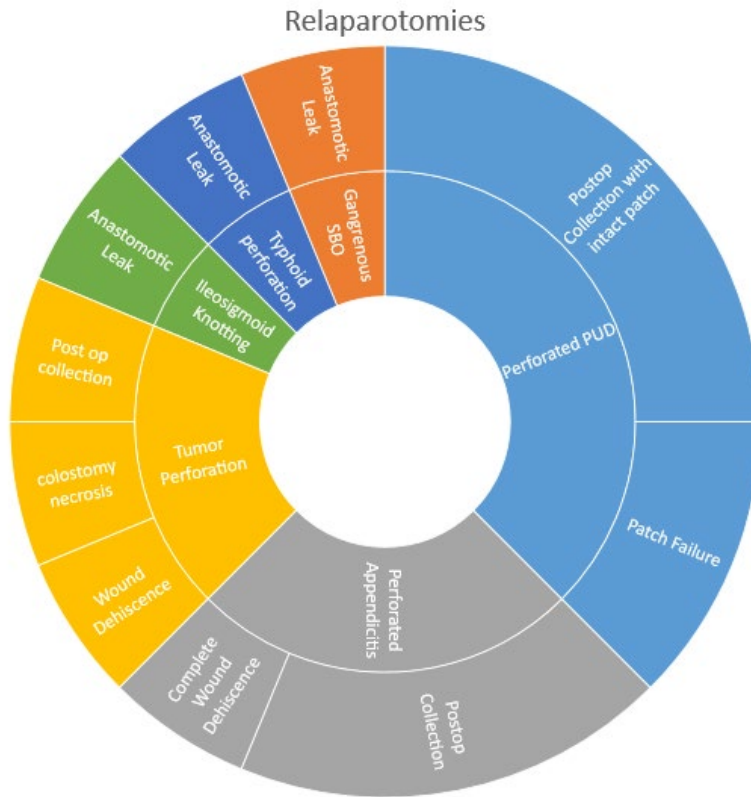
On examining the patients, **94.5 %** had direct tenderness and 93 % had rebound tenderness where as 87.7 % of them had involuntary guarding.

Through analysis, the post op Complications occurred in 21.7 % of total patients. Commonest complication being post op abdominal collection which occurred in 5.6 % of patients followed by pneumonia which occurred around 5.2 % of post op patients. 4.2% of patients developed superficial surgical site infection where as 2.5% of them deep surgical site infection. The new diagnosis of septic shock after surgery was made in 3% of patients. 1.7% of patients developed

acute kidney injury.



From the total patients 6.8% which equates to 16 patients had undergone re-laparotomies. 6 patients had a diagnosis of perforated PUD of which 2 of them had patch failure and the rest had post op collection. The second most common patient group to have re-laparotomy were 4 patients with generalized peritonitis secondary to perforated appendicitis followed by 3 patients with tumor perforation.



The indications for re-laparotomies were with intra-abdominal post op collection for 13 patients, deep SSI with complete wound dehiscence for 2 patients and colostomy necrosis for a single patient.

Among from the above patient group two patients died because of multi-organ failure secondary to refractory septic shock. All patients have prolonged hospital stay the longest being 41 days.

Relaparotomy_F

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	219	93.2	93.2	93.2
	Yes	16	6.8	6.8	100.0
	Total	235	100.0	100.0	

The mean duration of hospital stay for the patients was 7.76 with the maximum being 78 days. 25.1% of patients have prolonged hospital stay i.e greater than 8 days of hospital stay before discharge. It's interesting to see that 30% of patients with generalized peritonitis secondary to perforated appendicitis has prolonged stay because most patients had complications commonest being wound infection.

11.1% of patients have ICU admission post operatively. As compared to patients who are less than 30 years of age, patients who are greater than 60 years have an increased risk of ICU admission by the factor of 21 (P value= 0.001 95% CI). Initial Systolic blood pressure < 90 and diastolic blood pressure < 60mm Hg is significantly associated with ICU admission with P value of 0.025 and 0.043 respectively.

A total mortality recorded was 16 patients which accounted for 6.8 % of the total cases. Two of the patients were female. Commonest cause of death is refractory septic shock of GI focus with associated multi-organ failure responsible for demise of 13 patients. cardiogenic shock was responsible for demise of a single patient who is a known cardiac patient on follow up. Massive aspiration and massive PTE each caused one patient to die. From analysis with chi square having post op complications is significantly associated with death of a patient (P value= 0.001, 95% CI)

	Death_		Total
	No	Yes	
Gangrenous Primary small bowel volvulus	1	1	2
Gangrenous sigmoid volvulus	6	3	9
Perforated Duodenum	106	4	110
Perforated stomach ulcer	14	2	16
Tumor Perforation	7	5	12
Typhoidal Small bowel perforation	1	1	2

The table below shows multivariate logistic regression analysis of independent variables.

