



ST. PAUL'S HOSPITAL MILLENNIUM MEDICAL COLLEGE
DEPARTMENT OF PUBLIC HEALTH

**Magnitude and Pattern of Misdiagnosis in Acute Abdomen Cases
Seen in St. Paul's Hospital Millennium Medical College's Surgical
Emergency Department**

Dr. Redwan Nurhussien Wohab (Intern)

A STUDENT RESEARCH REPORT TO BE SUBMITTED TO THE
DEPARTMENT OF PUBLIC HEALTH, SPHMMC, IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF MEDICINE

August, 2018

ADDIS ABABA, ETHIOPIA



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Dr. Redwan Nurhussien Wohab (Intern)

Advisors

Mr. Temesgen Geleta (MPH)

Dr. Abiy Ephrem (MD, Cardiologist)

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ACKNOWLEDGEMENT

I would like to express my gratitude and appreciation to my research advisor, Mr. Temesgen for his constructive comments in the entire process of this student research project. Next, I would like to thank Dr. Abiy Ephrem for guiding the clinical aspect of my research. Last but not least I would also like to send my deepest gratitude for my class mates who has been helping me by giving me advices and different materials.

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ACRONYM & ABBREVIATION

- ✓ **AMA-** American Medical Association
- ✓ **BLH-** Black Lion Hospital
- ✓ **CBC-** Complete blood count
- ✓ **CXR-** Chest X-ray
- ✓ **DAP-** Duration of abdominal pain
- ✓ **DPS-** Duration of preoperative stay
- ✓ **IOF-** Intra-operative findings
- ✓ **IOM-** Institute of Medicine
- ✓ **NPV-** Negative Predictive Value
- ✓ **OPD-** Out patient department
- ✓ **PPV-** Positive Predictive Value
- ✓ **SBO-** Small Bowel Obstruction
- ✓ **SPHMMC-** St. Paul's Hospital Millennium Medical College
- ✓ **SPSS-** Statistical Package for Social Science
- ✓ **TLC-** Total Leukocyte Count
- ✓ **U/S-** Ultrasonography

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SUMMARY

INTRODUCTION: Acute abdomen refers to the sudden onset of abdominal pain due to abdominopelvic disease entities that require an immediate surgical intervention in most of the cases. Morbidity and mortality outcomes of patients depends on multiple factors. Among those, a reasonable, timely and accurate clinical diagnosis plays a pivotal role in determining subsequent outcomes. Even though, the magnitude of misdiagnosis in a general medical condition is difficult to reliably study due to the challenge of operationalizing the term “misdiagnosis”, it has been well studied in acute abdomen cases especially acute appendicitis.

OBJECTIVE: The main objective of the study is to determine the magnitude of misdiagnosis in acute abdomen Cases Seen in St. Paul’s Hospital Millennium Medical College’s Surgical Emergency Department

METHOD: With descriptive retrospective cross-sectional study design, 121 samples were selected from the study population via simple random sampling technique. The desired information about each variables of interest was extracted from the patient’s chart documentations and filled into a prepared template. The data was then fed into SPSS version 20. Finally, a descriptive analysis of the data was done to present the sociodemographic variables, pertinent clinical scenarios, magnitude and patterns of misdiagnosis in the operated acute abdomen Cases Seen in SPHMMC’s Surgical Emergency Department. Tables, figures, bar and pie charts are used to present the data.

RESULTS: 1 in less than 2 laparotomies done in SPHMMC is for the purpose of appendectomy. The magnitude of misdiagnosis in the operated acute abdomen Cases Seen in SPHMMC’s Surgical Emergency Department was 6.61%. The sample’s male: female ratio was 1.6:1. In contrast, most misdiagnosed cases were females (87.5%). The rate of negative appendectomy was 4.9%, which is within the acceptable range according to standard surgical textbooks.

CONCLUSION: Acute abdomen is the most common cause of acute abdomen. The magnitude of misdiagnosis in acute abdomen cases is comparable with other studies. Females are more likely to get misdiagnosed than males.

1. INTRODUCTION

1.1. Background

The term “acute abdomen” usually refers to those conditions causing abrupt abdominal pain and tenderness (i.e., pain lasting < 7 days) and requiring urgent diagnosis and surgical intervention. The most common causes of acute abdomen are appendicitis, cholecystitis, bowel obstruction, and perforated intra-abdominal organs.

Acute abdominal pain is a common complaint of patients presenting at the Emergency Department encompassing around 5-10% of emergency department admissions. Patients presenting with acute abdominal condition which often requires an immediate surgical intervention and is one of the commonly encountered emergencies in the practice of General Surgery. It is not uncommon that surgeons head towards the operation theatre without settling the diagnosis and the patient is subject to exploratory laparotomy. Subsequently many wonders are revealed upon opening the abdomen. So, it is often the last court of appeal in investigating abdominal cases.

Acute appendicitis is the most frequent acute abdomen disease with the lifetime incidence of approximately 7%, which requires operative treatment due to its life-threatening complications. Imitation of the symptoms makes appendicitis similar to other urgent abdomen pathologies and causes diagnostic difficulties, especially in early disease manifestation. Inaccurate diagnosis of appendicitis follows the unnecessary operation. A term negative appendectomy implies appendectomy for not inflamed appendicitis and reports claim its rate ranging from 10 to 30%. (1)

There are several steps that must be taken by healthcare professionals and patients and their families to reduce the incidence and cost of misdiagnosis.

1. Consider a second opinion from an experienced specialist to confirm a diagnosis and appropriate treatment options.
2. Include all healthcare providers, including radiologists and pathologists, as integral members of the diagnostic team.
3. Avoid undue reliance on fancy investigate modalities.
4. Actively and consistently involve the patient and family in the process of diagnosis and treatment.

1.2. Statement of the problem

The past decade's quest to improve patient safety has chiefly addressed quantifiable problems such as medication errors, health care–associated infections, and postsurgical complications. Diagnostic error has received comparatively less attention, despite the fact that landmark patient safety studies have consistently found that diagnostic error is common. In the Harvard Medical Practice Study, diagnostic error accounted for 17% of preventable errors in hospitalized patients, and a systematic review of autopsy studies covering four decades found that approximately 9% of patients experienced a major diagnostic error that went undetected while the patient was alive. Taken together, these studies imply that thousands of hospitalized patients die every year due to diagnostic errors. (2)

How Significant a Problem Is Misdiagnosis?

Misdiagnosis is the subject of a growing number of studies. The most recent one, *Improving Diagnosis in Healthcare* from the Institute of Medicine (IOM), claims that approximately 12 million people in the U.S. who seek outpatient medical care experience some form of diagnostic error. (3) Another Johns Hopkins study found that out of 6,000 cases from medical institutions across the country, one out of every 71 cancer cases were misdiagnosed and up to one out of five cancers were misclassified. (4)

General medical prevalence of misdiagnosis in various recent reported studies.

