ADDIS ABABA UNIVERSITY

TIKUR ANBESSA SPECIALIZED HOSPITAL

DEPARTMENT OF EMERGENCY MEDICINE AND CRITICAL CARE

MAGNITUDE OF EMERGENCY SURGICAL INTERVENTIONS DELAY FOR ACUTE ABDOMEN AND ITS ASSOCIATED PATIENT AND HOSPITAL-RELATED FACTORS IN TIKUR ANBESSA SPECIALIZED HOSPITAL

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PREVALENCE AND MAGNITUDE OF EMERGENCY SURGICAL INTERVENTIONS DELAY FOR ACUTE ABDOMEN AND ITS ASSOCIATED PATIENT AND HOSPITAL-RELATED FACTORS IN TIKUR ANBESSA SPECIALIZED HOSPITAL

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[Jan, 2024]

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Declaration

I, Edom, declare that this is my original work and that all sources of materials used for this thesis are properly acknowledged.

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This thesis has been submitted for examination with my approval as university advisor.

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Abbreviations

AAU- Addis Ababa University

ED- Emergency department

LOS- Length of stay

MNH - Muhimbili National Hospital

SBP – Systolic Blood Pressure

TASH- Tikur Anbessa hospital

TACS- Timing in acute care surgery

Abstract

Background: Acute abdomen surgeries require immediate attention and treatment. Delay of emergency surgical interventions results in increased mortality rates and healthcare costs, prolonged hospital stays, and poor patient outcomes. Understanding the magnitude and related factors of this delay in management can help in improving patients' outcomes, shorten the length of stay, and minimize the burden in emergency rooms.

Objectives: To identify the magnitude, and assess the associated patient and hospital-related factors for the delay of emergency surgery for acute abdomen in the TASH emergency department.

Methods: Single-center, prospective, cross-sectional study done among acute abdomen cases in the TASH emergency department with a total of 97 patients selected from September 1-December 4, 2023. Data was gathered through chart review and operation room documentation logbook utilizing a standardized questionnaire adapted from prior research with few modifications. The data was coded, cleaned, and loaded into the SPSS version 26 software program for further analysis. Descriptive statistics, and bivariate, and multivariate analysis were performed to evaluate the outcome and associated factors. The odd ratio was employed to estimate relative risk and P values < 0.05 were considered significant.

Results: The overall prevalence and magnitude of the delay in emergency surgical intervention for acute abdomen were 40.2%. The age group 35-45 had the highest frequency of delay, with an AOR of 27.067 (95% CI = 2.516-291.187, P=0.007). This study data also demonstrated that a prolonged duration of stay in an emergency (> 24 hours) is substantially associated with delays in surgical care, compared to less than 24 hours stays (AOR=4.551 (95% CI=1.355-15.283, P=0.014).

Conclusion: Acute abdomen is a surgical emergency that most commonly affects men and young adults. Patients aged 35-45 and who spent more than 24 hours in the emergency department were more likely to be delayed. This study indicated a considerable incidence of 40.2% delayed emergency surgical management for acute abdomen, above prior studies. Emergency surgical care at our hospital is frequently delayed due to a shortage of physical resources, delays in decision-making to operate, and the surgical team's preoccupation with other emergency cases.

1. Introduction

1.1 Background

By definition, emergency surgery is unplanned, and patients are booked for surgery with little preparation. Emergency treatment is distinguished from elective care by a shorter preoperative period for thorough patient workup optimization and team coordination. Emergency surgical interventions are critical to saving lives and preventing disabilities. Some abdominal surgical emergencies can be successfully managed within minutes and others within hours, other conditions necessitate observation and surgery may be avoided or safely postponed for several days.[1]

Emergency surgeries for acute abdomen are those that require urgent attention and treatment due to the abrupt onset of severe symptoms that may suggest potentially life-threatening intra-abdominal problems. The most common causes of acute abdomen include appendicitis, perforated peptic ulcer, acute pancreatitis, ruptured sigmoid diverticulum, ovarian torsion, volvulus, ruptured aortic aneurysm, lacerated spleen or liver, and ischemic bowel.[2]

To maximize good patients outcome, early consultation with the surgical team is necessary if a surgical emergency is thought to exist based on the patient's presentation or physical examination.

Delay of emergency surgical interventions may result in increased mortality rates, prolonged hospital stays, higher healthcare costs, and less favorable patient outcomes.[3] Despite the importance of timely access to emergency surgery, delays still occur frequently, and the root causes of these delays are not well understood.

Several reasons can contribute to delays in emergency surgical treatments, such as a lack of staff and operating rooms, system problems, the unavailability of doctors and nurses, prolonged resuscitation times, and delays in making the right diagnosis as well as deciding to operate.[4] [5]

Emergency surgery backlog is a complex issue that needs a multidisciplinary solution from administrators, policymakers, and healthcare professionals. We can enhance patient outcomes and ease the burden on the healthcare system by determining the primary causes of delays and putting into practice evidence-based treatments.

1.2 Statement of the problem

Acute abdomen is a challenging symptom that poses significant problems to emergency clinicians and experienced surgeons due to diagnostic ambiguity and the possibility of misinterpretation. Delays in diagnosis and treatment can result in higher morbidity, mortality, and expense.[6].

The mortality rate for emergency laparotomies for acute abdomen is significant and stayed constant at 9.6% between 2016 and 2018 in the UK, with studies in Europe and the US indicating a 30-day mortality of 9.6-18.5%. These numbers are significantly greater than the 1-2% risk reported in elective laparotomies across all specialties.[7]

Approximately 1% of hospital admissions are for patients with surgical acute abdomens, accounting for 5-10% of all visits to emergency rooms.[8] According to a systematic review of 21 studies published between 1990 and 2019, the median duration from symptom onset to surgery for acute abdomen was 12 hours, with 20% of patients experiencing a delay of more than 24 hours.

Delays in emergency surgery of more than 24 hours led to higher complication rates at 38.9% in the elderly.[9] Diagnostic accuracy of physicians at the time of hospital admission decreases with patient age. In the first three decades of life, 60% of patients with an acute abdomen are accurately identified, compared to less than 30% after the age of 80.[10]

A study in Tanzanian discovered that delays in surgical care increased mortality and morbidity, particularly among patients requiring emergency surgical care.[8] A study in Yaoundé University Teaching Hospital, Cameroon found surgical delays were higher than in the majority of European studies. These surgical cares are frequently delayed due to late consultation, a lack of financial resources, the unavailability of the medical team, and, in certain cases, the operating theatre. These delays contributed to an increase in the morbidity and mortality of the patients.[11] Several factors can contribute to emergency surgical delays in Africa including limited access to healthcare facilities, especially in rural areas, limited availability of diagnostic tests, and financial constraints.

