World Journal of Medical Sciences 16 (3): 98-106, 2019
ISSN 1817-3055

DOI: 10.5829/idosi.wjms.2019.98.106

Evaluation of the Common Findings in Emergency Abdominal X-Rays in Nnamdi Azikiwe University Teaching Hospital and Waves Medical Diagnostics and Research Center, Nnewi, Anambra State

C. Ugwuanyi Daniel, Chiegwu, Hyacinth, C. Eze Joseph and C. Onwuagha Arinze

Department of Medical Radiography and Radiological Sciences,
Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria

Abstract: The study is a retrospective research design aimed at evaluating the common findings on emergency abdominal x-rays in Nnamdi Azikiwe University Teaching Hospital, Waves Medical Diagnostics and Research Center Nnewi, Anambra state. The Subjects used for the study were those who underwent abdominal x-ray examination as an emergency investigation. The results showed that more males 133(53.2%) than females 117(46.8%) were referred for emergency abdominal x-rays. The patients with acute abdomen 49(19.6%) were the major emergency referrals while congenital disorders 2(0.8%) was the least common reason for referral of patients for emergency abdominal x-rays. However, patients less than 1 year of age gave n=64 (25.6%) formed the age group of patients with the highest incidence of clinical referrals whereas patients between 1-10 years gave n=8 (3.2%) formed the age group with the least incidence of emergency referrals. There were rare cases of necrotizing enterocolitis from age groups less than 1 year(4) and 11-20 years (1).The commonest radiological finding in patients undergoing emergency abdominal x-rays is normal bowel distribution pattern n=144 (57.60%). Thus an estimated diagnostic yield of emergency abdominal x-rays done for the study showed that n=95 (38.00%) was positive while n=108 (43.20%) was negative. There was also no significant association between the diagnostic outcome and gender or age (P>0.05). In conclusion, patients less than 1 year from the final diagnosis having necrotizing enterocolitis (4) might be because of lack of exclusive breast feeding for 6 months over formula feeding. The use of plain abdominal x-rays in emergency conditions cannot be underestimated or overemphasized; it still remains the first line of diagnostic work up in evaluating patients with non-specific abdominal disorders.

Key words: Emergency Radiography · Abdominal X Rays · Nnamdi Azikiwe University Teaching Hospital · Waves Medical Diagnostics And Research Center · Nnewi · Anambra State

INTRODUCTION

A medical emergency is an injury or illness that is acute and poses an immediate risk to a person's life or long term health. These emergencies may require assistance from another person who should ideally be suitably qualified to do so, although some of these emergencies can be dealt with by the victim themselves. The response to an emergency medical situation will depend strongly on the situation, the patients involved and availability of resources to help them. It will also vary depending on whether the emergency occurs whilst in hospital under medical care or outside of medical care. However, plain abdominal radiographs are commonly requested for acute medical emergencies on patients with non-specific abdominal symptoms and signs. Plain films are likely to remain the best and most useful methods of initial investigation for imaging gas shadows for many years to come and computed tomography scanning, isotope studies and nuclear magnetic resonance are unlikely to play any major role in the initial investigation of the acute abdomen [1]. Approximately 4-10% of

Correspondent Author: Ugwuanyi Daniel Chimuanya, Department of Medical Radiography and Radiological Sciences, Nnamdi Azikiwe University, Nnewi Campus, Anambra State, Nigeria.
Tel: +2348033971062, E-mails: dc.ugwuanyi@unizik.edu.ng, danc.1969@yahoo.com.

emergency department visits are due to acute abdominal pain making it one of the most encountered complaints [2]. An early and accurate diagnosis is essential in decision making and insufficient work up results in unnecessary interventions or delayed treatment. The use of plain abdomen radiographs (PAR) as part of the routine investigative profile to diagnose acute abdominal pain is still widely advocated at various levels of medical practice and has become ingrained in our system of management [3], however earlier retrospective and prospective studies have concluded that 77-78% of PAR requested were normal increasing to 84% if unsuspected and unrelated findings were taken into account [4]. Further studies have suggested that there is need to determine specific indications for requesting PAR in the emergency department which can effectively help to reduce numbers by at least 50% [5].