Prevalence of diagnostic errors in reported research	
10% of patient deaths	Balogh, 2015 (3)
10-20% of cases	Graber, 2012 (7)
25% of breast biopsies	Elmore, 2015 (8)
29% of malpractice claims	Newman-Toker, 2013 (9)

The Human Cost

Misdiagnosis too frequently results in serious harm to patients. In a survey of physicians, 64% said that up to 10% of the misdiagnoses they have experienced directly resulted in harm to the patient. (5) Another study found that 28% of 538 reported diagnostic errors were life-threatening or resulted in the patient's death or permanent disability. (6)

The Financial Impact

In addition to causing physical harm, misdiagnosis also has a significant financial impact on the national economy. Another IOM report estimates that 30% of annual healthcare spending in the United States, approximately \$750 billion, is wasted on unnecessary services and other inefficiencies. The national costs of medical errors resulting in injury are estimated to be between \$17-29 billion annually. (10)

1.3. Justification of the study

Abdominal pain is the most common reason for a visit to the emergency department accounting for 8 million (7%) of the 119 million emergency department (ED) visits in 2006 in the US. Approximately 12 million people in the U.S. who seek outpatient medical care experience some form of diagnostic error. Skill in the assessment of abdominal pain is an essential requirement of emergency medicine. Although a common presentation, abdominal pain is often a symptom of serious disease and may be difficult to diagnose, resulting in a high percentage of medicolegal actions against both general and pediatric EM physicians. (11)

Misdiagnosis too frequently results in serious harm to patients. In a survey of physicians, 64% said that up to 10% of the misdiagnoses they have experienced directly resulted in harm to the patient. Another study found that 28% of 538 reported diagnostic errors were life-threatening or resulted in the patient's death or permanent disability. Diagnostic errors contribute to 10% of patient deaths and 6-17% of hospital adverse events. Other researchers quantify the human cost of diagnostic errors at between 40,000 and 80,000 deaths per year. (12)

2. LITERATURE REVIEW

Researchers have used categories developed in cognitive psychology to classify several types of errors that clinicians commonly make due to incorrect applications of heuristics:

Availability heuristic- diagnosis of current patient biased by experience with past cases

Eg. A patient with crushing chest pain was incorrectly treated for a myocardial infarction, despite indications that an aortic dissection was present.

Anchoring heuristic (premature closure)- Relying on initial diagnostic impression, despite subsequent information to the contrary.

Eg. Repeated positive blood cultures with *Corynebacterium* were dismissed as contaminants; the patient was eventually diagnosed with *Corynebacterium* endocarditis.

Framing effects- Diagnostic decision-making unduly biased by subtle cues and collateral information.

Eg. A heroin-addicted patient with abdominal pain was treated for opiate withdrawal, but proved to have a bowel perforation.

Blind obedience- Placing undue reliance on test results or "expert" opinion.

Eg. A false-negative rapid test for *Streptococcus* pharyngitis resulted in a delay in diagnosis.

Medical misdiagnosis has three major categories:

- **False positive:** misdiagnosis of a disease that is not actually present
- **False negative:** failure to diagnose a disease that is present
- **Equivocal results:** inconclusive interpretation without a definite diagnosis

How can we estimate diagnostic errors?

Autopsy studies identify major diagnostic discrepancies in 10–20% of cases. Most cases in autopsy series derive from inpatient settings, but they also include deaths from the emergency department which, for many reasons, is considered to be the natural laboratory for studying diagnostic error. Despite the availability of modern imaging, autopsies continue to show diagnoses being missed that might have been lifesaving, particularly infections and cardiovascular conditions.

Although autopsy data is considered the ‘gold standard’ in terms of providing the most definitive data on the accuracy of diagnosis, only a subset of cases ever reach autopsy, and in many cases, the relationship between clinical diagnoses and autopsy findings remains unclear.

Autopsies also discover a large number of incidental findings that were not suspected during life, but that were clinically irrelevant.

Surveys have found that diagnostic errors are a major concern of both patients and physicians. A survey of over 2000 patients found that 55% listed a diagnostic error as their chief concern when seeing a physician in an outpatient setting. Similarly, physician surveys have consistently found that approximately half the respondents encounter diagnostic errors at least monthly. Moreover, compared with the many different safety concerns encountered in practice, physicians perceive diagnostic errors to be more likely to cause serious harm or death compared with other safety concerns. (16,17,18)

Standardized patients’ studies using ‘secret shoppers’ have also been used to estimate the accuracy of diagnosis. In these studies, real or simulated patients with classical presentations of common diseases, like rheumatoid arthritis, asthma, or chronic obstructive pulmonary disease (COPD) are sent anonymously into real practice settings.

The diagnostic error rates reported (13–15%) are very much in line with estimates from the other types of research approaches, and have substantial ‘face’ validity in that the studies are being carried out prospectively in real-world settings. In addition to providing an estimate of diagnostic error rates, this approach offers the unique ability to probe the various factors that promote or detract from optimal diagnosis. (19,20)

The chief limitation of these studies in regard to estimating error rates is that they are performed under research-directed conditions, presenting a much smaller subset of conditions than would be seen in usual practice. Moreover, in studies seeking to also study the factors relevant to accurate diagnosis, these patients may present with comorbid conditions or contextual complexities that are not representative of typical patients, and case complexity is a major factor in determining diagnostic accuracy.

Second reviews refer to research protocols in the visual subspecialties (eg, radiology, pathology, dermatology) where a second radiologist examines the same films after a first radiologist, or a

second pathologist reviews the same biopsy or cytology specimen as another pathologist. These second review studies may be performed under controlled conditions, involving the review of many or mostly abnormal cases. This approach has advantages from a research perspective, but substantially increases the possibility for diagnostic error, which can range from 10% to 50%. Interestingly, the studies also show that a diagnostician will also disagree with his or her own prior interpretation in a small fraction of cases.

In ‘real world’ situations, the majority of examinations are normal. Under these conditions, a critical abnormality is detected by a second expert reviewer in the range of 2–5%.

Diagnostic testing audits are used to estimate the incidence of error in the clinical laboratory. Thanks to impressive advances in quality control procedures, diagnostic errors in the modern age are rarely the result of an error in the analytical test itself. Most laboratory-related errors now originate from the preanalytical and postanalytical phases, namely issues related to the physician ordering and interpreting the test result. Overall, it is estimated that laboratory results are misleadingly wrong in 2–4% of cases, and roughly the same error rates are found in diagnostic radiology. (21,22)

The major limitation of diagnostic testing audits is that, although they excel at finding errors in test performance per se, they underestimate the true clinical impact because of the related preanalytical and postanalytical errors occurring outside the walls of the laboratory or radiology department which, typically, escape detection. Lapses in the reliable communication of abnormal test results, for example, is a universal problem, even in systems with advanced electronic medical records.

Malpractice claim databases are easily studied and provides interesting data on diagnostic errors. A recent analysis of malpractice cases extracted from the National Practitioner Data Bank over a 25-year period identified 100,249 cases of diagnostic error.³⁵ Diagnostic error was the most common reason for a claim (29%) and the costliest, averaging \$386 849 per claim. (23)

Studying closed claims provides a convenient approach to analyzing large numbers of cases, already preclassified as representing diagnostic errors. Limitations of this approach include the fact that only a small subset of errors results in claims, and these, typically, span just a narrow range of clinical conditions, predominated by cases involving cancer or cardiovascular disease in

young or middle-aged patients. Moreover, these cases provide only limited opportunities to study the etiology of diagnostic errors, as the proceedings by their nature are focused more on consequences than causes.