The prevalence of emergency surgical delays for acute abdomen in Ethiopia varies according to the research population. Several studies, however, have revealed that the prevalence of delays is higher in low-income countries than in high-income countries.[8]

Numerous factors that can contribute to emergency surgical delays for acute abdomen, in general, can be classified as patient-related factors and system-related factors. To name a few patient-related causes, there is a lack of understanding about the seriousness of the disease, delayed presentation to the health facilities, as well as financial restraints.[8,12] And for system-related factors inappropriate triaging, inadequate staffing in emergency departments, long wait times for diagnostic tests, and lack of communication between healthcare providers are common reasons.[8,13]

Delays in emergency surgery for acute abdomen are a worldwide issue that can increase morbidity and mortality.[3,7] Emergency surgical delays can have a significant impact on a patient's health, including:

- Increased risk of complications, such as sepsis, organ failure, and death[3,14]
- Extended hospital stays and increased healthcare costs[3]
- Psychological trauma and long-term disability[15]

During my two years as an emergency medicine resident at TASH, I observed nearly all of the aforementioned difficulties and risk factors for emergency surgical delay for acute abdomen. The consequences of these delayed surgical interventions have a significant influence on patients' health and the hospital's quality of treatment.

1.3 Rationale for the study

The rationale of this study is to understand the hospital-related factors that contribute to delays in the diagnosis and treatment of acute abdomen and to help identify solutions that can be implemented to reduce these delays. Studying the delay of emergency surgery is important because it has been associated with negative outcomes such as a higher risk of hospital mortality, a longer duration of stay, and higher healthcare expenses. Understanding the factors that cause delays in emergency surgery can help healthcare professionals develop strategies to reduce delays and enhance patient care.

In Ethiopia, there has been inadequate assessment of the scope of the problem of surgical delays, the causes of surgical delays, and the degrees to which patient factors and health system factors contribute to delays.

1.4 Literature Review

Acute abdomen is a surgical emergency that requires prompt diagnosis and treatment. Delayed emergency surgery for acute abdomen can have major repercussions, including increased complication rates, morbidity and mortality, and increased expenses.[3,7] Low- and middle-income countries have a larger risk of emergency surgical delays for acute abdomen than high-income nations.[8] It is essential to address the factors that lead to emergency surgical delays to enhance patient outcomes. Much research has been conducted to determine the scope and impact of emergency surgery delays for acute abdomen. and nearly all demonstrated the importance of delayed care on patients' surgical outcomes.

Globally

A retrospective cohort study conducted at The Ottawa Hospital, Canada showed that of 15,160 patients, 18.6% experienced a delay, and those with a delay had a mortality rate of 4.9% compared to 3.2% for those without a delay. [16] This delay was linked to longer hospital stays, greater in-hospital death rates, and higher stay costs.

A prospective cohort study done in France showed that the incidence of delayed admission to the operating room for patients who needed emergency surgery was 32.5%.[3] Shortening the wait times for emergency surgery improved patient outcomes and led to more efficient resource usage and allocation.

Studies done both in the USA and Hong Kong, on admission delays for emergency appendectomy, have been associated with higher incidence of perforation, systemic complications, and longer hospital stays. The failure to recognize the disease and admit the patient at the initial visit was the primary cause of the delay. Appendicitis cases with delays of 72 hours or longer tend to have major consequences. [17] [18]

A systematic review of sixteen papers, comprising 50,653 patients, undertaken by searching the MEDLINE and EMBASE databases (1 January 2005 to 6 May 2020), revealed that time from admission to surgery (1-72 hours) and mortality rate (10.6-74.5%) differed substantially between trials. The average time to surgery was much longer in deceased patients than in survivors. Imaging, diagnosis, decision-making, theatre availability, and staffing all contributed

to delays.[7]

According to the Tanzanian study of patients with acute abdomen, the median period from symptom start to surgery was 24 hours, with 40% of patients experiencing a delay of more than 24 hours.[8] Another study of patients with acute abdomen in Nigeria showed 81.6% of patients had surgical intervention more than 6 hours after admission and around 50% of patients had more than 24 hours wait time before intervention. The mean waiting time in these patients was 22.3 ± 10.0SD. This study revealed that excessive delays resulted in increased mortality and morbidity.[19]

A prospective cross-sectional study at Yaoundé Central Hospital, Cameroon found an average delay of 42 hours between patient admission and the commencement of surgery, as well as a 33.3% complication rate and an average hospital stay of nearly 10 days. It also showed a 15.9% mortality rate; this rate is attributable to the relatively long management delay.

Ethiopia

Research in northwest Ethiopia found that among 25 cases of small bowel volvulus, 20% of the patients died; all of these deaths were operated on more than 3 days after the onset of the illness.[20] A case fatality rate of 18.9% was recorded in Tikur Anbessa Hospital for 73 patients with perforated peptic ulcers; the high mortality rate was related to late presentation, purulent peritonitis, sepsis, delayed preoperative preparation, and inadequate therapeutic resources.[21]

A one-year cross-sectional study on surgically treated acute abdomen and abdominal trauma cases admitted to St Paul General Specialized Hospital and Gondar University Hospital, showed that delay of surgical intervention (pre-hospital and in-hospital delay) of more than 3 days adversely affected outcomes by increasing morbidity and mortality.[12]

Overall, the existing data suggests that emergency surgical delays for acute abdomen are a concern in Ethiopia, but more research is needed to understand the scope of the problem and identify the factors contributing to the delays.

To investigate the rates of delayed emergency surgery in hospitals having a specialized emergency surgery department, a cohort study can be the best approach. It will be able to measure the independent relationship between the delay of emergency surgical management and in-hospital mortality, duration of stay, and expenses.

Another approach is to identify the factors contributing to operating room delays, which may

help us reduce delays and improve patient outcomes.

Healthcare providers have an important role in minimizing surgical delay in emergency surgery for acute abdomen. Prompt recognition and diagnosis of acute abdomen is crucial to reduce surgical delay. Physicians should be able to prioritize patients with acute abdomen and ensure that they receive timely surgical intervention. It's important to communicate effectively with patients and their families about the need for urgent surgical intervention and the risks associated with surgical delay.

A good triaging system for patients admitted with acute abdomen is a critical step in decision-making to determine the order of priority of patients to be operated on as emergencies.

Timely access to the operating room for emergency surgery indications remains an issue around the world, and several triage systems for emergency surgical patients have been established globally. Among the various methods used to classify emergency surgical patients for timely management, "timing in acute care surgery" (TACS) classification is an effective method to minimize the delay in the management of patients in health facilities with scarce resources. An experienced panel, including international acute care surgeons, devised and presented the timing in acute care surgery (TACS) classification as a legitimate and accurate instrument for establishing the priority of access of emergency surgical patients to the operating theatre.[22]

The new TACS classification is the first internationally validated triage system for emergency surgical patients. It's a color-triage system developed according to the "traffic light color coding system" in 5 classes of priority/timing for surgery admission. These are 1) RED - immediate surgery; 2) ORANGE - surgery within an hour; 3) YELLOW - surgery within 6 hours; 4) GREEN - surgery within 12 hours; 5) BLUE - surgery within 24 or 48 hours.[22]

In this study, the TACS classification tool will be utilized to categorize patients with acute abdomen. based on the severity of their illness, in order to provide an ideal time from diagnosis to surgery and reduce unwanted delays.

