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(RESEARCH ARTICLE)

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Correlating clinical diagnosis with intra-operative findings in emergency exploratory laparotomies for acute abdomen in limited-resource settings: Our experience

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Abstract

Acute abdomen is a clinical condition that demands urgent attention and treatment to prevent morbidity and mortality. It may be caused by both intra-abdominal and extra-abdominal pathologies. It often produces diagnostic dilemma even for the experienced surgeon and more so in limited-resource settings. The purpose of this study is to review the indications for emergency laparotomy and correlate clinical provisional diagnosis with intra-operative findings in limited-resource settings. Medical records of 78 patients who had emergency exploratory laparotomy for acute abdomen between 2010 and 2014 were retrieved and analyzed. Acute abdomen was most common in males (64.1%). The predominant age group was 21-30 years (26.9%). Only one patient (1.3%) presented within 24 hours while majority (62%) presented within 4 days to two weeks. Plain abdominal X-rays were done for only 38 (48.7%) patients. Abdominal USS was done for just 18 (23.1%). The commonest pre-operative diagnosis was peritonitis secondary to bowel perforation (30.8%) and the commonest intra-operative finding was peritonitis secondary to ileal perforations (n=23, 29.5%). There was a statistically significant association between pre-operative diagnosis and intra-operative findings. Frequency of correct diagnosis is 59 (75.64%) and incorrect 19 (24.36%). P-value was 0.002, and the likelihood ratio's p-value was 0.001. Strengthening the teaching of basic clinical skills of history taking and bedside examination should be a priority in our medical schools both at undergraduate and postgraduate levels.

Keywords: Pre-operative; Intra-operative; Exploratory laparotomy; Acute abdomen; Limited-resources; Peritonitis; ileal perforation; Abdominal emergencies

1. Introduction

The term "Acute Abdomen" is a condition that demands urgent attention and treatment. Acute abdomen may be caused by an infection, inflammation, vascular occlusion or obstruction (1). Other causes of an acute abdomen will include trauma, viscus perforation or rupture of certain intra-abdominal organs like liver in primary liver cell carcinoma, spleen or aortic aneurysm. This complexity is even made more difficult for the Surgeon as many of the causes of acute abdomen may be of medical, gynaecological or referred pain.

An acute onset of abdominal pain lasting more than 6 hours will most probably require a surgical intervention to sort out the patient.

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The correct interpretation of abdominal pain is therefore one of the most challenging demands to any surgeon. Since proper therapy often requires urgent action, the luxury of the leisurely approach suitable for the study of other conditions is frequently denied (2).

The proper management of an acute abdominal pain will be to take an adequate history, physical examination combined with imaging and laboratory findings to make an urgent provisional working diagnosis and determine who will require urgent surgical intervention to minimize morbidity and mortality.

Unlike what was obtainable in the 70s and early 80s, the availability of imaging modalities like Ultrasound (USS), Computed Tomography Scan (CT scan), Digital X-rays and automated laboratory systems have revolutionized the early diagnosis and treatment of patients with acute abdominal conditions. This has also reduced the incidence of negative laparotomies with its associated morbidity and mortality.

The situation in many sub-Saharan African countries and communities is completely different. Majority of the hospitals serving the greater part of the populations are located in the rural areas where most of these populations reside. There exist the problems of poor access roads, absence or poor public power supply, inadequate healthcare experts (who prefer to live in urban or sub-urban areas), absence of basic imaging facilities (e.g. ultrasound and X-ray), and functional laboratory services. In Malawi for instance "arriving at a rural health center, you quickly realize that basic imaging services, such as X-rays or Ultrasound Scanners, are out of reach" [3]. Only four radiological consultants are serving a country with a population exceeding 18 million and the entire nation has access to only three CT Scanners and a single MRI machine (3). In Cameroon with a population of over 24 million, most imaging centers are located in Douala and Yaoundé, the two major cities. Most imaging centers have only conventional x-rays and/or ultrasound machines with only 1 radiologist per 500,000 and 1 radiation oncologist per 5 million people (5). The above two illustrations are a true reflection of the situation in many resource- limited countries of sub-Saharan Africa.