Case Reviews. Many specific symptoms and disease states have been studied using retrospective case reviews, and in each of these the incidence of diagnostic error is unacceptably high. For example, a systematic review of more than 8000 ER patients found a delayed diagnosis of stroke in 9%. Kostopoulou and colleagues reported a systematic review of this literature and identified 21 studies meeting their quality criteria. In one such study, children with asthma experienced a median delay in making the correct diagnosis of more than 3 years, spanning 7 ER visits. (24,25)

Delayed or wrong diagnosis rates of 10–50% have been identified in studies of coronary artery disease, HIV-associated complications, tuberculosis and a wide range of malignancies. Very similar data has been reported by Gandhi and colleagues, who studied 181 cases of diagnostic error in ambulatory settings. Delayed diagnosis of cancer and coronary artery disease were the most commonly identified problems in the study by Gandhi et al, and a growing number of studies have confirmed the frequency of missed opportunities for earlier cancer diagnosis. The point to be made is that whereas diagnostic errors may sometimes reflect encounters with extremely rare diseases or very unusual presentations of common diseases, in many cases, it is a relatively common disease that is mislabeled or missed entirely. (21,22,26)

The chief limitation of case reviews is that they typically rely just on data contained in the medical record, and many diagnostic errors are missed as a result. As an example, Schwartz and colleagues used standardized patients to estimate costs resulting from diagnostic errors in ambulatory practices. Only their knowledge of the actual diagnosis allowed accurate estimates of these costs; virtually none could have been surmised from record reviews alone. An additional limitation is that the medical record, typically, is lacking documentation on what the clinician was thinking at the time the diagnosis was being considered. Finally, random chart reviews are not well suited to measuring incidence rates of diagnostic error because the rate of error is low, thus requiring a large number of reviews.

Voluntary reports-Voluntary error-reporting systems are now in place in most healthcare organizations in the developed world, and were expected to provide a reliable way of identifying both minor and major adverse events. When they are used, and especially if follow-up interviews

with providers can be obtained, voluntary reporting offers the unique potential to explore both the system related and cognitive etiologies of diagnostic error.

Unfortunately, this method captures only a small fraction of diagnostic errors. Factors that detract from reporting include the time required to submit cases, a natural reluctance to call attention to one's own mistakes, and the ever-present fear of provoking a malpractice suit despite the reassurance that reports can be submitted anonymously. Another barrier to voluntary reporting of diagnostic errors is the lack of a 'common format' for reporting.

Recent Studies

In a prospective observational study performed in Haryana, India from January-2015, with a topic of *comparative Analysis of Clinical, Radiological and Operative Findings in Acute Abdomen*, a total of 125 patients underwent emergency laparotomy from December 2012 to February 2014. Acute appendicitis was the most common cause of acute abdomen, accounting for 55(44%) cases. These cases of appendicitis include simple inflamed appendix, gangrenous appendix and perforated appendix. Second commonest cause for acute abdomen was perforation peritonitis 38(30.4%), which include peptic perforation and intestinal perforation. Less commoner diagnosis for acute abdomen were intestinal obstruction 24(19.2%) and mesenteric ischemic disease accounting for total of 8(6.4%) cases. Acute abdominal pain was elicited to be the most common symptoms present in 98.4% patients followed by nausea/vomiting in 77.6%, anorexia in 42.4% and fever in 40.8% patients. Anorexia was most commonly demonstrated in acute appendicitis whereas Vomiting was the leading complaint in cases of obstruction. Fever was the overall least common symptom present only in 51 cases. (13)

The commonest clinical sign was tenderness present in 117 (93.6%) patients followed by guarding 78(62%) and was the only statistical significant factor ($p=.02$) among all the clinical signs. Tachycardia was present in 58 (46.4%) patients followed by distension in 43 (34%) patients, rigidity in 29 (23%) and rebound tenderness in 22 (17%) patients. Bowel sounds were exaggerated in 3 cases all belonging to obstructive pathology. A total of 59 (47.2%) patients had raised TLC among which 58 patients had positive laparotomy findings with sensitivity of 47.54%, and specificity of 66.67% respectively. The test was statistically not significant with two tailed $p = .58$; differential leukocyte count was raised in 86(68.8%) patients with sensitivity of 70.49% and positive predictive value of 97.73% the test was statistically significant ($p = .0092$). (13)

Abdominal X-Ray was requested in 70 (56%) of acute abdominal patient. In 51 (72.86%) cases abnormal finding was present. Abdominal X-ray was performed in all suspected cases of perforation, obstruction, and mesenteric ischemic sparing acute appendicitis cases. Highest accuracy of X-ray abdomen was found in cases of obstruction (87.5%). Ultrasound was performed in all patients. A total of 94 (75.2%) had positive finding in ultrasound in which 2 patients were found to have no intra-operative pathology. 31 (24.8%) patients had either inconclusive or normal ultrasound finding, in which 30 patients had positive intra-operative finding, giving a sensitivity

of 75.41%, specificity of 33.33%, a PPV of 97.87% and NPV value of 3.23%. The two-tailed P value equals 0.3270. The test is statistically not significant. Highest accuracy of ultrasound was present in cases of appendicitis (90.19%) followed by perforation (84.21%), obstruction (54.16%) and was least diagnostic in cases of mesenteric ischemia (12.5%). (13)

CT scan was asked in 6 cases out of which it helped in confirming the clinical diagnosis in two cases, in another 2 cases it gave new diagnosis and in rest of two it was inconclusive adding no advantage to clinical or radiological diagnosis.

Overall radiological diagnostic accuracy depends upon the positive findings present in either X-ray or ultrasound or both so that the x-ray and ultrasound can complement each other while making a diagnosis. A total of 105(84%) patients had one or the other positive radiological finding out of which 103 were correct. In 20(16%) patients it was either inconclusive or negative among which 21 were found to have pathology. (13)

Clinical evaluation resulted in operative decision in 114 patients out of which 112 were correct and 2 cases undergo negative laparotomy. Highest diagnostic accuracy was found in perforation peritonitis (97%) followed by appendicitis 94.54%, obstruction 91.66% and in cases of mesenteric ischemia accuracy was 50%. The overall accuracy was 89%. The sensitivity of clinical diagnosis was 91.80% and its specificity was 33.33% whereas percentage of positive predictive value and negative predictive value was 98.25 and 9.09 respectively. In overall clinical diagnostic accuracy, the two-tailed P value equals 0.0047 which is highly significant. In appendicitis, the p value = 0.0005 which is highly statistically significant. (13)

3. OBJECTIVES

3.1. General Objective

- To determine the magnitude and pattern of misdiagnosis in operated acute abdomen Cases in SPHMMC's Surgical Emergency Department.

3.2. Specific Objective

- To access the magnitude of misdiagnosis comparing with the intraoperative findings
- To describe the misdiagnosed cases in terms of various sociodemographic variables
- To assess the rate of negative appendectomy

4. METHODS AND MATERIALS

4.1. Study Design

A retrospective cross-sectional descriptive study.

4.2. Study Area

The study was conducted in St. Paul's Hospital Millennium Medical college. Addis Ababa, Ethiopia. According to the national census, 2002 the total population of Addis Ababa was 3.8 million. SPHMMC is a tertiary hospital located in Addis Ababa/gulele sub city and is the second largest hospital in the country next to Black Lion Hospital. It was built in 1969 by Emperor Haile Selassie in collaboration with the German Evangelical Church. It used to be called Saint Paul General Specialized Hospital up until 2008 and later shifted to SPHMMC with the opening of the medical school with the intention to alleviate the severe shortage of medical doctors at the country. It currently has 392 beds, with an annual average of 200,000 patients and a catchment population of more than 5 million.