2. Objectives

2.1 General Objective

The objective of this study is to identify and determine the magnitude of delay of emergency surgical interventions for acute abdomen in the Tikur Anbessa adult emergency department.

2.2 Specific Objective

To assess the associated patient-related factors for delays of emergency surgical interventions for acute abdomen in Tikur Anbessa adult emergency department.

To assess the associated hospital-related factors for delays of emergency surgical interventions for acute abdomen in Tikur Anbessa adult emergency department.

3. Methods

3.1 Study area

This study was conducted in Tikur Anbessa Specialized Tertiary Hospital (TASH), Addis Ababa. TASH is the largest specialized teaching hospital in Ethiopia under the institution of AAU, College of Health Sciences. AAU was established in 1950 and the School of Medicine was founded in 1972. The hospital has over 700 beds and serves as a training center for various undergraduate and postgraduate programs. It offers diagnostic testing and treatment for approximately 370,000–400,000 patients per year.[23]

The adult emergency department of Tikur Anbessa Specialized Hospital was established in association with AAU, the University of Wisconsin, and the University of Toronto. The department began a three-year residency program and a two-year EMCC nursing program in October 2010. The emergency room structure is made up of the triage area, the front (where patients are first checked in), the waiting area, and green, yellow, and red rooms. Nearby laboratories and imaging facilities, that are only for emergency patients, serve the emergency.

The department of surgery is organized into different units namely General surgery including gastrointestinal, endocrine, and vascular surgeries, urology, cardiothoracic surgery, neurosurgery, plastic and reconstructive surgery, and pediatric surgery. TASH features eight operating rooms, and as of February 2011, a distinct additional operating room was constructed solely for emergency surgeries. [24]

A one-year retrospective study of adult patients admitted to TASH with acute abdomen found that acute abdomen accounted for 36.4% of surgical emergency operations performed

during the research period. According to the study, acute appendicitis was the major cause of acute abdomen, accounting for 52% of cases, followed by intestinal obstruction (26%), and perforated peptic ulcer disease (9%).[25]

3.2 Study design and period

A single-center prospective cross-sectional study of acute abdomen cases presented to the TASH emergency department from September 1, 2023 – December 04, 2023.
This hospital was chosen because the primary investigator works there and the facility handles a significant volume of emergency surgery cases.

3.3 Population

3.3.1 Source population

All adult emergency surgical patients were triaged and checked for acute abdomen in to emergency department of TASH.

3.3.2 Study population

All adult patients admitted to the TASH emergency room after being diagnosed with acute abdomen by any emergency residents or interns working in the emergency room during the study period (who fulfill the inclusion criteria)

3.4 Eligibility criteria

3.4.1. Inclusion criteria

- All adult patients triaged as acute abdomen on arrival or admitted with presumed or confirmed diagnosis of acute abdomen by any year emergency residents or interns attaching emergency.

3.4.2. Exclusion criteria

- Pediatric patients age <13 years
- Requiring obstetrics, endoscopy, or interventional radiology
- Patients whose medical records were found to be incomplete, completely lost or misplaced

3.5. Sample size determination and sampling technique

3.5.1. Sample size determination

The sample size formula for cross-sectional study design is given by the single population

proportion formula denoted by:

$$n = \frac{(Z\ \alpha\ /2)^2\ p\ (1 - p)}{d\ 2}$$

Here **n** is the minimum required sample size for an infinite population

Zα/2 - critical value for normal distribution at 95% confidence interval= 1.96

p- is the best estimate of prevalence; because no previous research has been done in our nation; we assume 50%;

d is the margin of error – 5% (0.05)

$$n = \frac{(1.96)^2\ 0.5\ (1 - 0.5)}{(0.05)^2} = 384.16$$

Next, adjust the sample size to the required population. Our source population is 206 (acute abdomen patients admitted over 6 months) since the population is less than 10,000, we used the correction formula where n*o* is the sample size we calculated (384) for an infinite population, N is our source population 206

Final corrected sample size (**n_f**): $n_f = \frac{no}{1+(no/N)} = 134$

Adding a 10% non-response rate, the sample size calculated is ≈ 149

If the sample size is not reached, all acute abdomen patients who are admitted during the study period will be included.

3.5.2. Sampling technique

A consecutive sampling method was used, and all adult patients with acute abdomen who fulfilled the inclusion criteria and trailed during the study period were included.

3.6. Study variables

3.6.1. Dependent variable

Delay of emergency surgical interventions for acute abdomen more than the specific wait time mentioned in the TACS classification system.

3.6.2. Independent variables

Sociodemographic variables

- Age
- Sex

Referral system

- Self
- Health facility

Length of stay in ED

Triage time

Triage category

Skin incision time

Causes of acute abdomen

Causes for delay of surgical intervention

3.7. Operational definitions

Complication at arrival: Unstable vital signs, shock (SBP <90), sepsis, septic shock (sepsis plus SBP<90), or peritonitis upon arrival at TASH

Length of stay: number of days from emergency admission to discharge from emergency or transfer to operation room/ward.

Commencement of surgery: Onset of general anesthesia.

Skin incision time: the time when the surgeon made the first incision to start the surgery.

Surgical delay- if the recorded duration from triage time/admission time to skin incision time is more than the specific wait time mentioned in the TACS classification system for each acute abdomen case.

Uncomplicated Appendicitis – appendicitis without local or generalized peritonitis, abscess, sepsis or septic shock

Table 1 Timing in Acute Care Surgery (TACS) classification system

Color Code Class	The ideal time to surgery	Clinical condition	Surgical scenario
RED	Immediate surgery (immediate lifesaving surgical intervention)	Hemodynamically unstable and vascular compromise, bleeding emergencies	Blunt or penetrating trauma, postoperative bleeding, ruptured aneurysm
ORANGE	Surgery within 1 hour	Hemodynamic stability after targets rapid resuscitation, patient at high risk of becoming unstable, with signs of septic shock, peritonitis	Acute mesenteric ischemia, bowel ischemia, Strangulated hernia with bowel ischemia, gastrointestinal perforation with peritonitis and septic shock, infected pancreatitis with shock, anastomotic dehiscence, complicated appendicitis (necrotic, appendicular abscess, perforated) with local/generalized peritonitis, complicated diverticulitis (with local/ generalized peritonitis and signs of septic shock), gangrenous cholecystitis with septic shock, intrabdominal abscesses with septic shock
YELLOW	Surgery within 6 hours	Hemodynamic stability, patients at high risk of developing multiorgan failure, with signs of sepsis	Gastrointestinal perforation, complicated appendicitis with signs of sepsis, complicated diverticulitis with sepsis, intraabdominal abscess with sepsis, gangrenous cholecystitis, infected pancreatitis with sepsis,

			abdominal evisceration, complete bowel obstruction, incarcerated hernia
GREEN	Surgery within 12 hours	Patients presenting local disorder with mild (reversible) organ dysfunction are at high risk of developing a systemic disease	Appendicitis

3.8. Data collection tool, methods and procedures

A pretested questionnaire was prepared after adopting previous studies with few adjustments; it was prepared in the English language. The tool includes demographic characters such as sex, age, triage time and category, skin incision time, acute abdomen pathology, causes for delay of emergency surgery, length of stay in ED,

After obtaining permission from the responsible authorities, the chart numbers of acute abdomen cases were acquired from registries in the ED registration book. The skin incision time was collected from the emergency surgery performance reporting format kept at the emergency operation room theatre. Sociodemographic characters, diagnosis, investigations done time, triaged time, and length of stay were collected from charts and the patient's I-care system. The primary investigator was largely responsible for collecting data; with the help of a few nurses in the triage area and operation room so as not to miss acute abdomen cases and for clear documentation. If clear and proper documentation cannot be retrieved from the charts, the respective treating emergency and surgery physician of the case was communicated and asked for an explanation after getting verbal permission. And a specified number of charts with acute abdominal diagnoses were enrolled.