Whether plain abdominal radiography contributes to therapeutic decision making or disposition remains questionable particularly in the case of a negative result, the additional value of plain abdominal radiographs most especially in emergency situations is disputed. However it is amidst all the backdrops and challenges associated in emergency abdominal radiography as regards the radiation dose reception, diagnostic value and accuracy that the researchers were motivated to carry out this research to ascertain the pattern of common findings in abdominal x-ray emergency cases and further correlate these findings with the final diagnostic and prognostic outcome as well as its utilization.

Although certain disease processes such as cholecystitis, appendicitis and diverticulitis commonly present with pain localized to a specific quadrant of the abdomen, diffuse abdominal pain is also a common clinical presentation. The differential diagnosis of acute nonlocalized abdominal pain is broad. CT is typically the imaging modality of choice if there is significant concern for serious pathology or if the diagnosis is unclear from history, physical examination and laboratory testing. Yaghmai *et al*.[6] carried a prospective study on 584 patients with nontraumatic abdominal pain in an emergency department setting, CT results altered the leading diagnosis in 49% of patients and changed the management plan in 42% of patients [7].

Conventional radiography is widely available in the ambulatory setting and is often the initial imaging test for evaluation of outpatients with abdominal pain. However, studies have shown that it has limited diagnostic value for assessing abdominal pain and that the results rarely change patient treatment [8]. Conventional radiography may be appropriate for a select group of patients. It has been shown to have good accuracy for diagnosing suspected bowel obstruction, perforated viscus, urinary tract calculi, or foreign bodies [9].

The use of CT for the evaluation of abdominal pain has increased significantly in recent years. In 2001, approximately 10% of patients with abdominal pain who presented to U.S. emergency departments underwent CT. By 2005, that number increased to more than 22% of patients [10]. With the widespread use of CT come concerns about exposing patients to ionizing radiation. Abdominal CT exposes a patient to an effective radiation dose of approximately 10 mSv, compared with the annual background radiation dose of 3 mSv in the United States [10].

In the interest of decreasing radiation exposure, efforts have been made to use CT more judiciously. For example, studies have evaluated ultrasonography as the initial imaging modality for suspected appendicitis, using CT only if the ultrasonography results are inconclusive or negative. These studies have shown significant decreases in CT use while maintaining acceptable diagnostic sensitivity and specificity [11]. The use of low-dose CT for evaluating suspected appendicitis is another strategy to decrease radiation exposure. A study of low-dose CT compared with standard-dose CT found no significant difference in the negative appendectomy rate between the two groups and the median radiation dose of the low-dose protocol was 22% of the standard-dose protocol [12]. MRI is an emerging modality in the evaluation of suspected appendicitis, showing excellent sensitivity and specificity (97% and 95%, respectively) in a meta-analysis of eight studies [11]. MRI avoids radiation exposure altogether, but its high cost and lack of widespread availability continue to limit its use.

Objectives:

- To identify the major clinical indications of patients for emergency abdominal x-rays as well as the diagnostic value.
- To ascertain and document the commonest radiographic findings of emergency abdominal x-rays in NAUTH and Waves Medical Diagnostics using patient's clinical indications and final diagnosis.
- To find out the age and sex distribution of patients undergoing abdominal x-ray as emergency investigation and determine if there is a significant association of the diagnostic outcome with either age or gender.

- To determine the rate of adherence to the guidelines for use of plain abdominal radiography in the emergency department by referring clinicians.
- To determine the utilization rate of emergency abdominal radiographs in NAUTH and Waves Medical Diagnostics.

MATERIALS AND METHODS

Research Design: A cross sectional retrospective research design was used for the study.

Study Population: The patients who had emergency abdominal x-rays in NAUTH and Waves Medical Diagnostics between January 2016 – May 2018 were included.

Sample Size: A convenience sampling technique was adopted to obtain a sample size of 250 emergency abdominal x-rays for the study.