The surgical department in SPHMMC encompasses both outpatient and inpatient care. The outpatient care functions five days per week and is run by the surgical residents and at times by the attendings themselves. The inpatient care is relatively broad comprising of an 80-adult general surgery, 24 urologic surgery and 9 pediatric surgery beds.

4.3. Source Population

The source population for this study was all patients visiting the emergency OPD in SPHMMC.

4.4. Study Population

The study population for this study was all surgically managed acute abdomen cases in SPHMMC surgical emergency OPD.

4.5. Sample size determination and Sampling technique

The first step in determining the sample size was determining the sampling frame and this was done by recovering the documentations from the operation theater. Subsequently, a simple random sampling technique was used up until the calculated sample size is achieved.

From literature reviews, the prevalence of misdiagnosis in acute abdomen was 8.2%. With a 95% confidence interval and margin of error 5%, the initial sample size would be 116.

$$n_0 = \frac{Z_{\alpha/2}^2 p(1-p)}{d^2} = \frac{(1.96)^2 (0.082)(0.918)}{(0.05)^2} = 116$$

$$n = \frac{n_0}{1 + \frac{n_0 - 1}{N}}$$

Adjustment for N=2000 with would make the sample size 110.

At last adding 10 % (11) for missing file and record the final sample size became 121.

Inclusion Criteria

- All operated cases with the assessment of acute abdomen in the past two years.

Exclusion Criteria

- Those cases with incomplete chart documentation
- Those acute abdomen cases managed non-operatively (patients managed conservatively)
- acute abdomen in pregnancy
- gynecological causes of acute abdomen

4.6. Study Variables

- Socio demographic variables
 - Age
 - Sex
 - Educational status
 - Marital status
 - Ethnicity
 - Religion
- Clinical presentation
 - Signs and Symptoms- nausea, vomiting, fever, duration of abdominal pain, obstipation, distention, fever, tachycardia, abdominal tenderness...
 - Laboratory findings as leukocytosis, Leukouria....
 - Radiologic findings
- Duration of preoperative stay
- Misdiagnosis

4.7. Operational Definitions

Misdiagnosis- the failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient. (14)

For this research, the operational definition of misdiagnosis would be *“a significant difference in clinical diagnosis and intraoperative findings that alters the management approach.”* (13)

Acute Abdomen- previously undiagnosed pain that arises suddenly and is of less than 7 days (usually less than 48 hours) duration.

Negative Appendectomy- Performing an appendectomy for a grossly uninflamed appendix witnessed intra-operatively

Laparotomy- Surgical opening of the abdominal cavity.

4.8. Data collection procedures

The first step in data collection procedure was getting the charts of the selected sample patients from the record room. The charts was reviewed grossly and those with poor documentation and meeting the exclusion criteria were put aside.

A template in the form of table was initially prepared and used to extract the desired information of variables of interest. The questionnaires were given questionnaire number and data collected by the principal investigator. Questionnaires were checked for completeness and any incompletely filled questionnaire was rejected.

4.9. Data processing and analysis

Data was analyzed by using SPSS, version 20. Based on the study design, descriptive statistics of the various variables were computed as mean, mode, percentage and standard deviation and presented with histograms, bar and pie chart.

4.10. Ethical Considerations

Ethical clearance was requested from the department of public health prior to data collection. It was then approved by both the academic and research vice provost and medical vice provost. Finally, it was submitted to both general surgery department and record room.

5. RESULTS

Sociodemographic characteristics- From the total of 121 selected sample population ,46 (38%) was female and 75 (62%) was male. More than 80 percent of the sample population was either from Oromia or Addis Ababa, each accounting for 57 (47.1%) and 41 (33.9%), respectively. Most of the patients were married 49 (40.5%), followed by singles and minors, 32 (26.4%) and 30 (24.8%), respectively. Primary school 45 (37.2%) and secondary school 35 (28.9%) was the most common educational status of the sample population. Similarly, student 38 (31.4%) was the most frequent occupation followed by farmer 21 (17.4%). 28 (23.1%) of the sample were illiterate.

Table-1- Sociodemographic characteristics of the sample population

Variable	Frequency	Percentage (%)
Gender		
Male	75	62
Female	46	38
Region		
Oromia	57	47.1
Addis Ababa	41	33.9
Amhara	14	11.6
SNNPR	4	3.3
Other	5	4.1
Educational Status		
Illiterate	28	23.1
Pre-school	5	4.1
Primary School	45	37.2
Secondary School	35	28.9
Graduate	8	6.6
Marital status		
Minor	30	24.8
Single	32	26.4
Married	49	40.5
Divorced	5	4.1
Widowed	5	4.1
Occupation		
House wife	9	7.4
Student	38	31.4
Farmer	21	17.4
Government employee	13	10.7
Merchant	14	11.6
Private sector	9	7.4
Other	17	14

The mean age of operated patient among the sample population was 28.04 with a standard deviation of 15.7. The age range of sample population was 67 ranging from 6 to 73. The most commonly affected age range were (6-10) and (11-15) each accounting for 16(13.2%) of operated cases