3.9. Data processing and analysis

Data retrieved from patients' medical charts were entered into a computer using the SPSS

version 26 software application and cleaned for further analysis. Descriptive statistics was presented using frequency distribution and categorical variables were summarized as percentages of occurrence.

The association between independent variables were checked with the chi-squared test. Multivariable binary logistic regression analysis was performed to determine the degree of associations between the independent variables and dependent variables, with a statistically significant cut-off (p value<0.05). Variables with a p-value of less than 0.25 in univariate analysis were included in multivariable analysis. An odds ratio with a 95% confidence interval was computed to measure the amount of association and statistical significance. A statistically significant association was defined as p-value < 0.05 with a 95% confidence interval. The analyzed data was appropriately described using tables, graphs, and figures.

3.10. Ethical considerations

The study was carried out after being reviewed by the department research committee and received ethical permission from the Department of Emergency Medicine and Critical Care. Documents and information gathered during each course of study were kept confidential. Confidentiality was also preserved by using the card-identifying number (MRN) for data entry. Communication with the treating team will be kept confidential after getting verbal consent from the respective physician.

3.11. Dissemination of results

The results of the study will be presented to the Department of Emergency Medicine and Critical Care at the College of Health Sciences, AAU. And, if possible, publication of the study on journal websites.

6. Results

6.1 Sociodemographic characteristics

During the study period, there were a total of 97 cases of acute abdomen retrieved from the triage and emergency surgery documentation logbook. Among these, 3 patients were transferred out to other health institutions and only one patient disappeared from the emergency department without complete information on the chart. Of the 97 cases analyzed, 68 (70.1%) of them were males and 29 (29.9%) of them were females. With regard to age, the highest percentage belonged to the age group of 24 to 34 years which accounts for 33 (34%). The range of 35 to 45 years and 13 to 23 years were closely comparable to each other, accounting for 21 (21.6%) and 20 (20.6%) respectively. The proportions of patients who came with referral from health facilities or transferred from intrahospital outpatient units were greater (n= 70, 72.2%) than those who were self-referred (n=27, 27.8%).

Table 2 Sociodemographic characteristics of study subjects in relation to delayed surgical intervention

Sociodemographic characteristics		Delayed Intervention (Outcome)	
		NO	YES
		N (%)	N (%)
Age of the patient	13-23	19 (32.8%)	1 (2.6%)
	24-34	22 (37.9%)	11 (28.2%)
	35-45	6 (10.3%)	15 (38.5%)
	46-56	4 (6.9%)	5 (12.8%)
	>56	7 (12.1%)	7 (17.9%)
Sex of the patient	Male	44 (75.9%)	24 (61.5%)
	Female	14 (24.1%)	15 (38.5%)
Referral system	Health Facility	44 (75.9%)	26 (66.7%)
	Self	14 (24.1%)	13 (33.3%)

6.2 Clinical-related characteristics

Triage category and Length of stay

The majority of patients were triaged as Green, accounting for 37 (38.1%), followed by Yellow and Orange, accounting for 33 (34%) and 23 (23.7%), respectively. Only four patients (4.1%) were classified as Red.

About one-third (n=27, 27.8%) of the participants had greater than 24 hours emergency department length of stay, and the rest 70 patients (72.2%) had less than 24 hours length of stay.

Figure 1 Proportion of emergency department length of stay

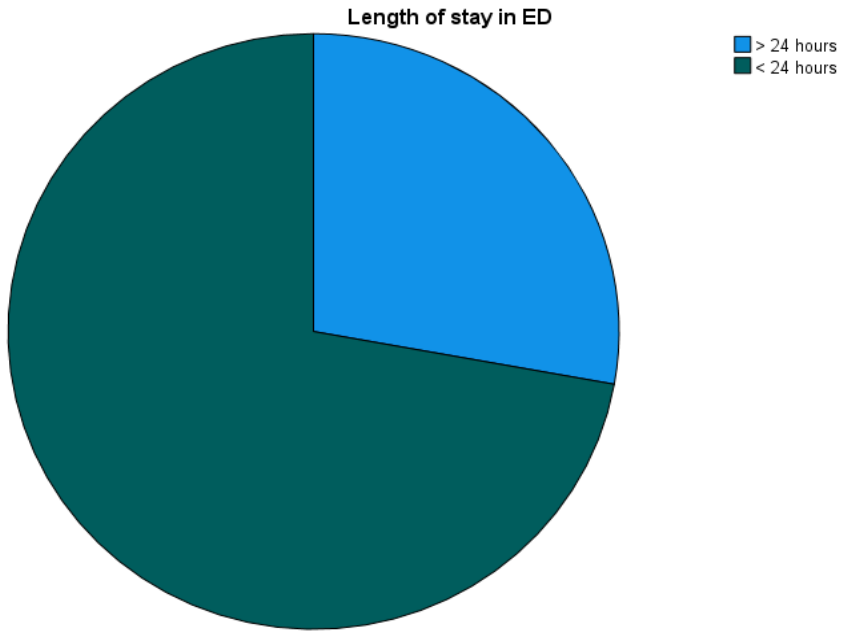


Table 3 Relation of triage category and length of stay with delayed surgical intervention

		Delayed intervention	
		No	Yes
		N (%)	N (%)
Triage Category	Red	3 (5.2%)	1 (2.6%)
	Orange	8 (13.8%)	15 (38.5%)
	Yellow	18 (31.0%)	15 (38.5%)
	Green	29 (50.0%)	8 (20.5%)
Length of stay in ED	> 24 hours	9 (15.5%)	18 (46.2%)
	< 24 hours	49 (84.5%)	21 (53.8%)

6.3 Acute Abdomen Diagnosis

Trauma accounted for 6.2% of the cases, while the remaining 93.8% were nontraumatic acute abdominal conditions. These included 43 uncomplicated acute appendicitis (44.3%), 25 complete intestinal obstruction (25.8%), and 13 gastrointestinal perforations (13.4%). Other less common causes of acute abdomen are gangrenous cholecystitis and intraabdominal abscess with sepsis which account for 5 (5.2%) each.