According to the International Fund for Agricultural Development (IFAD), 53% of the population of Nigeria live in the rural areas (6).

Many of the healthcare workers may not have the luxury of imaging modalities or functional laboratory services and would depend more on their clinical acumen to provisionally diagnose acute abdomen and take a decision for urgent surgical intervention. In some rare situations where these basic imaging and Laboratory facilities are available in the rural areas, their usage is hampered by lack of technical support or constant electricity supply.

In the face of these challenges, medical curricula in sub-Saharan Africa must be tailored towards our peculiar unavoidable situations.

A case is therefore made for tailoring our clinical trainings or re-enforcing clinical skills of history taking and painstakingly careful physical examination to improve the accuracy of clinical diagnosis.

2. Material and methods

This was a 5-year retrospective study undertaken at Federal Medical Center Makurdi, North-Central Nigeria, between 2010 and 2014. It involved the retrieval and review of the medical records of all patients who had emergency exploratory laparotomy for acute abdomen admitted through the accident and emergency unit of the hospital or referral from wards of the hospital of patients who suddenly developed abdominal pain of surgical significance.

2.1. Statistical Analysis

For the analysis of these results, we deployed Descriptive Statistics (mean, standard deviation, frequency, and Percentage) to report the demographic characteristics of sampled population using Microsoft Excel and SPSS version 26, while a Chi-Square test of independence, Crammers V test was applied to examine the association between clinical working diagnosis and intraoperative findings and the strength of the association respectively. P value <0.05 was considered as the level of significance.

3. Results

A total of 78 patients who underwent emergency exploratory laparotomy for a preoperative provisional diagnosis of acute abdomen over the study period were analysed. Acute abdomen was most common in males (n=50, 64.1%) and females (n=28, 35.9%).

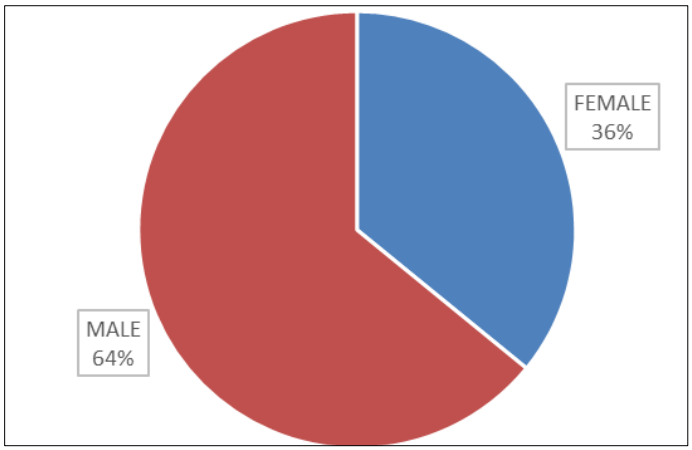

Figure 1 Gender distribution

The predominant age groups were 21-30 years (n=21, 26.9%), 11-20 years (n=14, 17.9% and 1-10 years (n=13, 16.7%).

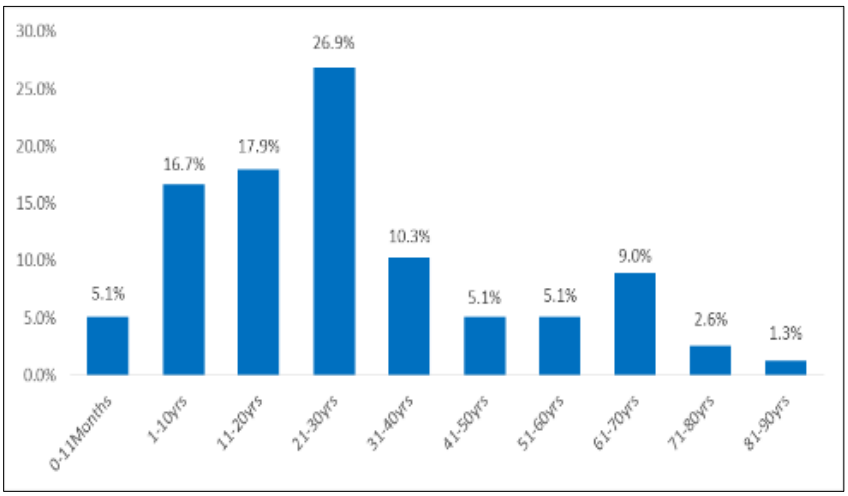

Figure 2 Age distribution

Majority of the patients were students (n=36, 51%), farmers (n=17, 24.3%).