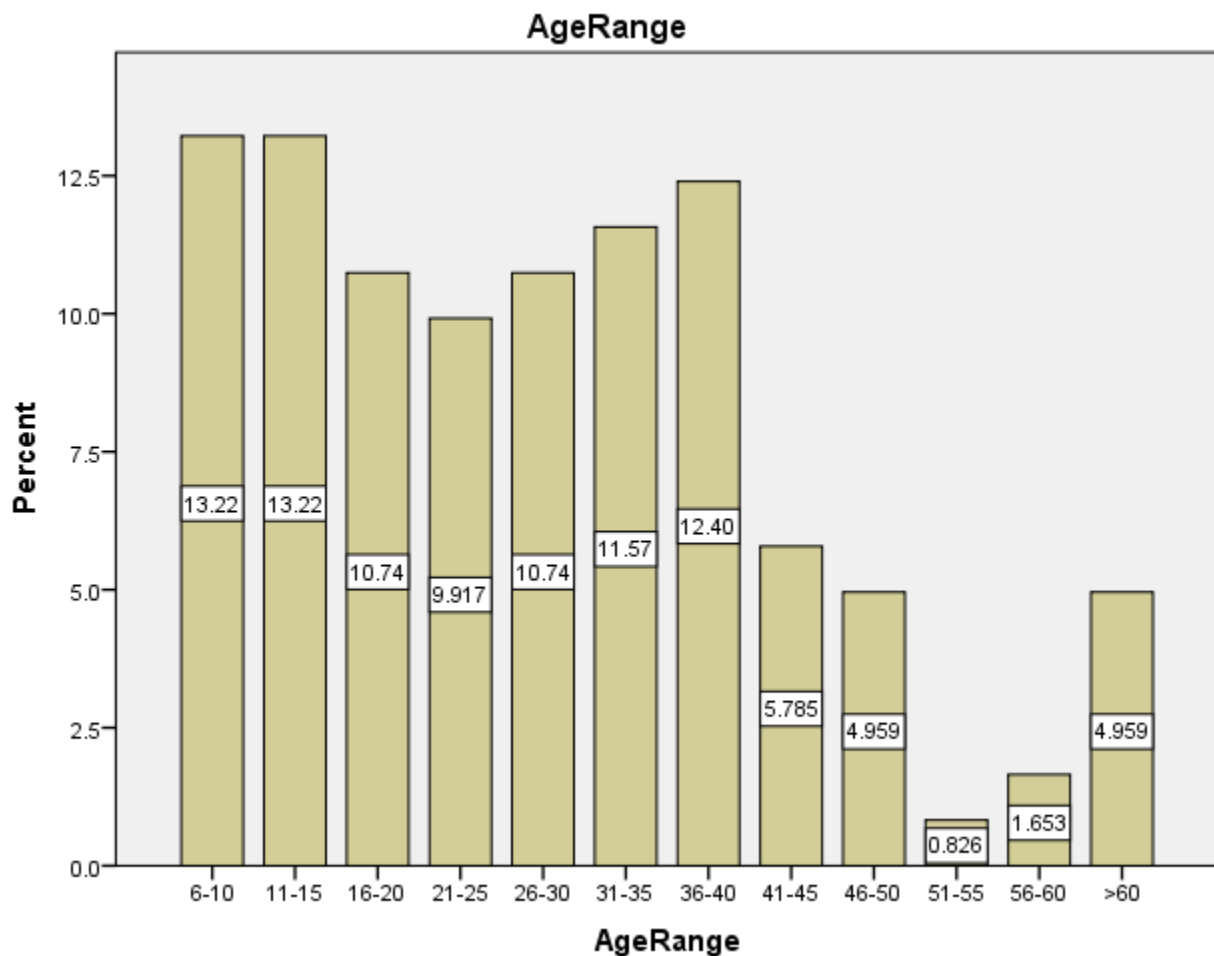


Figure-1- Ages of the study population in range

Acute appendicitis was the most common final clinical diagnosis accounting for 82 (67.8%) of cases. These cases of appendicitis include simple inflamed appendix, gangrenous appendix and perforated appendix. The second commonest cause for emergent laparotomy in the study was colonic obstruction 13 (10.7%), followed by perforated viscus 11 (9.1%). Less commoner diagnosis for acute abdomen were small bowel obstruction 6 (5%), obstructed hernia 6 (5%) and acute cholecystitis 3 (2.5%).

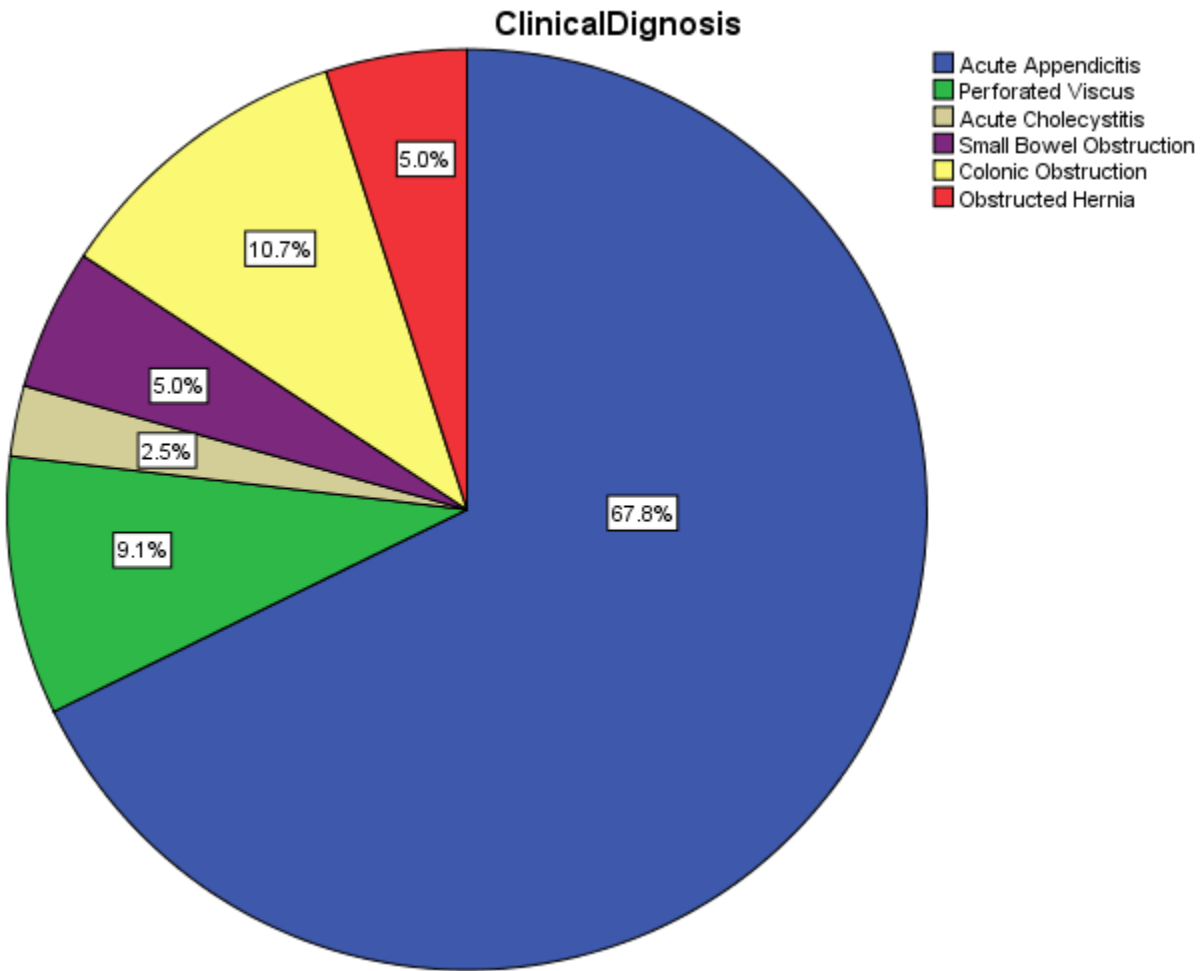


Figure-2- Clinical diagnosis of the study population

Signs and Symptoms

Abdominal pain was elicited to be the most common symptom virtually present in all 121 patients, followed by vomiting 96 (79.3%), nausea 68 (56.2%) and anorexia 66 (54.5%). Less common complaints among patients presenting with acute abdomen were subjective fever 39 (32.2%), abdominal distention 18 (14.9%), obstipation 14 (11.6%), urinary symptoms and diarrhea 10 (8.3%) each. Vomiting 68 (82.9%) was most commonly demonstrated in acute appendicitis were as abdominal distention was most commonly reported in colonic obstruction.

The most commonly elicited clinical sign was abdominal tenderness 117 (96.7%) followed by fever 65 (53.7%) and tachycardia 61 (50.4%). Positive signs of fluid collection were the least commonly demonstrated physical signs 10 (8.3%).

The trend in Acute Appendicitis

Among the cases of appendicitis, 54 (65.9%) were males while 28 (34.1%) were females. The mean age of patients who underwent laparotomy for clinical appendicitis was 22.3 yrs with a standard deviation of 12.3 yrs. The most commonly affected age range was (5-10) and (10-15) accounting for 36.6% of appendectomies. The mean duration of abdominal pain was 12.6 hrs with a standard deviation of 5.9 hrs. The mean duration of preoperative stay 6.9 hrs with a standard deviation of 5.2 hrs. Abdominal pain was the most commonly reported complaint in acute appendicitis occurring in virtually all patients 82 (100%) followed by vomiting 68 (82.9%), nausea 56 (68.3%) and anorexia 54 (65.9%). Diarrhea was the least commonly reported complaint in acute appendicitis 7 (8.5%).