Independent Variable		df	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
	Presence of dehydration	1	.622	1.439	.338	6.133
	Presence of comorbidities	1	.679	1.517	.211	10.913
	ASA class I	4	.031			
	ASA class II	1	.097	8.548	.676	108.116
	ASA class III	1	.044	15.300	1.072	218.369
	ASA class IV	1	.009	30.483	2.344	396.360
	ASA class V	1	.004	215.716	5.374	8659.693
	Time gap from triaging to surgery greater than 14.5 hrs	1	.568	1.872	.218	16.100
	Duration of illness greater than 44 hours	1	.043	8.531	1.065	68.317
	Initial systolic_blood pressure between 90 to 139 mm Hg	2	.078			
	Initial systolic blood pressure less than 90 mm Hg	1	.026	50.091	1.592	1576.326
	Initial systolic blood pressure greater or equal to 140 mm Hg	1	.608	1.991	.143	27.673
	Initial diastolic_blood pressure between 60 – 90 including	2	.277			
	Initial diastolic_blood pressure less than 60	1	.730	.548	.018	16.744
	Initial diastolic_blood pressure greater than 90	1	.128	4.178	.663	26.326
	Residence in rural areas	2	.882			
	Residence in semi urban areas	1	.999	.000	.000	.
	Residence in urban areas	1	.617	.590	.075	4.669
	Constant	1	.000	.001		

Logistic regression analysis of lab values

		df	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Independent Variables	Initial hemoglobin greater than 13 gm/dl	3	.014			
	Initial hemoglobin less than 8 gm/dl	1	.003	47.116	3.703	599.552
	Initial hemoglobin between 8 and 10.9 gm/dl	1	.103	3.589	.774	16.648
	Initial hemoglobin between 11 and 12.9gm/dl	1	.999	.000	.000	.
	WBC_count between 4,000-11,000 cells per microliter	2	.022			
	WBC_count less than 4000 cells per micro liter	1	.008	11.852	1.898	73.995
	WBC_count greater than 11,000 cells/micro liter	1	.404	1.848	.437	7.811
	Neutrophil_percentage greater than 70 %	1	.174	.377	.092	1.540
	Constant	1	.002	.076		

		df	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Step 1 ^a	Amount of intraoperative fluid in litres	1	.030	1.706	1.054	2.760
	Duration of surgery_greater than 2.1 hours	1	.003	8.473	2.041	35.175
	Intraoperative vasopressor requirement	1	.000	31.058	6.981	138.169
	Constant	1	.000	.007		

Predictors of Mortality

Age

The minimum age is 14 years and maximum is 96 years old with a mean age of 32.4 yrs. Most of the patients presenting are those less than 30 years of age accounting for about 60% of the total patients.

In comparison to patients who are less than 30 years of age patients who are greater than 60 years of age has a greatly increased mortality by a factor of 30 (P value=0.001 CI=95%, OR=30). Whereas age group between 30 to 60 years have also increased mortality by a factor of 7 (P value=0.01 CI=95%, OR=7.96).

This pattern also holds true for complications and patients >60 years of age has increased complications by the factor of 5.3 (P value=0.01 CI=95%, OR=5.3) and by a factor of 2.7 in age between 30-60 years of age P value=0.04 CI=95%, OR=2.7)

Duration of Illness

Duration of illness > 54 associated with increased mortality by a factor of 3.338. P=0.030 95%CI. It is peculiar to this study that duration of illness doesn't have significant relation with mortality of patients. However its associated with increased morbidity of the patient. (P value of 0.001, OR of 9, 95% CI)

Duration of time from triaging to operation

The duration of time till operation of the patients is related to their mortality. (p value = 0.008 95% CI, OR=1.006)

Duration of Surgery

When Duration of surgery is greater than 2 hours there is increment in the likely of mortality by a factor of 6.4 (P value of 0.001 95 %CI ,OR of 6.4) and also with morbidity of the patient (P value of 0.001 95 %CI ,OR of 2.1)

Initial Pulse rate

The mean pulse rate of patients is 105 bpm with a range of 84 bpm. It doesn't have statistically significant relation to the mortality and morbidity of the patient.

Temperature

It was found that 14.9 % of total patients are febrile with temperature >37.3 oC. The mean temperature of patients is 36.19. It was found that there was no correlation between temperature measure of adult patients to their outcome.

Respiratory Rate

The mean respiratory rate of patients is 22.41 with a range of 22. There is no statistically significant relationship with final patient outcome.

