DIAGNOSTIC YIELD OF PLAIN ABDOMINAL RADIOGRAPH IN PATIENTS PRESENTING WITH ACUTE ABDOMINAL PAIN IN JOS, NORTH-CENTRAL NIGERIA

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ABSTRACT

Background*:* Abdominal pain is one of the most commonly encountered complaints seen in the emergency room and constitutes a significant proportion of emergency department visits. An abdominal radiograph is a noninvasive imaging tool commonly utilized in the evaluation of acute abdominal pain. It is cheap, readily available, reproducible, and a quick and reliable technique for evaluating abdominal pain. The aim of this study was to review the diagnostic yield of plain abdominal radiographs in patients presenting with acute abdominal pain in a peripheral facility in Jos, Plateau State Nigeria.

Methods: A seven-year retrospective review of the archive of abdominal radiographs of 638 consecutive patients presenting with acute abdominal pain between January 2015 and December 2022 was conducted. Only 503 patients with complete documentation who met the inclusion criteria were enrolled. Patients with incomplete documentation were excluded from the study.

Results: The study included 271 (53.9%) males and 232 (46.1%) females, giving a male-to-female ratio of 1.2:1 and a mean age of 31.91± 18.76 years. Abdominal x-ray findings were normal in 57.1% and abnormal in 42.9% of patients. The abnormal abdominal findings were intestinal obstruction (23.7%), bowel perforation (7.8%), degenerative spine disease (3.8%), abdominal mass (2.0%), and renal calculus (1.4%).

Conclusion: Abdominal radiograph is an effective, cheap, and complementary imaging tool in a resource-constrained setting like ours. Its diagnostic yield in acute abdominal pain can be improved by following the American College of Radiologists' guidelines.

Keywords: Abdominal radiography, acute abdominal pain, diagnostic yield, American College of Radiologist guideline

Introduction

The abdominal cavity houses the numerous abdominal viscera and pathologic abnormalities from these organs may present with abdominal pains with a variety of symptoms ranging from mild self-limiting to life threatening diseases requiring emergency surgery. Insufficient work up results in unnecessary interventions or delayed treatment. Therefore, early and accurate diagnosis is essential in decision-making.

Abdominal pain is one of the most encountered presenting complaints seen in the emergency room and constitutes approximately 4%□10% of emergency department visits.[1] Diagnosis based solely on clinical history, physical examination and laboratory investigations is not reliable enough, despite the fact that these aspects are essential parts of the workup of a patient presenting with acute abdominal pain.[1,2] Imaging workup is therefore mandatory in patients acute abdominal conditions. Imaging workup traditionally starts with abdominal radiography especially in a resource constraint setting.[3] Computed Tomography is the most commonly used imaging modality for evaluating acute abdomen. It provides detailed cross-sectional images of abdominal organs. X-ray has found usefulness in the evaluation fractures, foreign body and some abdominal diseases causing acute abdominal pain

Abdominal radiograph is often the initial imaging investigation performed in acute abdominal pain especially in low- and medium-income countries.[4] However, in the era of cross-sectional imaging, the role of an abdominal radiograph in the evaluation of acute abdominal pain is being questioned due to its low sensitivity and diagnostic yield.[4] Abdominal x-ray performed in suspected cases of bowel obstruction or perforation, urinary calculi, or bowel ischaemia is often helpful.

The percentage of diagnostic accuracy of acute abdominal pain has improved over the years due to establishment of emergency medicine, increased laboratory testing and widespread availability of various diagnostic modalities, such as computed tomography (CT), ultrasound, and nuclear imaging.[5] Despite this feat, making a definitive diagnosis of the underlying cause of acute abdominal pain still remains a challenge. The ideal diagnostic imaging modality should provide a balance between the highest diagnostic value, lowest radiation exposure and duration of stay at the emergency department while ultimately resulting in the lowest cost to the health care system.[6]

The value of plain abdominal radiography to therapeutic decision-making remains questionable particularly in the case of a negative result. It is for this reason that several studies suggest plain abdominal radiographs for specific indications such as suspicion of perforated viscus, urinary tract stones, bowel obstruction, and ingested foreign body in order to reduce the number of unnecessary requests.[7,8,9,10]

In spite of the advent of other newer imaging techniques, plain abdominal radiographs still retain their position as one of the most useful initial investigations.[11] Imaging techniques such as CT scan and ultrasound have been shown to increase diagnostic accuracy substantially,[7] and consequently have significantly decreased the added diagnostic value of plain abdominal radiography in a clinical setting.[11]

Despite recent abundant evidence of its limited value, many physicians still rely on plain abdominal radiography as a simple, cheap, and widely available first diagnostic modality with lower radiation exposure than CT scan.[12] Proponents of plain abdominal radiography advocate its use to prevent high radiation exposure in patients due to unnecessary CT imaging. The average plain abdominal radiograph exposes the patient to 0.7 mSv and an abdominal CT exposes the patient to 10.0 mSv.[13,14]

Materials and Methods

A seven (7) year retrospective review of the archive of abdominal radiographs from a private peripheral diagnostic facility of 709 consecutive patients presenting with abdominal pain or an acute abdomen between January, 2015 and December 2022 was conducted. Patients with incomplete documentation were excluded from the study.