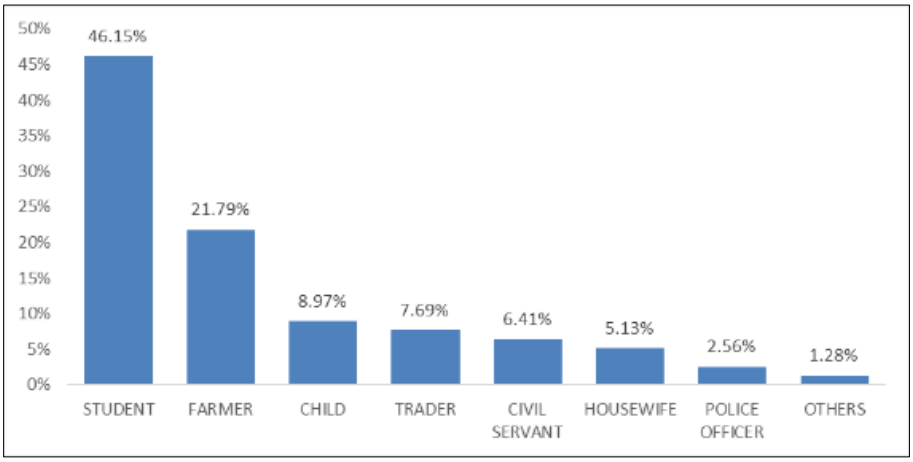

Figure 3 Occupational Distribution

As per residence, majority of the patients (n=30, 38.5%) were from Makurdi and 7(9.0%) were from Gboko, two urban centres.

Table 1 Residential Distribution

Residence	Frequency	Percent
AGATU	2	2.56%
APA	1	1.28%
BURUKU	1	1.28%
GBOKO	7	8.97%
GUMA	6	7.69%
GWER	1	1.28%
GWER WEST	2	2.56%
K/ALA	1	1.28%
KONSHISHA	5	6.41%
KWANDE	3	3.85%
MAKURDI	30	38.46%
OBI	2	2.56%
OGBADIBO	3	3.85%
OJU	2	2.56%
OKPOKWU	3	3.85%
OTUKPO	3	3.85%
TARKA	1	1.28%
UKUM	1	1.28%
USHONGO	1	1.28%
VANDEIKYA	3	3.85%
Total	78	100

The commonest presenting complaints were abdominal pain (n=69, 31.1%), abdominal swelling (n=46, 20.7%), vomiting (n=38, 17.1%), constipation (n=25, 11.3%) and fever (n=26, 11.7%).

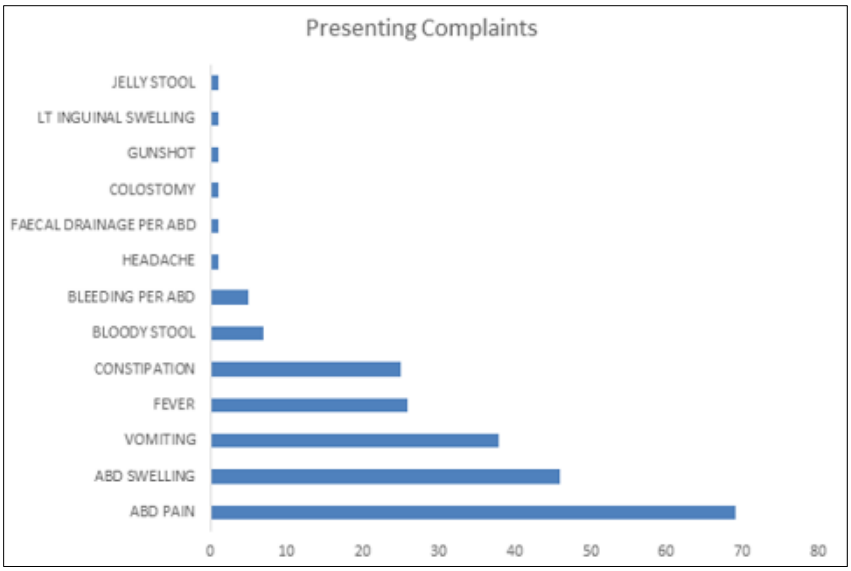

Figure 4 Frequency of complaints presented:

As per duration of symptoms or complaints, it was observed that only 1(1.3%) presented within 24 hours while majority of the patients presented within 4 days to 2 weeks(n=49,62%).

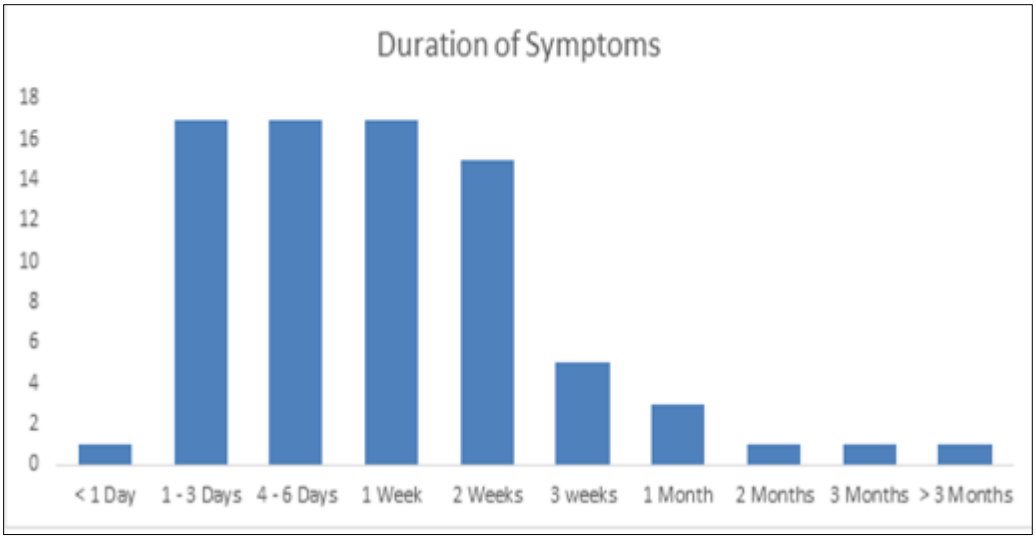

Figure 5 Duration of Symptoms

Analysis of the signs shows that 71(91.0%) presented with abdominal distension. Similarly, only 8(10.3%) had evidence of blunt or penetrating abdominal trauma and all the 8 had haemoperitoneum or ascites.

Table 2 Physical Signs

Signs	Response	N	Percent (%)
Abdominal Distension			
	Yes	71	91.0
	No	7	9.0
		78	100.0
Evidence of blunt or penetrating abdominal trauma			

	Yes	8	10.3
	No	70	89.7
		78	100.0
Haemoperitoneum or Ascites.			
	Yes	8	10.3
	No	70	89.7
		78	100.0

Plain abdominal X-rays was done for only 38(48.7%) patients with the most consistent findings being air-fluid levels 29(76.3%) and bowel distension 29(76.3%) while air under the diaphragm was noticed in 13(34.2%).

Table 3 Plain abdominal X-ray findings

Abdominal X-ray	**Response**	**N**	**Percent (%)**
Air Under Diaphragm			
	Yes	13	34.2
	No	25	65.8
		38	100.0
Air Fluid Level			
	Yes	29	76.3
	No	9	23.7
		38	100.0
Bowel Distention			
	Yes	29	76.3
	No	9	23.7
		38	100.0

Abdominal ultrasound (USS) was done for just 18(23.1%) of which haemoperitoneum was noticed in 1(5.6%) but there was no solid organ injury.

Table 4 Abdominal USS findings

Abdominal USS	**Response**	**N**	**Percent (%)**
Haemoperitonium			
	Yes	1	5.6
	No	17	94.4
		18	100.0
Solid Organ Injuries			
	Yes	0	0.0
	No	18	100.0
		18	100.0

The various pre-operative provisional diagnosis and Intra-operative findings are presented below.