Initial Blood pressure

Initial systolic blood measurement less than 90mm Hg is associated strongly with mortality of the patient when comparing them with patients of normal blood pressure. (P value CI=95% OR=10)

Diastolic blood pressure less than 60mm Hg is associated with death of a patient by a factor of 6 (P=0.002, OR=6.2 , 95% CI)

	Minimum	Maximum	Mean	Std. Deviation
Initial Pulse rate	62	146	105.26	16.904

Respiratory Rate	12	44	22.41	5.075
Objective temperature record in C	34.0	39.0	36.191	1.0597
Systolic blood pressure at arrival in mmHg	0	160	110.43	27.749
diastolic blood pressure at arrival in mmHg	0	114	69.16	18.565

Summary of laboratory values

	N	Minimum	Maximum	Mean	Std. Deviation
WBC count per 1000cell/microl	235	.80	164.00	13.5018	11.59125
Neutrophil percentage	210	3.90	98.00	82.9567	13.32290
Haemoglobin in gm/dl	235	5.0	25.0	15.171	2.6961
Serum creatinine in mg/dl	44	.30	6.70	1.2336	1.18111
Urea level in mg/dl	38	5.0	192.0	40.966	42.0980
Serum sodium level	38	3.4	160.0	132.914	22.6341
Serum potassium Level	35	1.30	6.70	3.9443	1.09578

WBC count and Neutrophil percentage.

WBC count is associated with death of a patient with P value of 0.01 Chi square test. Further analysis patients with WBC count < 4000 per microliter is associated with death of patients with a factor of thirteen times as compared with patients with normal WBC count. (P value of 0.02 OR of 13.1 CI = 95%).

Neutrophil percentage is found to have no relation with the mortality and morbidity of patients.

Haemoglobin Level

Patients who were anemic with Hgb <8g/dl were associated with a great increase by a factor of 34 in mortality (P value of 0.05 and OR of 34 95% CI) as compared with patients with normal

hemoglobin level. Whereas Patients with moderate anemia of 8 – 10.9 g/dl have increased mortality by a factor of 4 (P value of 0.034 CI=95% and OR of 4.7)

Anemia by percentage

		Frequency	Percent	Valid Percent
Valid	<8	3	1.3	1.3
	8-10.9	14	6.0	6.0
	11-12.9	16	6.8	6.8
	>13	202	86.0	86.0
	Total	235	100.0	100.0

Only 38 patients out of 235 patients have preoperative serum creatinine and urea level thus it is difficult to analyze since most patients don't have the result. The same holds true for serum electrolyte level.

Nature and amount of intraperitoneal fluid

There is direct correlation between the amount of intraperitoneal fluid and post op complications (P value of 0.001 and OR of 2.667).

Hemorrhagic fluid in the peritoneum is associated with increased mortality of patients. (P=0.02, OR=6.42 95% CI)

Comorbidities

From the collected data only 5.5% of total patients have comorbidity. Patients who have comorbidities have worse outcome than their previously healthy counterparts. They are likely to have mortality by a factor of 4 times. (P value= 0.028 95% CI, OR=4.26)

		Frequency	Percent
Valid	Cardiac	4	31
	CLL	1	7.6
	Diabetes	1	7.6
	Diabetes + Chronic HBV Infection	1	7.6
	Diabetes + Hypertension	1	7.6
	Hypertension	3	23
	Hypertension + Cardiac	2	15.3
	Total	13	100%

Intraoperative vasopressor Requirement

It is a very strong indicator for mortality of patients with patients requiring vasopressor have increased mortality by a factor of 30(P value=0.001 CI=95%, OR=30)

Discussion

Generalized peritonitis is one of the commonest surgical reason for patients' emergency visits. Besides this in the training of General Surgery it is commonly encountered by residents and mostly managed by residents. The disease entity by itself is associated with high mortality and morbidity and the various delays and lack of essential resources for management worsens the condition. Thus early detection of patients who are likely to deteriorate and timely support greatly helps to improve their outcome.

From this research perforated PUD is the commonest etiology accounting for about 53.6 % of total cases operated followed by Generalized Peritonitis secondary to perforated appendicitis accounting for 25.5 % of cases. A research done in a hospital in Eastern Ethiopia showed similar finding the commonest etiology being PUD followed by perforated appendicitis. (9) The trend is slightly different in other African states that one research done in Tanzania where commonest cause is perforated appendicitis followed perforated PUD. (5) Another study done in Nigeria showed commonest cause to be typhoidal perforation succeeded by perforated PUD. (6) This is clearly different from the developed countries in which commonest cause is perforated appendicitis and lower GI perforation secondary to complicated diverticulitis. (6)

In this study the mortality of patients is 6.8 % which is significantly lower than that of Tanzania which is about 15% (5). Another study done in Nigeria which enrolled 153 patients showed a mortality of 26.1%. (6) In contrast to African studies an Indian study showed a mortality rate of 17.86 % (10) Another Indian study which enrolled 100 patients showed a mortality rate of 17 %.