Abdominal tenderness, fever and tachycardia was the most common objective findings in acute appendicitis occurring in 82 (100%), 56 (68.3%) and 38 (46.3%) respectively.

Physical findings suggestive of appendicitis such as Rovsing, Obturator and Psoas sign was also watched and subsequently Rovsing sign was found to be the most commonly encountered finding 45 (54.9%).

Table-2- Prevalence of the appendicitis specific clinical signs in the sample population

Clinical Sign	Positive	Negative
Rovsing	45 (54.9%)	37 (45.1%)
Psoas	15 (18.3%)	67 (81.7%)
Obturator	14 (17.1%)	68 (82.9%)

Investigations

CBC was requested in all 121 cases of the study and a total of 73 (60.3%) had a raised TLC of which 70 (95.9%) had consistent clinical diagnosis. Urinalysis was requested in 104 (86%) of the

cases and majority of them, 93 (76.9%) had a normal urinalysis. Leukouria was evident in 9 (7.4%) and 2 (1.7%) had ketonuria.

Abdominal ultrasound was requested in 102 (84.3%) of the cases and 95 (93.1%) of the sonographic conclusions were in line with the actual intraoperative findings.

Radiography was requested in 30 (24.8%) of the cases and 24 (80%) of these had a reading consistent with the intra-operative finding. Inconsistent and inconclusive readings account for 3 (10%) cases each.

Abdominal CT-scan was requested in 7 (5.8%) of the cases and all of them had a reading in line the actual intraoperative findings.

Magnitude of Misdiagnosis

Among the 121 patients who underwent emergent laparotomy, 8 (6.6%) had inconsistent intraoperative findings as compared to clinical diagnosis. Acute appendicitis was the most commonly misdiagnosed case 50%(N.B, but not with the most inaccurate clinical diagnosis), followed by perforated viscus 25%, obstructed hernia and small bowel obstruction 12.5% each.

The Rate of negative appendectomy in this study was 4.9% (4 out of 82).

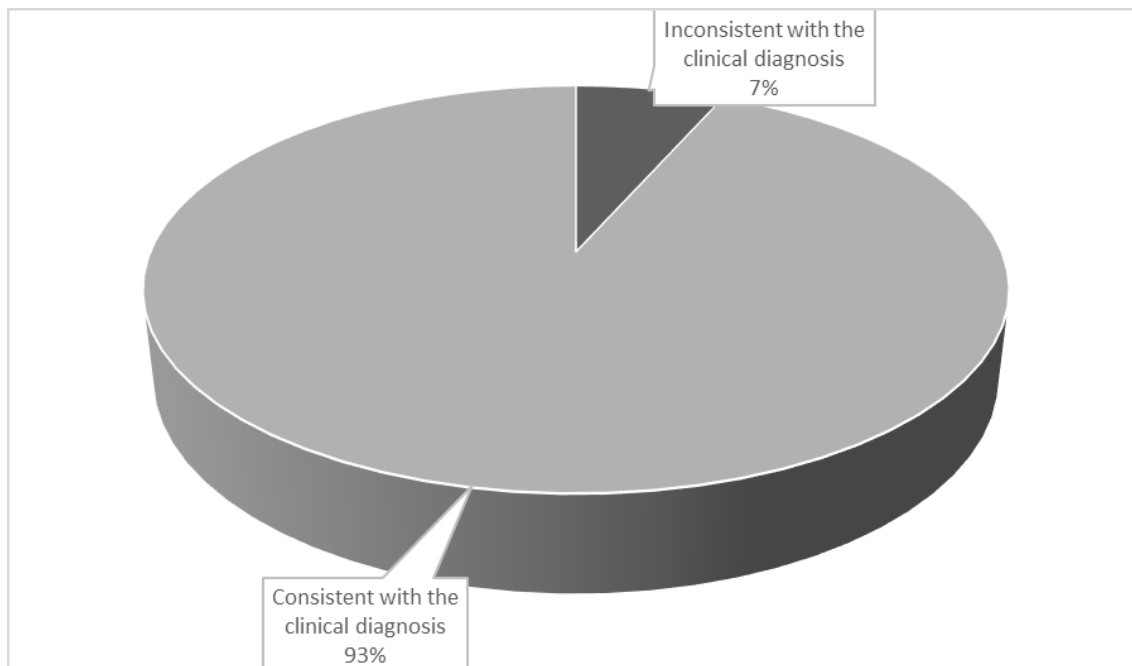


Figure-3- Prevalence of Misdiagnosis in the study population

Diagnostic accuracy of clinical assessment

The overall diagnostic accuracy of clinical diagnosis was 93.4% with the highest accuracy observed in colonic obstruction 100% followed by acute appendicitis 95.1%, small bowel obstruction and obstructed hernia both 83.3%. The least accurate pre-operative clinical diagnosis was noted in cases of perforated viscus 81.8%.