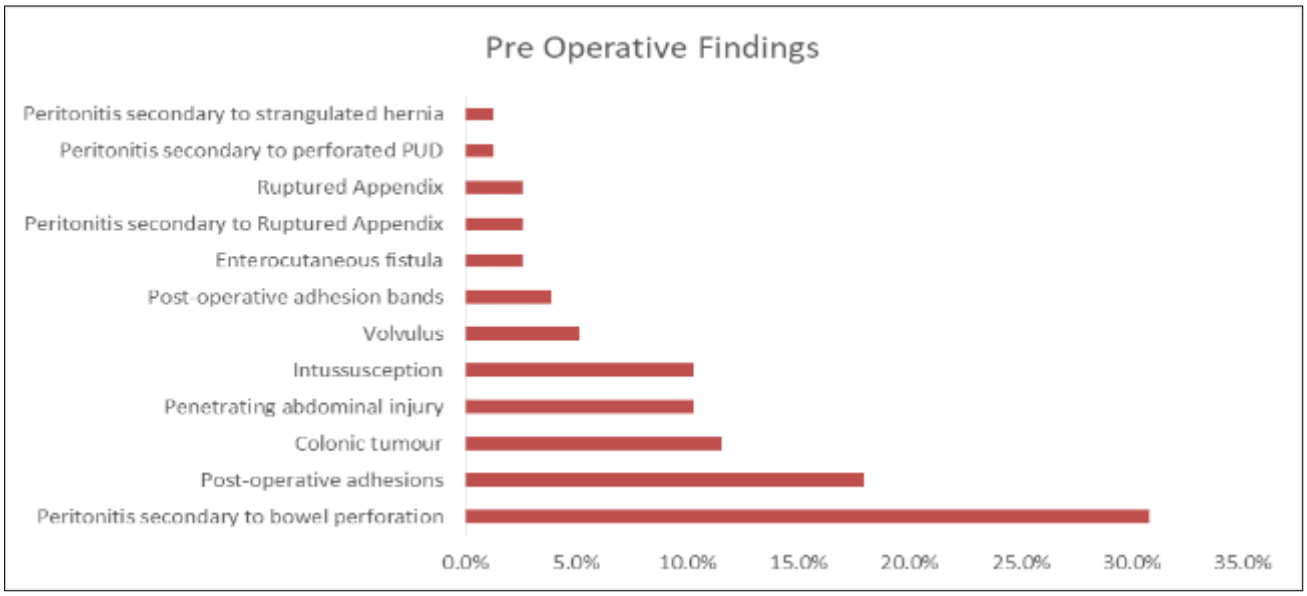

Figure 6 Pre- Operative Findings

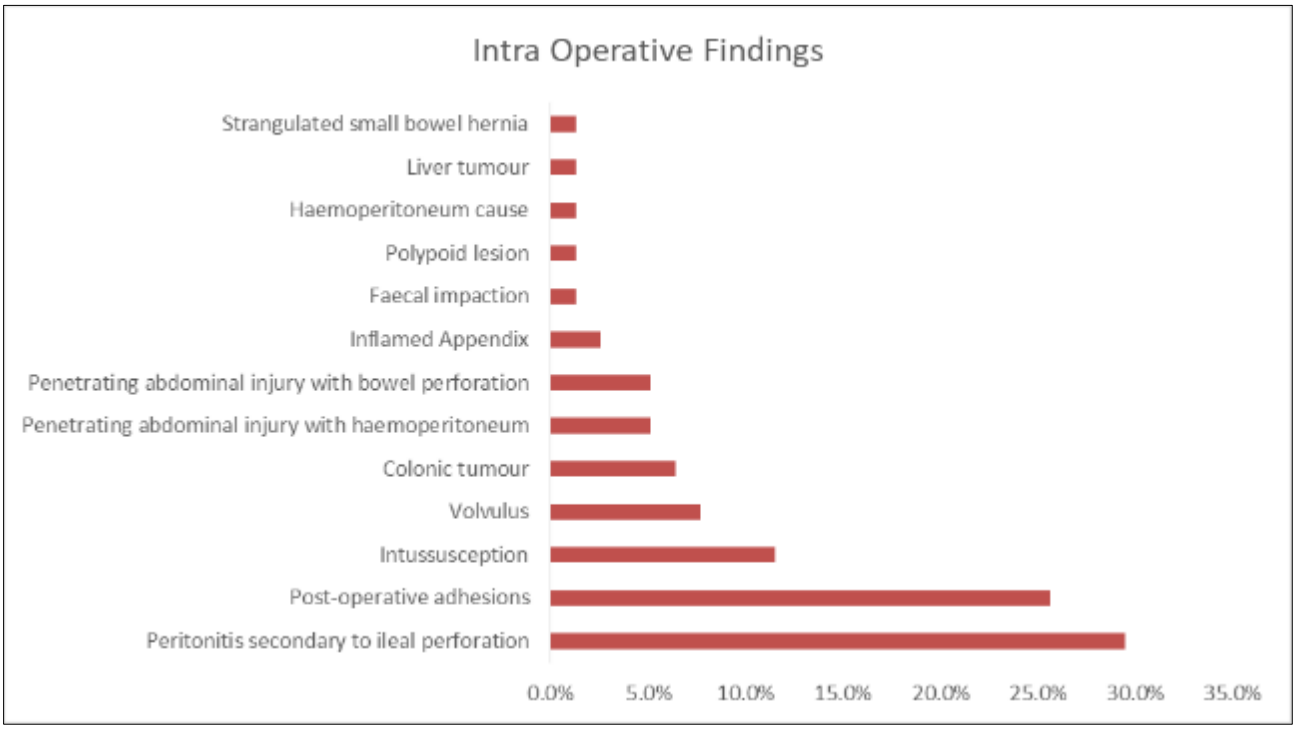

Figure 7 Intra-Operative findings

4. Discussions

Acute abdomen is the most commonly attended surgical emergency. It can be caused by intra-abdominal, extra-abdominal or metabolic causes (7). In some instances, the causes may be of gynaecological origin. Most cases of acute abdomen will require urgent surgical intervention as a definitive means of treatment to reduce morbidity and mortality. The proper management of patients with acute abdominal pain requires a timely decision about the need for surgical operation (2). This decision requires evaluation of the patient's history and physical findings, laboratory data and imaging tests (2). Time is of essence and it's the surgeon racing against time. The availability of imaging facilities like Computed Tomography Scan, Ultrasound and plain abdominal x-rays have revolutionized and improved the accuracy

of diagnosis of acute abdomen and subsequent surgical intervention to reduce morbidity and mortality. These imaging modalities have also reduced negative laparotomy rates in the management of acute abdomen.