Post op Complications was found to occur in 21.7% of total patients. The commonest complication is post op abdominal collection followed by pneumonia. Where as in another study Eden et al found post op complications in 29.8 % of patients. The commonest complication is pneumonia followed by post op complications. (9)

Age of the patient has strong association both to the morbidity and mortality of patients. Specifically age greater than 60 years has grim prognosis with strong relation to mortality. This can be explained by the fact that old people present with an illness that have poor prognosis like tumor perforation and gangrenous sigmoid volvulus. Undiagnosed underlying comorbidities and adult malnutrition also contribute to this.

In this study duration of illness doesn't contribute much to the mortality of the patients because most patients present late as 98.4% of patients present after 48 hours of illness. The time gap from arriving in the hospital to beginning of surgery is also related to mortality of patients.

Duration of surgery is directly associated with patients' mortality. This could be due to prolonged stress due to the surgery itself and anesthesia leading to further physiologic deterioration.

The Pulse rate of a patient doesn't have direct correlation with the patients' mortality. Increased pulse rate can be secondary to various factors in addition to systemic inflammatory response syndrome. Dehydration is also one of the common cause because patients usually present late to the hospital.

Both initial systolic and diastolic blood pressure affects the patients' mortality greatly. Low blood pressure at presentation can be due to severe volume depletion or due severe sepsis which can both lead to severe demise of the patient.

Laboratory parameters like white blood cell count also have prognostic implications and patients with value < 4000 cells/microliter are more likely to die as compare to the ones with normal count. Sepsis is also one of the known strong risk factor for the death of a patient. A study done in India has shown that this WBC value is not associated with survival of a patients. (11)

Anemic patients have a worse outcome i.e increased mortality. The outcome is even worse for patients whose hemoglobin level is less than 8 gram/ deciliter. Patients with generalized peritonitis have already compromised physiology due to the sepsis and fluid shift and anemia will add to that worsening the outcome.

Post op complications tend to occur in patients with high intraperitoneal fluid collection. Because of increased peritoneal contamination the intraperitoneal fluid might not be completely drained and lavage might not be adequate for the patient.

Patients with intraperitoneal Hemorrhagic fluid have increased mortality because the patients had gangrenous sigmoid volvulus which have grim outcome by it self.

From the analysis patients with comorbidities have adverse outcome. This holds true in researches done in various areas of the continent. Intraoperative vasopressor requirement is also a key determinant of mortality of patients. Patients are usually septic and there is underlying organ failure that is fully unmasked when anesthetic medications are given leading to intraoperative hypotension.

Recommendation

GP is one of the commonest illness treated by general surgeons and is the base of general surgery training for residents. In the study areas of this study it is the commonest reason for emergency visit and it carries significant morbidity and mortality for the patient. The human and material resource invested in the management of these patients is huge, Thus appropriate use of resources and early identification and support of patients likely to have complicated course is mandatory for best outcome.

From this study perforated PUD accounted for most cases of GP. Thus appropriate testing for Helicobacter Pylori and eradication of the bacteria should be given priority. Smoking and also chewing Khat which is a local drug, should be discouraged in patients with dyspepsia.

It is clearly deduced from this study that patients with age greater than 60 years have worst outcome with respect to morbidity and mortality. Thus special care for this group of patients is recommended especially those with comorbidities. ICU should be arranged for the patients and intensified care can be delivered. This also holds true for patients with high ASA score.

Patients who are presenting late after the onset of symptoms have worse outcome. Care must be taken in managing these patients and early transfer to ICU is recommended.

Patient having hypotension presenting to the ER should be adequately resuscitated. Vasopressor should be started if no adequate response. These patients are in a dire need of organ support thus should be transferred to ICU or other units with intensive care. The intensive care should also continue post operatively.

Low initial WBC count is associated with increased mortality of patients. In most of the cases it is a sign of hematologic failure. This group of patients need appropriate organ support of a kind. Anemic patients have increased morbidity and mortality. The relation is stronger for patients with severe anemia of less than 8g/dl. Correcting the anemia by transfusing the patient prior to surgery will be the best option.

Increased surgery time also is significantly associated with worse outcome. It is prudent to practice damage control surgery and have an effort to minimize intraoperative time of the patient. Second surgery can be considered after the patient is stabilized and in a better condition and the surgeon well prepared.

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