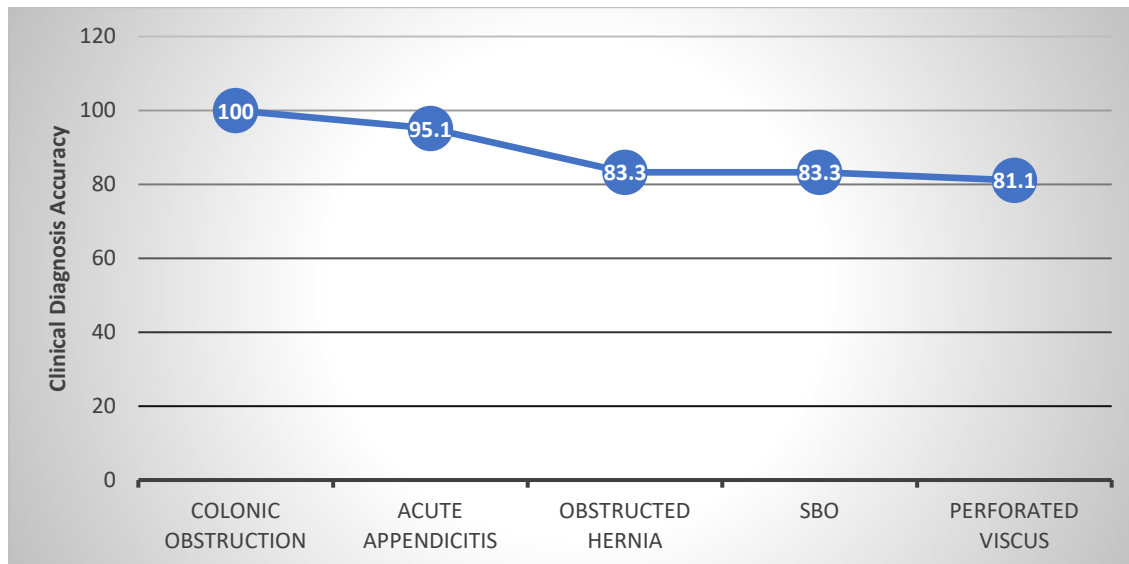


Figure-4 Diagnostic accuracy in common causes of acute abdomen

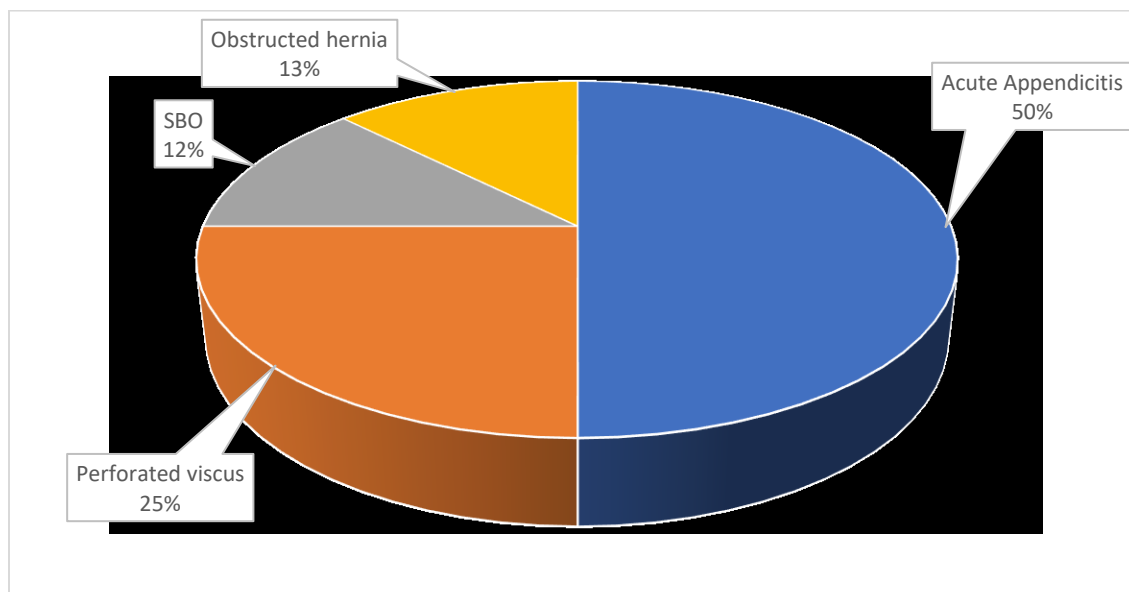


Figure-5- Clinical diagnosis of the Misdiagnosed cases among the study population

Pattern of Misdiagnosis

The over whelming majority of the misdiagnosed cases were females 87.5%, while males contributed for the minute 12.5%. To the contrary, among the cases with consistent intraoperative findings, 74 (65.5%) were males while females account for only 39 (34.5%).

The mean age of misdiagnosed cases was 40.3 with a standard deviation of 17. The range was 48 ranging from 22 to 70.

The mean duration of abdominal pain in the misdiagnosed cases was 15.3 hrs with a standard deviation of 10.3 hrs. The range was 32 hours ranging from 4 to 36 hrs.

The duration of preoperative stay in the misdiagnosed cases was 4.37 hrs with a standard deviation of 1.8 hrs. The range was 4 hrs ranging from 3 to 7 hrs.

In contrast to the accurate cases, the misdiagnosed cases tend to be older females presenting with comparable duration of abdominal pain and shorter duration of preoperative stay.

Table-3- Sociodemographic characteristics of the misdiagnosed cases

Variable	Mean	SD	Range	Min	Max
Age (M)	40.3	17	48	22	70
Age (A)	27.2	15.3	67	6	73
Duration (M)	15.3	10.3	32	4	36
Duration (A)	15.05	11.1	70	2	72
Stay (M)	4.37	1.8	4	3	7
Stay (A)	7.24	7.1	45	3	48

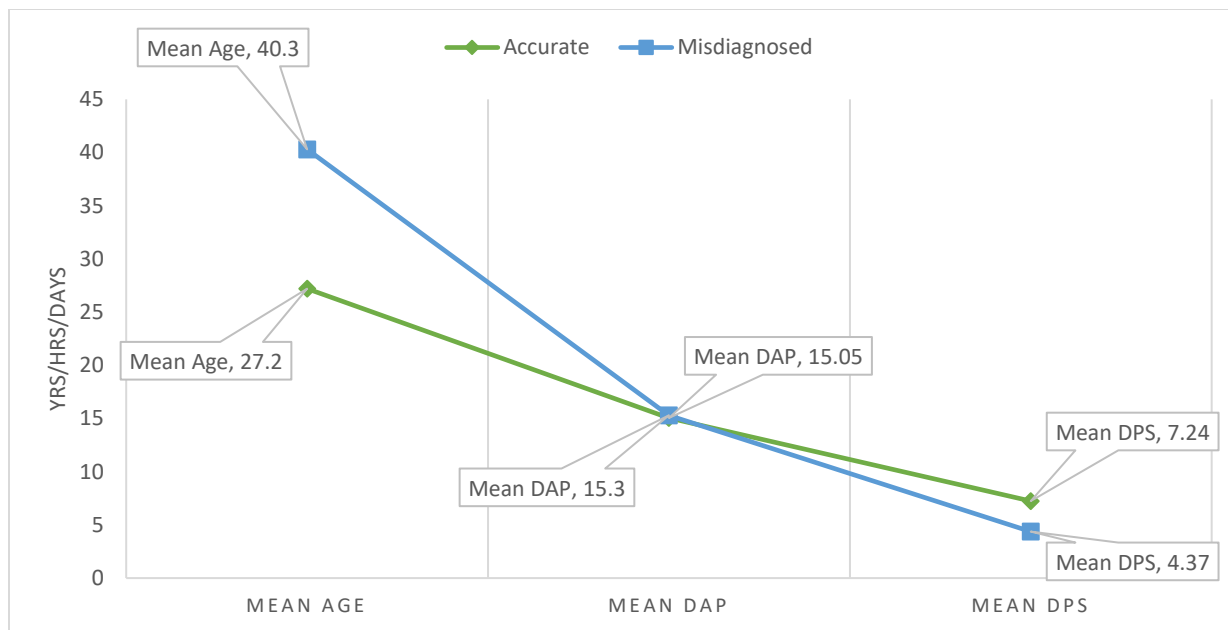


Figure 6- Comparison of the accurate and misdiagnosed cases among the study population

Out of the eight misdiagnosed cases Four of them were negative appendectomies, two had gynecologic cause of acute abdomen and the rest two had no identifiable cause. All of them had abdominal ultrasound and Only 3 (37.5%) had consistent index with IOF. Abdominal radiography was requested in 3 of the 8 cases and all had inconclusive reading.