In many resource-limited countries of sub-Saharan Africa, these basic imaging facilities are not available especially in the rural areas where most of the populations reside. However, these rural communities are being confronted with the same cases of acute abdomen requiring urgent diagnosis and surgical intervention. Correct pre-operative diagnosis of acute abdomen with limited resources is very crucial to minimize morbidity and mortality in developing countries like ours, where the facilities of diagnosis are limited and not economical, the clinical skills play a pivotal role in the diagnosis and management of acute abdomen (8). A case is therefore made that, in training Doctors in resource-limited countries, strong emphasis must be placed on basic clinical skills of history taking and physical examination. Clinical judgement is key to diagnosis of acute abdomen and with radiological and blood investigations only aiding in its management and cannot replace the clinical decision (1).

Our study was conducted over a period of 5 years from 2010-2014 at the Federal Medical Centre Makurdi, the capital city of Benue state in North-Central, Nigeria. A total of 78 patients were analysed.

The predominantly affected age group was 21-30 years (n=21, 26.9%), mean 25.5 years. This finding conforms to other studies [10, 4], and reflects the predominantly younger population of Nigeria and most developing countries.

There was a male predominance (n=50, 64.1%) and females were (n=28, 35.9%). These findings also agree with those of other studies (10, 2, 12, 14, and 4).