Procedure for Data Collection: A secondary method of data collection was used for the study. The researcher obtained information such as;

- Date,
- Patient's age,
- Gender,
- Provisional diagnosis (clinical indication) from the patients' request cards while the following information was obtained from the patient's folder containing radiologist report;
- The radiographic findings
- The final diagnosis

Hence this information was obtained at the filing room where x-ray folders and reports were being stored. However, ethical approval was also obtained from the radiology department.

Data Analysis: The collected data was categorized according to patient's age and gender, clinical indications, distribution of the clinical indications according to patient's age and gender and final diagnosis of the examination. Pearson chi-square was used to determine if there is a significant association of the diagnostic outcome with either age or gender.

Thus the rate of adherence and utilization rate were determined using simple mathematical formulas.

RESULTS

Presentation of Data: Table 1 shows age distribution of respondents. The subjects with age range of <1 year have the highest participation 64 (25.6%). The age range of the 1-10 years have the least participation forming 8 (3.2%) of the participants.

Table 2 there are 250 cases; male constituted the highest proportion and female constituted the lowest proportion which were 133 (53.2%) and 117 (46.8%), respectively.

Table 3a shows clinical indications with age distributions. Acute abdomen constituting the highest number forming 49 (19.6%) whiles congenital disorders forming 2 (0.8%). However, the age group <1 year (n=64) had highest incidence of acute abdomen (21), intestinal obstruction (18) and necrotizing enterocolitis (12). The age group 1-10 years (n=8) occurred the least in terms of clinical indications.

Table 3b shows clinical indications with gender distributions. Females had highest incidence in intestinal obstruction (26) and nephrolithiasis (17) respectively. Males had the highest incidence in acute abdomen (28), abdominal pain (17) and bladder pathology (19).

Table 4 Table 4 shows that normal bowel distribution pattern (n=144) 57.60% is the commonest radiographic findings for emergency abdominal x-rays and 46 (18.4%) of the cases were not reported.

Table 5 shows that the most common final diagnosis for patient's referral were normal 107(42.8%), not reported 48(19.2%) and intestinal obstruction 24(9.6%). Fecal impaction 3(1.2%) and appendicitis 1(0.4%) were the least common final diagnosis. The age group < 1 year (n = 12) had highest incidence of intestinal obstruction whereas the age group 41-50 years (n = 0) (None occurring) occurred least in terms of intestinal obstruction.

Table 6 shows that the estimated diagnostic yield of emergency abdominal x-rays was (n = 95) 38.00% as positive values and (n = 108) 43.20% as negative values while (n = 47) 18.80% was the frequency of unreported radiographs.

Table 7a shows that the P value was 0.324 (degree of freedom (df) = 28), however this implies that there was no significant association between diagnostic outcome and age.

Table 7b shows that the P value for the cross tabulation was 0.237 (degree of freedom (df) = 4), thus there is no significant association between the two variables $P > 0.05$.

Table 1: Age distribution of subjects

Age (years)	Total
< 1 year	64(25.6%)
1-10 years	8(3.2%)
11-20 years	14(5.6%)
21-30 years	24(9.6%)
31-40 years	26(10.4%)
41-50 years	30(12.0%)
51-60 years	34(13.6%)
> 60 years	50(20.0%)
Total	250(100%)

Table 2: Gender distribution of the subjects.

Gender	Frequency	Percentage (%)
Male	133	53.2
Female	117	46.8
Total	250	100

Table 3a: Distribution of patient's clinical indication according to their age

Age distribution / Clinical Indications	Abdominal pain (gen/ regional)	Acute abdomen	Intestinal obstruction	Congenital disorders	Gastric disorders	Abdominal mass	Necrotizing enterocolitis	Bleeding PUD	Bladder pathology	Nephrolithiasis	Others	Total
1 year	0	21	18	2	5	2	12	0	0	0	4	64
1-10 years	1	3	2	0	0	0	0	0	1	0	1	8
11-20 years	4	3	2	0	0	0	2	2	0	0	1	14
21-30 years	4	2	2	0	0	0	0	0	5	3	8	24
31-40 years	2	7	3	0	3	1	1	0	3	1	5	26
41-50 years	5	2	4	0	0	5	0	3	3	6	2	30
51-60 years	1	4	7	0	0	5	0	1	4	10	2	34
>60 years	5	7	7	0	1	4	0	3	7	8	8	50
Total	22	49	45	2	9	17	15	9	23	28	31	250