Figure 2 Frequency of acute abdomen diagnosis

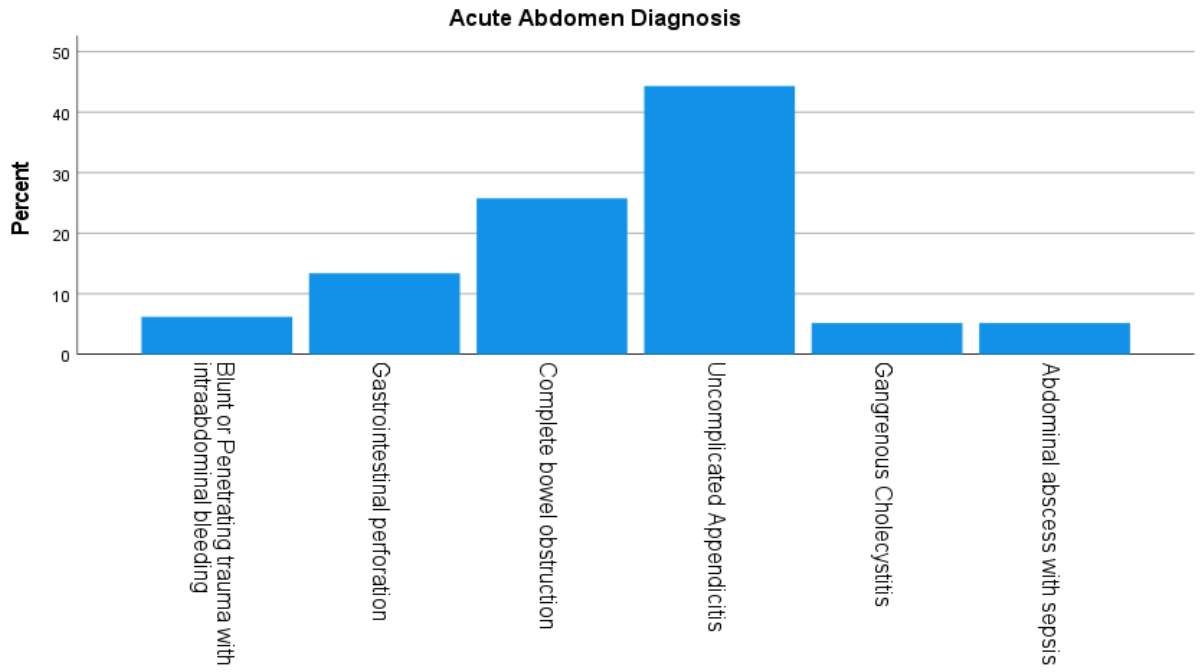
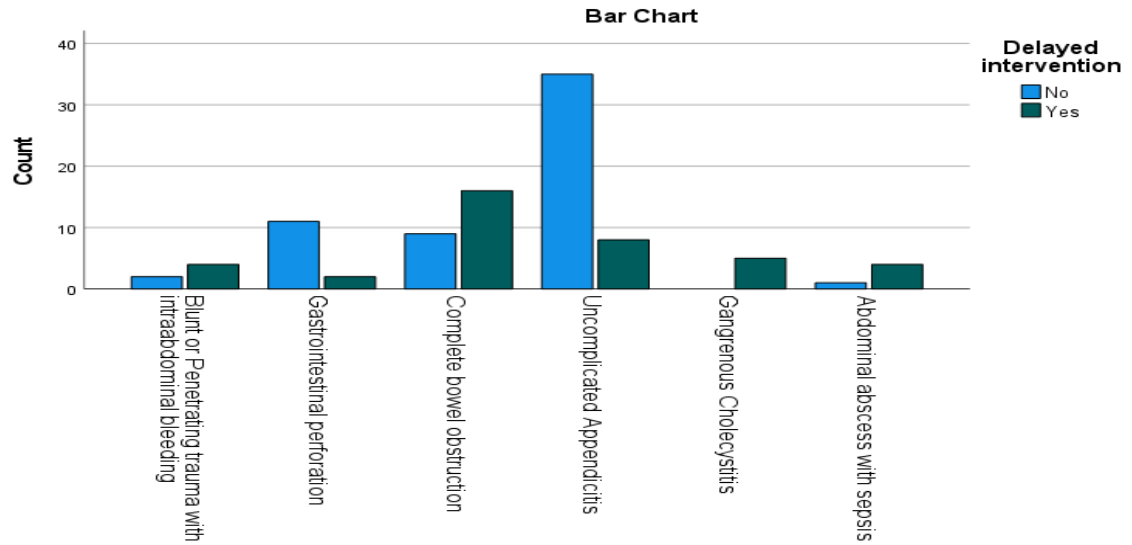


Table 4 Acute Abdomen Diagnosis in relation to delayed surgical intervention and sex of the patient

Acute Abdomen Diagnosis	Delayed Intervention	
	No	Yes
	N (%)	N (%)
Blunt or Penetrating trauma with intraabdominal bleeding	2 (3.4%)	4 (10.3%)
Gastrointestinal perforation	11 (19%)	2 (5.1%)
Complete bowel obstruction	9 (15.5%)	16 (41%)
Uncomplicated Appendicitis	35 (60.3%)	8 (20.5%)
Gangrenous Cholecystitis	0 (0.0%)	5 (12.8%)
Abdominal abscess with sepsis	1 (1.7%)	4 (10.3%)

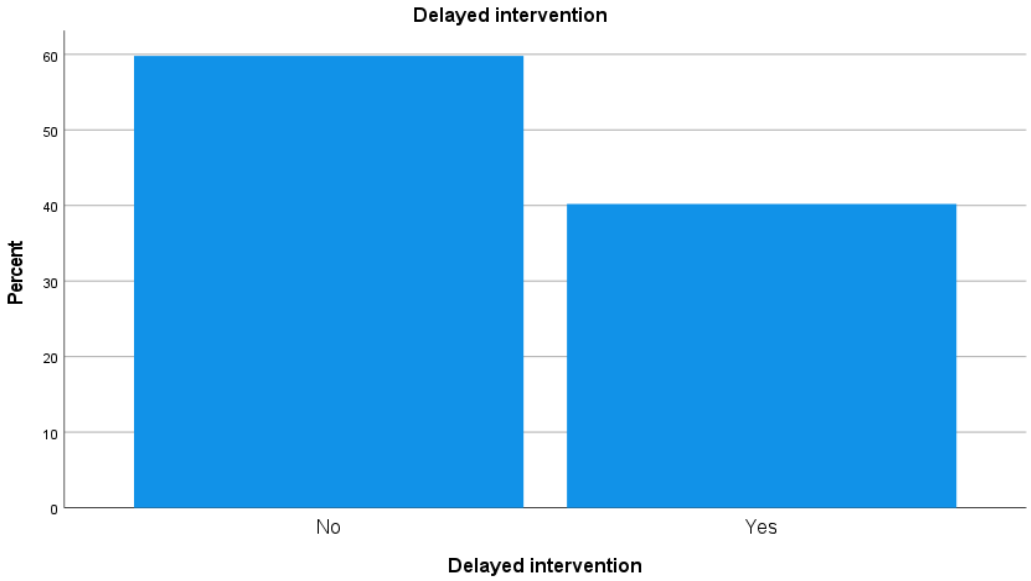
Figure 3 Relation of acute abdomen diagnosis with delayed intervention



6.4 Outcome

From a total of 97 cases of acute abdomen, 58 patients (59.8%) received surgical management within the appropriate time for the specific surgical case. While the rest of the 39 patients (40.2%) had surgical intervention delays beyond the TACS ideal time for surgery for each diagnosis.