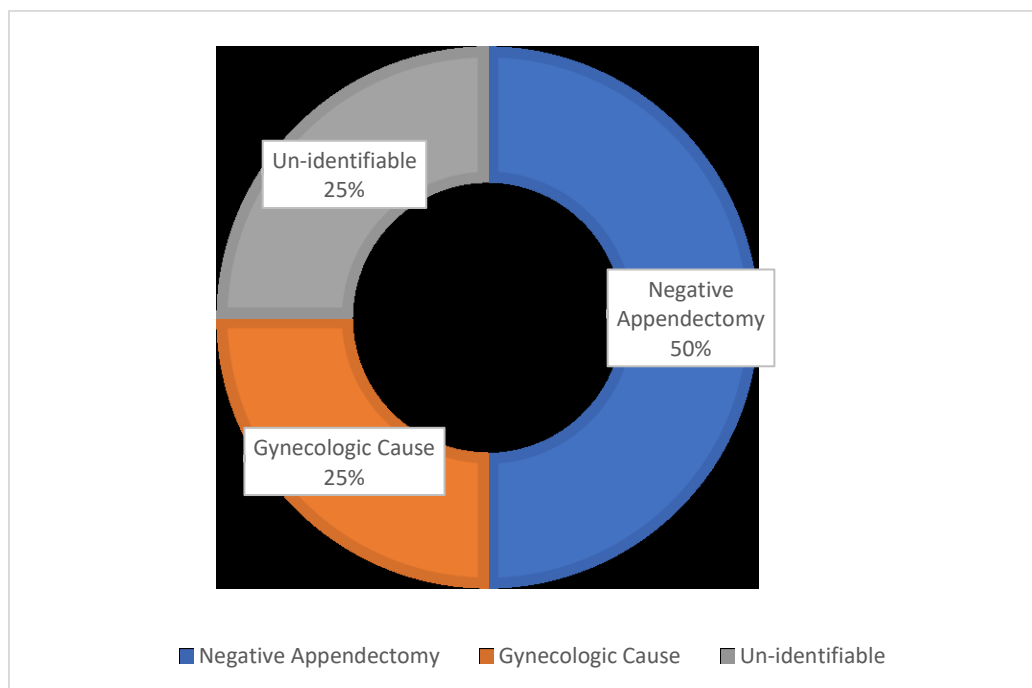


Figure 7- IOF of the misdiagnosed cases in the study population

6. DISCUSSION

Acute appendicitis was the most common cause of non-traumatic emergency laparotomy (67.8%) followed by colonic obstruction (10.7%) which is similar to the studies done in BLH and Nekemt, Ethiopia but is in contrast to the one in Gondar University and Yirgalem hospital, which found intestinal obstruction to be the leading cause of acute abdomen. (27,28,29,30)

The mean age of the sample population was 28.04 years which appears to be comparable to Tsehay et. al, the same research done in Gondar University. However, the most commonly affected age group in this study was from 5-10 and 11-15 which is younger than the other reported Ethiopian studies. This could be due to the difference in disease epidemiology and pattern in different parts of the study. (28)

The prevalence of misdiagnosis in this study was 6.61% which is comparable to that of the reported case in India, 8.2%. (13)

The rate of negative appendectomy in this study was 4.9%, which is significantly lower than that of the reported cases in Nigeria, 16%, England, 22% and USA, 15% which compared clinical diagnosis with histopathology reports. This could be due to the fact that this study used gross inspection of the IOF as an ultimate diagnostic method which is less accurate and more prone to subjective bias as compared to histopathology. (29,30,31)

Similar to ayenew et al, a study done in Nekemt, Ethiopia, Males were more commonly affected by acute abdomen than females with a ratio of 1.6:1. This could be explained by the flatus theory which states that males generally spend their time in outdoor activities which restricts them from freely passing feces and flatus for a long time and bulky feeding habit per cycle of meal of males. The opposite is true for females. (27)

Even though appendicitis is more common in males, it is more likely to be misdiagnosed in females. This could be due to the fact that some gynecologic conditions as ectopic pregnancies, adnexal torsion and ruptured ovarian cysts presents with acute abdominal pain and get confused with abdominal causes of acute abdomen. (31)

7. CONCLUSION

In this study, it is noted that appendicitis is most common non-traumatic cause of emergency laparotomy. Females are by far more likely to be misdiagnosed in acute abdomen than males. Abdominal pain, vomiting and fever was the most common triad of symptoms among the patients presenting with acute abdomen. The magnitude of misdiagnosis in this study was comparable with other studies and the rate of negative appendectomy is within the acceptable range of “error”. Perforated viscus was the most likely case to be misdiagnosed and colonic obstruction is the least likely to be misdiagnosed. Among the misdiagnosed cases, radiologic studies offered minimal advantage as they were either inconclusive or inconsistent. Thus, in acute abdomen clinical judgment is the key to diagnosis and investigations are only supplementary and cannot replace clinical decision.

8. LIMITATION OF THE STUDY

- The fact that the study design is retrospective study
- Poor chart keeping
- Difficulty in proceeding into association analysis and conclusion as the number of misdiagnosed cases found was too small.

9. RECOMMENDATIONS

- Health professionals, especially those on the front line in the emergency OPD encountering newly coming acute abdomen cases should strive to maintain the currently observed low magnitude of clinical misdiagnosis in acute abdomen cases
- Considering overwhelming majority of misdiagnosed cases were females, emergency physicians need to keep a vigilant eye upon females presenting with acute abdomen.
- Operating surgeons need to adopt the habit of requesting histopathology of the appendix following appendectomy as it will settle the diagnosis more accurately and reflect a realistic negative appendectomy rate.
- Based on my observation, the chart keeping clarity and proper documentation is suboptimal which poses a significant challenge not only for a retrospective study as of mine but also in the outpatient follow-up of these patients in the OPD. Thus, any member of the managing team need to write an eligible, easy to understand and coherent notes on the order and progress sheets.

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ANNEXES

Questionnaire ID		
1. Gender		
☐ Male ☐ Female		
2. Age		
3. Region		
☐ Oromia ☐ Addis Ababa ☐ Amhara ☐ SNNPR ☐ Tigray ☐ Other		
4. Marital status		
☐ Minor ☐ Single ☐ Married ☐ Divorced ☐ Widowed		
5. Occupation		
☐ House wife ☐ Farmer ☐ Government Employee ☐ Merchant ☐ Private Sector ☐ Student ☐ Other		
6. Educational Status		
☐ Pre-school age ☐ Illiterate ☐ Primary School ☐ Secondary School ☐ Graduate		
7. Symptoms		
☐ Nausea ☐ Vomiting ☐ Anorexia ☐ Abdominal pain	☐ Urinary symptoms ☐ Diarrhea ☐ Distention ☐ Obstipation	
8. Duration of Abdominal pain		
9. Signs		
☐ Fever ☐ Tachycardia ☐ Hypo/Hypertension ☐ Abdominal tenderness ☐ Guarding	☐ Rovsing sign ☐ Obturator sign ☐ Murphy' sign ☐ CVAT ☐ DRE- stool on examining finger	

10. Clinical Diagnosis	
i. Acute appendicitis ii. Perforated viscus iii. Acute cholecystitis iv. Small bowel obstruction v. Colonic obstruction vi. Pancreatitis vii. Cholecysto-/cholelithiasis viii. Acute diverticulitis ix. Small bowel ischemia x. Incarcerated hernia xi. Colonic disease (e.g. carcinoma) xii. Urologic disease (e.g. nephrolithiasis) xiii. Other.....	
11. Laboratory studies	
➤ CBC	▪ Leukocytosis ▪ Neutrophilia ▪ Anemia ▪ Other.....
➤ Urinalysis	▪ Leukouria ▪ Ketonuria ▪ Other.....
➤ LFT	▪ Normal ▪ Abnormal
➤ RFT	▪ Normal ▪ Abnormal
➤ Stool Analysis	▪ Normal ▪ Abnormal ▪ Other.....
12. Abdominal X-ray	▪ Reading consistent with the IOF ▪ Reading inconsistent with the IOF
13. Abdominal Ultrasound	▪ Index consistent with the IOF ▪ Index inconsistent with the IOF
14. CT/MRI/DL (if any)	▪ Conclusion consistent with the IOF ▪ Conclusion inconsistent with the IOF
15. Duration of pre-operative stay (Hrs)	
16. Intra-operative findings	