As per symptoms, the commonest presenting symptoms were abdominal pain (n=69, 31%), abdominal swelling (n=46, 20.7%) vomiting, (n=38, 17.1%), fever (n=26, 11.7%) and constipation (n=25, 11.3%). These findings also agree with those of (15).

The major signs were abdominal distension (n=71, 91.0%), haemoperitoneum/ascites (n=8, 10.3%), and evidence of blunt or penetrating abdominal trauma (n=8, 10.3%)

Plain abdominal X-rays was done for only 38(48.7%) and the consistent x-ray findings were air-fluid levels (n=29, 76.3%), bowel distension (n=29, 76.3%) and air under the diaphragm (n=13, 34.25). Diagnostic utility of x-rays is more in hollow viscus perforation and intestinal obstruction [9]. The above findings correlate with those of [16].

Abdominal ultrasound was done for just 18(23.1%) of the patients. Abdominal ultrasound was only able to detect haemoperitoneum in 1(5.6%) of patients. X-ray abdomen and ultrasound abdomen have limitations and are diagnostic only in handful cases of acute abdomen caused by intestinal obstruction (16).

The above findings demonstrate a low utilization of basic imaging facilities like plain x-ray of the abdomen and ultrasound in the management of acute abdomen in a tertiary hospital within an urban setting further re-enforcing the need for reliance on clinical skills in limited-resource settings. Furthermore, even where these basic imaging facilities are available, there exist the problems of constant electricity supply or absence of radiologists and Radiographers as in (17).

We observed that only 1(1.3%) patient presented within 24 hours of onset of abdominal pain while majority of the patients (n=49, 62%) presented within 4 days to two weeks. This highlights the late presentation of diseases in Africa which will ultimately increase morbidity and mortality. This late presentation may be due to ignorance, preference for herbs, delay at primary health care centres or inaccessibility of urban areas where most tertiary hospitals are located.

The commonest pre-operative provisional working diagnosis was peritonitis secondary to bowel perforation (n=24, 30.8%), followed by Intestinal obstruction (IO) secondary to post-operative adhesions (n=14, 17.9%).

The commonest intra-operative finding was peritonitis secondary to ileal perforation possibly from typhoid enteritis causing small bowel obstruction (n=23, 29.5%), followed by post-operative adhesions (n=20, 25.6%). These findings also correlate with similar findings by (11, 12), who also found that the commonest intra-operative finding in emergency laparotomy in acute abdomen was peritonitis secondary to bowel perforation. Similarly, other studies (2, 19) had all reported bowel perforation as the second cause of acute abdomen inclusive of acute appendicitis.

While Amone et al; (11), Chhetri and Shrestha, (13) had reported negative laparotomy rates of 8% and 17.6% respectively, negative laparotomy rate was nil in our study which also correlates with the findings of Kumar et al ; (4). In essence, all patients diagnosed clinically with acute abdomen had positive findings at exploration.

Correlating pre-operative provisional diagnosis with intra-operative findings, we observed that in 59(75.64%) patients the diagnosis was correct while in 19(24.36%) patients, it was incorrect. Other researchers have demonstrated a compatibility of intra-operative diagnosis with pre-operative provisional clinical diagnosis to be USS (89%), CT scanner (81%) and Clinical diagnosis (59%) in non-traumatic acute abdomen (17). Similarly, (9) had demonstrated that clinical diagnosis was concordance with intra-operative findings in 84% of the cases and discordant in 16%.