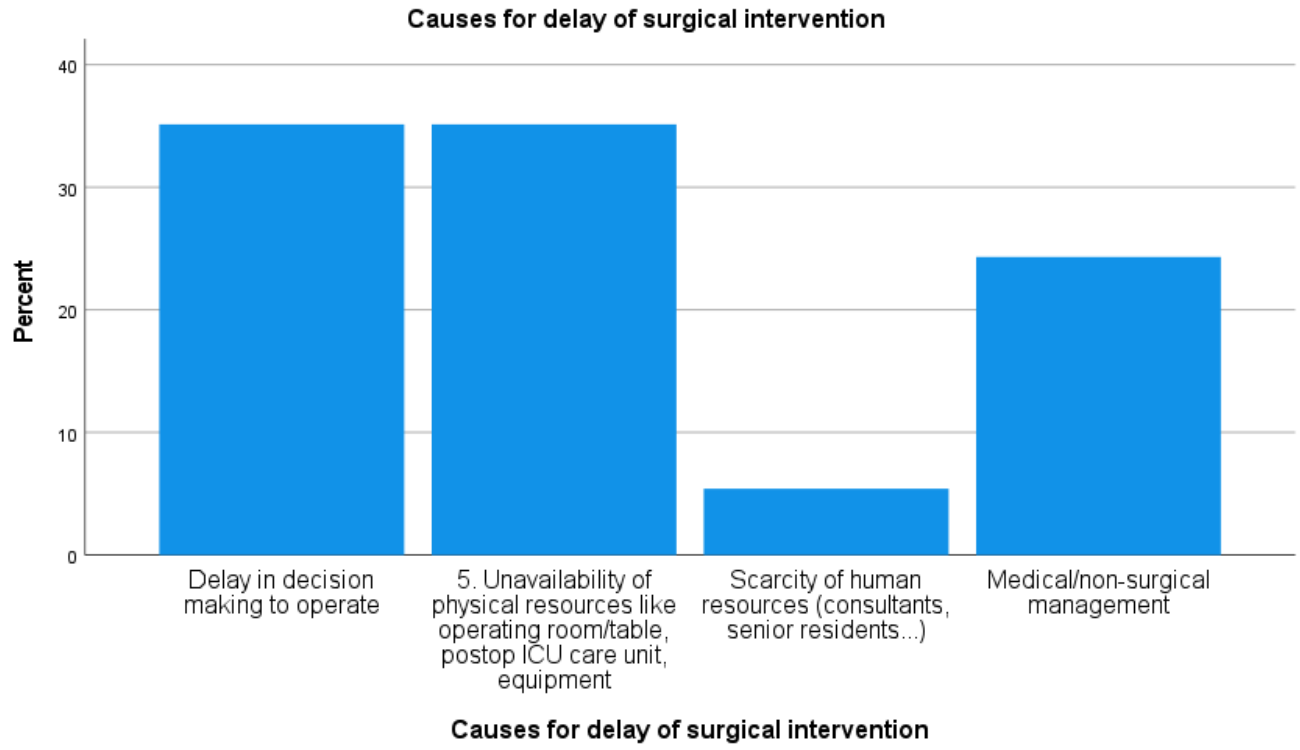
Figure 4 Percentage of delayed intervention



6.5 Health System related causes associated with delay in surgical intervention

Among the causes for delay of surgical intervention, delay in decision-making to operate and unavailability of physical resources (like operating room/table, postop ICU care unit, and equipment) hold the highest proportion each accounting for 13 (35.1%). 9 of the delayed cases (24.3%) had decisions for non-surgical or medical management. The rest of the 2 cases (5.4%) faced delayed surgical treatment beyond the appropriate time due to a shortage of human resources meaning the duty consultant or senior residents being occupied by other emergency cases.

Figure 5 Frequency of causes for delayed intervention



6.6 Factors associated with outcome

Initially, all independent variables underwent univariate analysis and those variables with a p-value of less than 0.25 were selected as candidate variables and considered for multivariate analysis.

In the univariate/bivariate analysis, the following variables showed statistically significant association with the outcome: among sociodemographic factors age, and sex variables with COR=1.723 (95% CI= 1.224-2.427 P=0.002) and COR= 1.964 (95% CI= 0.813-4.745, P= 0.134) respectively. From clinical-related characteristics, the triage category with COR= 0.523 (95% CI= 0.321-0.853, P=0.009) and length of stay with COR=0.214 (95%CI=0.083-0.554, P=0.001). These variables were taken and analyzed together using a multivariate logistic regression model.

After controlling for the effects of potentially confounding factors using a multivariate logistic regression model, the age of the patient and length of stay of more than 24 hours were found to be statistically significant predictors of delayed surgical intervention. Relative to the age group [13-23], being from age groups of [24-34], [35-45], [46-56], and [>56] were strongly associated with delayed intervention with adjusted odds ratio of 11.751 (95%CI=1.187-116.365, P=0.035), 27.067 (95% CI=2.516-291.187, P=0.007), 25.323 (95% CI=1.789-358.358, P=0.017), 15.820 (95% CI= 1.371-182.524, P=0.027) respectively. Compared with length of stay less than 24 hours, patients stay in the emergency department > 24 hours were 4.551 times more likely to have delayed surgical intervention [AOR=4.551; 95% CI=1.355-15.283, P=0.014)

Table 5 Bivariate and Multivariate Analysis to identify factors associated with delayed surgical intervention for acute abdomen cases (n=97)

Variables	Categories	Delayed Intervention		COR (95%CI)	AOR (95%CI)	p-value
		YES	NO			
		N (%)	N (%)			
Age of the patient	13-23	1 (2.6%)	19 (32.8%)		1	
	24-34	11 (28.2%)	22 (37.9%)	9.500 (1.121, 80.516)	11.751 (1.187, 116.365) *	0.035
	35-45	15 (38.5%)	6 (10.3%)	47.500 (5.146, 438.490)	27.067 (2.516, 291.187) *	0.007
	46-56	5 (12.8%)	4 (6.9%)	23.750 (2.149, 262.472)	25.323 (1.789, 358.358) *	0.017
	>56	7 (17.9%)	7 (12.1%)	19.000 (1.968, 183.435)	15.820 (1.371, 182.524) *	0.027
Sex of the patient	Male	24 (61.5%)	44 (75.9%)		1	