Most of the radiographs were requested to evaluate abdominal pain and to exclude pneumoperitoneum, bowel obstruction, or calculus disease. Each

radiograph was reviewed, interpreted and placed in diagnostic categories, including obstruction, pneumoperitoneum, mass lesion, foreign body, pathologic and nonspecific abnormal gas collections, organomegaly, and no specific abnormality (normal).

The abdominal x-ray examination was performed using a multix swing floor mount 500MAs
X- ray machine (Siemens, 2007 Germany) fitted with a stationary grid. Demographic data obtained included age, sex, clinical indications and abdominal x-ray findings. The data was collated, entered into a computer and processed by the use of Statistical Package for Social Sciences (SPSS) version 23 to determine frequencies; means ± standard deviations. Results are presented using frequency tables and percentages as appropriate. A p-value of <0.05 was considered statistically significant with a confidence interval of 95%.
The hospital's ethical committee and review board concurred that the retrospective study was a continuous quality improvement initiative for patient care and did not require ethical approval.

Results
Findings were considered significant if they were diagnostic for a particular disease process or if they were suspicious enough to warrant further clinical or radiographic investigation. Interpretations made independently for each radiograph in the abdominal series were then compared for patient's clinical information.

Patients Demography: A total of 638 radiographs were reviewed but only 503 with complete documentation and met the inclusion criteria were enrolled for the study, a documentation completion rate of 78.8%. Of these patients, 271 (53.9%) were males, 232 (46.1%) were female giving a male to female ratio of 1.2:1 with a mean age of 31.91± 18.76 years (Table 1).

Table 1: Age and Sex distribution

	Age group (years)									
Sex	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥70**	**Total**	**Percent**
Female	21	33	59	66	20	11	11	11	232	46.1
Male	37	41	48	47	44	20	18	16	271	53.9

Mean (±SD): 31.91 ± 18.76 years

Abdominal findings: Abdominal x-ray findings were normal in 57.1% of the subjects while 216 (42.9%) patients show various abnormal findings. The common abnormal abdominal findings were intestinal obstruction (23.7%) and followed distantly by bowel perforation constituting 7.8%. Other findings include degenerative spine disease (3.8%), abdominal mass (2.0%),ascites(1.6%) and renal calculus (1.4%).The least findings were ureteric stent, soft tissue calcifications and hepatomegaly constituting 0.4% each ***(Table 2)***.

Table 2: Relationship between plain abdominal x-ray findings and sex

Findings	Sex		Total	Percent (%)
	Male	Female		
Normal	138	149	287	57.1
Intestinal obstruction	61	58	119	23.7
Intestinal Perforation	32	7	39	7.8
Foreign Body	4	1	5	1.0
Renal Calculus	5	2	7	1.4
Bladder calculus	3	0	3	0.6
Ascites	5	3	8	1.6
Degenerative spine disease	14	5	19	3.8
Soft tissue calcifications	0	2	2	0.4
Hepatomegaly	0	2	2	0.4
Abdominal mass	7	3	10	2.0
Ureteric stent	2	0	2	0.4

The age groups 20-29 years and 30-39 years had the majority of the abnormal abdominal findings constituting 19.0% and 16.7% respectively. Also, age groups 20-29 years and 30-39 years had normal findings constituting 23.0% and 26.8% respectively. The least abnormal and normal abdominal findings were seen in age groups 60-69years and ≥70 years constituting 7.4% and 8.8% respectively. This was statistically significant ($p<0.005$) ***(Table 3)***.