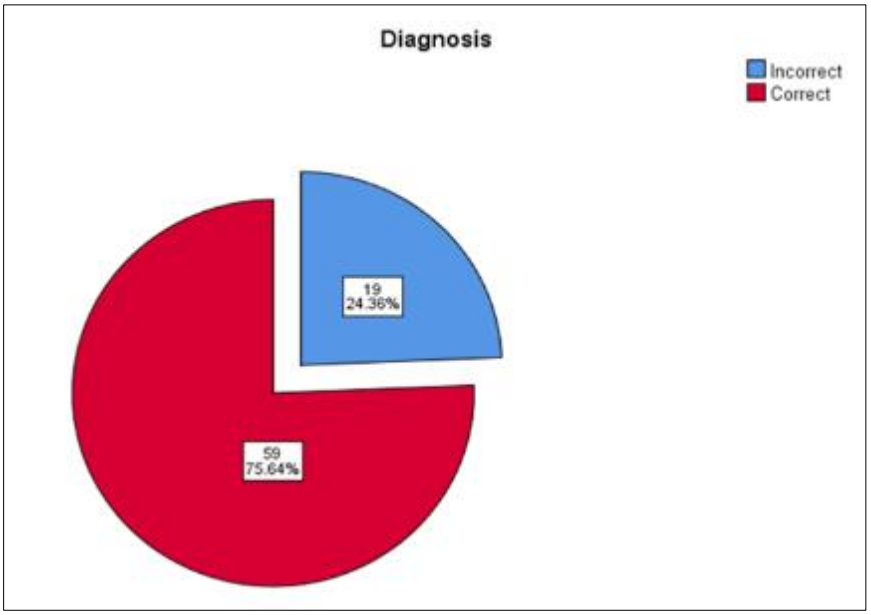

Figure 8 Clinical diagnosis versus Intra-operative findings

A Chi-Square test of independence was conducted to examine the association between pre-operative provisional clinical diagnosis and the actual intra-operative findings

The results showed $\chi 2$ (11) was 31.377 and the p-value = 0.002. A Likelihood ratio $\chi 2$ (11) was 33.389 and the p-value = 0.001 with the number of cases equal 78. Since the Pearson Chi-Square test yielded a p-value of $0.002 < 0.05$, we reject the null hypothesis of independence. This shows that there is a significant association between pre-operative provisional clinical diagnosis and the actual intra-operative findings.

The likelihood Ratio Chi-Square test used as an alternative when sample sizes are small also supports this conclusion with a lower p-value, 0.001.

To further assess the strength of this association, we calculated Cramer's V and the Phi coefficient.

A Phi coefficient of 0.638 and Cramer's V of 0.638 was gotten from the analysis with a p-value of 0.002. Both measures suggest a strong association between pre-operative provisional clinical diagnosis and intra-operative findings based on Cohen's (1988) effect size interpretation where 0.6 represents large associations.

The frequency of correct is 59 and incorrect is 19, the strong effect size (Cramer's V= 0.638) indicates that while pre-operative diagnosis is mostly accurate, potential discrepancies exist that could lead to misdiagnosis or diagnostic errors.

Ali MZ et al; (9), had earlier found that 95% of clinical diagnosis correlated with intra-operative findings, kappa is 0.912, while Pradeep Sharma et al; (13) also found that clinical diagnosis was made in 47(94%) of cases of non-traumatic acute abdomen while x-ray diagnosis was correct in 20(40%) patients and ultrasound in 26(52%) patients.

Similarly, Jessica Dei-Asamoa et al;(18) had demonstrated that clinical diagnosis had a higher sensitivity, specificity, positive predictive value, negative predictive value and accuracy than an ultrasound scan in the diagnosis of acute and

uncomplicated appendicitis and a higher sensitivity, negative predictive value, and accuracy compared to an X-ray in the diagnosis of intestinal obstruction.

Our findings also agree with the findings by other researchers who reported statistically significant positive correlation between clinical diagnosis and intra-operative findings (2, 11, 12, 4, and 6).

Limitations

While all ileal perforations were assumed to be due to typhoid enteritis which is common in our environment, we did not routinely confirm this diagnosis by laboratory investigations.

5. Conclusion

This study has demonstrated the low utilization of basic imaging facilities for the diagnosis of acute abdomen. It also demonstrated the late presentation to healthcare facilities. There is a demonstrable statistically significant association between pre-operative provisional working diagnosis and ultimate intra-operative findings. Clinical judgement is key to diagnosis of acute abdomen and other investigations are only supportive.

We make a strong case for strengthening the teaching of basic clinical skills of history taking and meticulous physical examination to improve the correctness of pre-operative provisional clinical diagnosis in our medical Schools.

Compliance with ethical standards

Disclosure of conflict of interest

The authors have no conflict of interest to be disclosed.

Statement of informed consent

The patient's informed consent was not required as the study was limited was limited to reviewing existing electronic medical records.

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