	Female	15 (38.5%)	14 (24.1%)	1.964 (0.813, 4.745)	1.261 (0.380, 4.188)	0.705
Triage Category	Red	1 (2.6%)	3 (5.2%)		1	
	Orange	15 (38.5%)	8 (13.8%)	5.625 (0.500, 63.282)	1.845 (0.122, 27.893)	0.658
	Yellow	15 (38.5%)	18 (31.0%)	2.500 (0.235, 26.600)	0.693 (0.047, 10.226)	0.789
	Green	8 (20.5%)	29 (50.0%)	0.828 (0.075, 9.074)	0.259 (0.018, 3.733)	0.259
Length of stay in ED	> 24 hours	18 (46.2%)	9 (15.5%)	4.667 (1.806, 12.061)	4.551 (1.355, 15.283) *	0.014
	< 24 hours	21 (53.8%)	49 (84.5%)		1	

*p-value < 0.05- statistically significant 1- indicate for the reference variable

7. Discussion

This study examined the prevalence and magnitude of surgical intervention delays for acute abdomen cases presenting to the study site during the study period, as well as assessed the associated system-related factors. The most common causes of abdominal surgical emergencies were acute uncomplicated appendicitis, followed by complete intestinal obstruction and gastrointestinal perforation. The findings are consistent with previous Ethiopian reports[12,21,26]. This study showed that the frequency of delayed surgical intervention for patients requiring emergency surgery was 40.2%, which is greater than other prior studies done in France (32.5%)[3] and Ottawa Hospital in Canada (18.6%)[16] and similar with a study done in Tanzania (40%)[8]. This finding difference might be due to the underdevelopment of the African health system compared with the developed countries.

The majority of the acute abdomen cases were represented by males (70.1%), which is similar to previous research done in MNH, Tanzania (67.6%)[8], Bergen area[27], and also here in Ethiopia at St. Paul and Gondar hospitals (75%)[12]. Concerning age, the age group of 24 to 34

years had the largest percentage, accounting for 34% of the total in this survey. In comparison to previous research, the biggest number (35.5%) belonged to the age category of 21-40 years in a study conducted at MNH in Tanzania[8], while 68% were between 15 and 44 years of age in St. Paul and Gondar hospital study[12]. But comparing a study done in Yaoundé Central Hospital, showed similar highest age group distribution[11]. According to this research data, the frequency of delay was largest in the age group 35-45 accounting for 38.5% however other studies revealed that delay in surgery is more common in older age groups and reasoned this for the higher surgical complication rates in the elderly[10,12]. Numerous prior Ethiopian study reports showed that delays in emergency surgery were more common in females[12,26] but this study analysis showed no statistically significant relation between the sex of the patient and emergency surgical care delay.

The majority of patients (75.9%) in this study were referred from health institutions such as local health centers, private clinics, and TASH outpatient units (intrahospital referral). In addition, compared to prior research results, these individuals had a decreased rate of surgical delay[12]. These findings suggest that the health and referral systems that cause delays in surgical care have improved. This study data also showed that a prolonged length of stay in an emergency (> 24 hours) is highly associated with delays in surgical management, compared to shorter stays (< 24 hours). A similar conclusion is reported in other systematic review papers [7] and research done in Nigeria[19]. To prevent delays in surgical care among these patients and so improve their outcomes, it is important to minimize their time of stay in emergency units as much as possible and transfer them to the operating theatre.

The majority of patients presented to the emergency department with an acute abdomen were triaged as green, followed by yellow and orange, with only a few patients assigned to the red unit. Among these triage categories, the highest rate of delay in surgery was seen in patients admitted in the green and yellow categories. However, the final data reports of the study showed no statistically significant relation between surgical intervention delay and the assigned triage categories.

The numerous causes of delay in timely surgical management, delay in decision-making to operate and unavailability of physical resources (such as operating room/table, post-operative ICU care unit, and equipment) rank first in this study, followed by non-surgical or medical

management. The smallest proportion was accounted for by deficiencies in human resources or the unavailability of the treating team due to other emergency cases. This finding shows a close relation and some variances with reports from other studies. The study at Muhimbili National Hospital (MNH), Tanzania illustrates shortages in health care workers on duty, unfamiliarity with medical facilities, and inadequate experience in dealing with emergency cases as the associated factors for delayed surgical care among patients[8]. Lack of imaging tests, patients' financial constraints, and paucity of operating rooms are other causes of delay in surgical care mentioned in research at Yaoundé Central Hospital, Cameroon[11]. As explained in the reports the hospital's surgical emergency department shares a single operating theatre with trauma, digestive, urological, and neurosurgery emergencies, leading to longer wait times. This reason can be related to this study as the emergency operating room of TASH is also used by different departments to operate emergency cases.

This study has some limitations that must be recognized. Because this was a single-center cross-sectional study, the external reliability of the results is limited. Some of the variables are missing due to inconsistencies in the medical records of the participants. There was a significant documentation gap in the operating room recording book to collect the exact incision time and number of operated cases. Lastly, the predicted number of patients to be included in the research was not possible to achieve during the specified study period.

8. Conclusion

Overall, an acute abdomen is a surgical emergency that requires prompt diagnosis and treatment. It is most prevalent among men and young adults. Acute uncomplicated appendicitis, complete intestinal obstruction, and gastrointestinal perforation are the most common causes of acute abdomen admissions. This study found a significant prevalence of 40.2% delayed emergency surgical care for acute abdomen, surpassing previous data. Patients aged 35-45 and who had prolonged length of stay more than 24 hours in the emergency were delayed more frequently. Emergency surgical care at our hospital is often delayed due to a lack of physical resources, such as unavailability of operating rooms, delays in decision-making to operate, and unavailability of the surgical team by being occupied with other emergency cases.

9. Recommendation

As emergency physicians, we must perform quick resuscitation, transport acute abdominal patients to the surgical room on time, and keep their length of stay in the ED to a minimum. The hospital should focus more on the availability of surgical equipment, operating rooms, and post-operative intensive care facilities. More research is required to improve the quality of care, which should largely focus on discovering why these delays occur, identifying other possible factors, and ways to eliminate them. Lastly, the complete recording of operating room performances, as well as the record-keeping method, should be improved.