Table 3: Relationship between abdominal findings and age groups

	Age group								
Findings	**0-9**	**10-19**	**20-29**	**30-39**	**40-49**	**50-59**	**60-69**	**≥70**	**Total**
Normal abdominal	33	39	66	77	38	13	13	8	287
findings (%)	(11.5)	(13.6)	(23.0)	(26.8)	(13.2)	(4.5)	(4.5)	(2.8)	(100.0)
Abnormal findings (%)	25	35	41	36	26	18	16	19	216
	(11.6)	(16.2)	(19.0)	(16.7)	(12.0)	(8.3)	(7.4)	(8.8)	(100.0)
Total	58	74	107	113	64	31	29	27	503

$X^2 = 20.267$; $df = 7$; $P = 0.005$

Discussion

The American College of Radiology (ACR) states that an abdominal radiograph should be taken for adult patients who have constipation, pneumoperitoneum, suspected ileus or intestinal obstruction, foreign body assessment, or urinary tract stone evaluation.[8] A basic abdominal radiography typically consists of an upright abdominal view, a supine abdominal view, and an erect chest film.[15]

A total of 503 radiographs of the abdomen were examined. Table 1 displays the male-to-female ratio of 1.17:1 and the mean age of 31.91 ± 18.76 years, with 271 (53.9%) men and 232 (46.1%) females among them. The sex distribution of the patients in this study is comparable to that of Anyanwu *et al.,* who found that there were more men (53.2%) than women (46.8%) in their study.[10] A comparable sex distribution trend of 63.89% men and 36.11% females was also found by Morris-Stiff *et al.*[18]

In the present study, 42.9% of patients had varied abnormal findings on plain abdominal x-rays, while

57.1% of individuals had normal results. These findings are consistent with several earlier publications, which show a significant percentage of plain abdominal radiographs without abnormality or particular features.[16,17,21] According to two separate studies, 77% and 78% of all requested plain abdominal radiographs showed no abnormal findings.[16] In another study, it was found that among individuals experiencing acute abdominal discomfort, only 10% of specific diagnostic abnormalities were detectable on a plain abdominal radiograph.[17] Additionally, only 10% of the 1780 plain abdominal radiography examinations had positive findings, according to Eisenberg *et al.*[21]

Intestinal obstruction (23.7%), bowel perforation (7.8%), and ascites (3.8%) accounted for the majority of the abnormalities seen on plain radiograph in the present study. Renal calculus, soft tissue calcification, and hepatomegaly were the least positive findings of the current study. According to various other studies, a significant portion of the positive findings on a plain abdominal radiograph include intestinal obstruction and bowel perforation. The percentage of patients in this study with intestinal obstruction and perforation does seem to be larger than in many other previous studies, though. For instance, only 3% of the plain abdominal radiographs in Abdel-Rauf *et al*'s investigation showed appropriately identified intestinal perforations and obstructions.[17] Furthermore, bowel obstruction was detected in roughly 7% of individuals with acute abdominal pain, according to Gans *et al*□s study.[12] They also discovered that in 50%□60% of patients with bowel obstruction, plain abdominal radiography findings are diagnostic; in 20%□30% of cases, they are indifferent; and in 10%□20% of cases, findings are misleading.[12] The small number of positive diagnoses of bowel obstruction reported by the preceding studies may be explained by a decline in the use of plain abdominal radiography as a first-line imaging modality in patients suspected of having intestinal obstruction throughout the industrialized nations of the world. According to Gans *et al*, there is a general decline in the use of plain abdominal radiography. They discovered that, whereas plain abdomen radiographs were used less frequently, CT and ultrasound scans were used more frequently.[18] The significant positive detection rate of intestinal obstruction in this present study could be attributed to the fact that alternative imaging modalities other than plain abdominal radiography are still uncommon in our context. Plain abdominal radiography is almost always performed on individuals presenting with acute abdominal pain in our setting.

In conclusion, several investigations have demonstrated that the sensitivity and accuracy of plain abdominal radiography are low when assessing specific conditions such intestinal obstruction, ureteral stones, perforated viscus, swallowed foreign objects, and acute abdominal pain.[12] However, plain abdomen films still remain one of the useful preliminary examinations, despite the recent proliferation of various imaging techniques.[11]

Limitations

The most important limitation of this study is that the abdominal radiographs were reviewed without adequate history or insufficient clinical information which may impact negatively on the accuracy of the final diagnosis. The retrospective review of the records without inputs from further laboratory workup, clinical reviews, definitive diagnosis and intra-operative findings may also affect this study.
A prospective study in multiple centers for the evaluation of abdominal radiograph findings is required.

Conclusion

Abdominal radiography is an effective, cheap and complementary imaging tool in evaluating the abdomen. However, the low sensitivity and accuracy of plain abdominal radiography in the evaluation of acute abdominal pain underscores the need to uphold the American College of Radiologist practice guideline for the performance abdominal radiography to improve the diagnostic yield especially in resource constraint settings like ours.

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Conflicts of Interest
There are no conflicts of interest.

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