Bibliography

1. Book Review: Management of the Acute Abdomen - Adrian Marston, 1983 [Internet]. [cited 2023 May 1]. Available from: https://journals.sagepub.com/doi/10.1177/014107688307600431
2. Patterson JW, Kashyap S, Dominique E. Acute Abdomen. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2023 May 1]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK459328/
3. Association of Organizational Pathways With the Delay of Emergency Surgery | Critical Care Medicine | JAMA Network Open | JAMA Network [Internet]. [cited 2023 May 1]. Available from: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2803785
4. Causes of delays in emergency surgical interventions | Download Table [Internet]. [cited 2023 May 1]. Available from: https://www.researchgate.net/figure/Causes-of-delays-in-emergency-surgical-interventions_tbl1_215518430
5. Patients whose emergency surgery is delayed are at higher risk of death [Internet]. [cited 2023 May 1]. Available from: https://medicalxpress.com/news/2017-07-ottawa-hospital-emergency-surgery.html
6. Saaristo L, Ukkonen MT, Laukkarinen JM, Pauniaho S-LK. The rate of short-term revisits after diagnosis of non-specific abdominal pain is similar for surgeons and emergency physicians - results from a single tertiary hospital emergency department. Scand J Trauma Resusc Emerg Med. 2020;28:63.
7. Murray V, Burke JR, Hughes M, Schofield C, Young A. Delay to surgery in acute perforated and ischaemic gastrointestinal pathology: a systematic review. BJS Open [Internet]. 2021 [cited 2023 Jun 22];5. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8413368/
8. Hamdan M, Yang X, Mavura M, Saleh M, Kannani G, Haonan K, et al. Factors associated with delayed reporting for surgical care among patients with surgical acute abdomen attended at Muhimbili National Hospital: Tanzania. BMC Gastroenterol. 2023;23:59.
9. Ong M, Guang TY, Yang TK. Impact of surgical delay on outcomes in elderly patients undergoing emergency surgery: A single-center experience. World J Gastrointest Surg. 2015;7:208–13.
10. Kizer KW, Vassar MJ. Emergency department diagnosis of abdominal disorders in the elderly. Am J Emerg Med. 1998;16:357–62.
11. Evaluate the delay in the management of acute abdomen at the Yaounde central hospital: a prospective cohort study. MOJ Clin Med Case Rep [Internet]. 2021 [cited 2023 Jun 28];Volume 11. Available from: https://medcraveonline.com/MOJCR/MOJCR-11-00404.pdf
12. Tamrat G, Osman M, Deyessa N, Taye M, Lett R, Bekele A. Delay of emergency surgical interventions in Ethiopia: Patient and health system factors. East Cent Afr J Surg. 2018;23:59–65.
13. Eldar S, Nash E, Sabo E, Matter I, Kunin J, Mogilner JG, et al. Delay of surgery in acute appendicitis. Am J Surg. 1997;173:194–8.
14. Ciarleglio FA, Rigoni M, Mereu L, Tommaso C, Carrara A, Malossini G, et al. The negative effects of COVID-19 and national lockdown on emergency surgery morbidity due to delayed access. World J Emerg Surg. 2021;16:37.
15. Fu SJ, George EL, Maggio PM, Hawn M, Nazerali R. The Consequences of Delaying Elective Surgery: Surgical Perspective. Ann Surg. 2020;272:e79–80.
16. McIsaac DI, Abdulla K, Yang H, Sundaresan S, Doering P, Vaswani SG, et al. Association of delay of urgent or emergency surgery with mortality and use of health care resources: a propensity score–matched observational cohort study. CMAJ. 2017;189:E905–12.

17. Chung CH, Ng CP, Lai KK. Delays by patients, emergency physicians, and surgeons in the management of acute appendicitis: retrospective study. Hong Kong Med J Xianggang Yi Xue Za Zhi. 2000;6:254–9.
18. Von Titte SN, McCabe CJ, Ottinger LW. Delayed appendectomy for appendicitis: causes and consequences. Am J Emerg Med. 1996;14:620–2.
19. Adamu A, Maigatari M, Lawal K, Iliyasu M. Waiting time for emergency abdominal surgery in Zaria, Nigeria. Afr Health Sci. 2010;10:46–53.
20. Tegegne A. Management of small intestinal volvulus in a district hospital. Trop Doct. 1995;25 Suppl 1:54–7.
21. Ersumo T, W/Meskel Y, Kotisso B. Perforated peptic ulcer in Tikur Anbessa Hospital: a review of 74 cases. Ethiop Med J. 2005;43:9–13.
22. The new timing in acute care surgery (new TACS) classification: a WSES Delphi consensus study | World Journal of Emergency Surgery | Full Text [Internet]. [cited 2023 Jul 3]. Available from: https://wjes.biomedcentral.com/articles/10.1186/s13017-023-00499-3
23. Yosha HD, Tadele A, Teklu S, Melese KG. A two-year review of adult emergency department mortality at Tikur Anbesa specialized tertiary hospital, Addis Ababa, Ethiopia. BMC Emerg Med. 2021;21:33.
24. Hanks L, Lin CP, Tefera G, Seyoum N. Abdominal Surgical Emergencies at Tikur Anbessa Specialized Hospital in Ethiopia; A Shifting Paradigm. East Cent Afr J Surg. 2014;19:90–4.
25. Pattern of Acute Abdomen in Adult Patients in Tikur Anbessa Teaching Hospital, Addis Ababa, Ethiopia. | Request PDF [Internet]. [cited 2023 Jul 23]. Available from: https://www.researchgate.net/publication/27799663_Pattern_of_Acute_Abdomen_in_Adult_Patients_in_Tikur_Anbessa_Teaching_Hospital_Addis_Ababa_Ethiopia
26. Asefa Z. Pattern of acute abdomen in Yirgalem Hospital, southern Ethiopia. Ethiop Med J. 2000;38:227–35.
27. Svanes C, Salvesen H, Stangeland L, Svanes K, Søreide O. Perforated peptic ulcer over 56 years. Time trends in patients and disease characteristics. Gut. 1993;34:1666–71.

Annex 1

Data collection tool

Please mark the given checkbox spaces and write comments accordingly

I. Age
    1. 13-23
    2. 24-34
    3. 35-45
    4. 46-56
    5. >56

II. Sex
    1. Male
    2. Female

III. Referral system
    1. Health facility
    2. Self

IV. Length of stay in ED
    1. > 24 hours
    2. < 24 hours

V. Triage time

VI. Triage category
    1. Red
    2. Orange
    3. Yellow
    4. Green

VII. Acute Abdomen diagnosis (according to TACS surgical case)
    1. Blunt or Penetrating trauma with intraabdominal bleeding
    2. Bowel ischemia
    3. Complicated Appendicitis with peritonitis
    4. Gastrointestinal perforation with peritonitis and septic shock
    5. Abdominal abscess with septic shock
    6. Gastrointestinal perforation
    7. Abdominal evisceration
    8. Complete bowel obstruction
    9. Incarcerated hernia
    10. Uncomplicated Appendicitis
    11. Gangrenous Cholecystitis
    12. Gangrenous Cholecystitis with septic shock

13. Abdominal abscess with sepsis

VIII. Admitted/transferred to operation room
1. Immediately
2. < 1 hour
3. < 6 hours
4. < 12 hours
5. More than the above-mentioned hours

IX. Delayed
1. No
2. Yes

X. Causes for delay of surgical intervention
1. Delayed lab investigation results
2. Delayed imaging results
3. Lack of cross-matched blood
4. Delay in decision-making to operate
5. Unavailability of physical resources like operating room/table, postop ICU care unit, equipment
6. delay to diagnose
7. scarcity of human resources (consultants, senior residents...)
8. medical/non-surgical management

XI. Transferred out
1. No
2. Yes

IX. patient disappeared
1. No
2. Yes