Table 3b: Distribution of patient's clinical indications according to their gender

Clinical indications	Male	Female	Total	Percentage (%)
Abdominal pain	17	5	22	8.8
Acute abdomen	28	21	49	19.6
Intestinal obstruction	19	26	45	18.0
Congenital disorders	0	2	2	0.8
Gastric disorders	5	4	9	3.6
Abdominal mass	9	8	17	6.8
Necrotizing enterocolitis	7	8	15	6.0
Bleeding PUD	3	6	9	3.6
Bladder pathology	19	4	23	9.2
Nephrolithiasis	11	17	28	11.2
Others	15	16	31	12.4
Total	133	117	250	100.0

Table 4: Relative Sex Distribution of the most prevalent findings in patients referred for emergency abdominal x-rays

S/N	Radiological Findings	Sex		Frequency	Percentage (%)
		Male	Female		
1	Dilatation of multiple segment of the large intestine, bilateral flank fullness with generalized ground glass appearance, shadows of gas in rectum, normal osseous components	14 (63.6%)	8 (36.4%)	22	8.8
2	Dilatation of multiple segment of the small intestine, bilateral flank fullness with generalized ground glass appearance, shadows or gas in rectum, normal osseous components	17 (54.8%)	14 (45.2%)	31	12.4
3	Gaseous dilatation of the large bowel with thickening of the bowel wall and haustral markings, flank fullness	1	6	7	2.8
4	Normal bowel distribution pattern	75	69	144	57.6
5	NOT REPORTED	26	20	46	18.4
Total		133	117	250	100

Table 5: Distribution of patient's final diagnosis according to age distribution

Age distribution Final Diagnosis	Normal study	Not Reported	Intestinal Obstruction	Constipation	Gastric outlet obstruction	Spondylosis	Necrotizing Enterocolitis	Nephro-lithiasis	Intra-abdominal mass	Bladder pathology	Splenomegaly & Hepatomegaly	Fecal impactiom	Appen-dicitis	Cholel-ithiasis	Others	Total
< 1 year	26	12	12	0	5	0	4	0	1	0	0	0	0	0	4	64
1-10 years	4	1	1	0	0	0	0	0	0	0	1	1	0	0	0	8
11-20 years	5	3	1	0	0	1	1	0	0	0	0	1	0	1	1	14
21-30 years	10	5	1	0	0	1	0	0	0	2	1	0	0	1	3	24
31-40 years	12	8	3	0	0	0	0	1	0	0	1	0	0	1	0	26
41-50 years	13	8	0	1	0	0	0	3	1	1	0	1	1	1	0	30
51-60 years	13	4	4	3	0	4	0	5	0	1	0	0	0	0	0	34
> 60 years	24	7	2	0	1	4	0	2	3	2	2	0	0	0	3	50
Total	107	48	24	4	6	10	5	11	5	6	5	3	1	4	11	250

Table 6: The Estimated Diagnostic yield of emergency abdominal x-rays

Abdominal Results	Frequency	Percentage (%)
Positive	95	38.00
Negative	108	43.20
Not reported	47	18.80
Total	250	100.00

Table 7a: Results of cross tab Pearson chi square of radiographic diagnostic outcome and age

	Chi-Square Tests		
	Value	Df	P-value
Pearson Chi-Square	30.840	28	0.324

Table 7b: Results of cross tab Pearson chi-square of radiographic diagnostic outcome and gender

	Chi-Square Tests		
	Value	Df	P value
Pearson Chi-Square	5.529	4	0.237

$$Rate\ of\ Adherence = \frac{No.\ of\ adhered\ clinical\ Indication}{Total\ No.\ of\ Indication} \times 100\%$$

$= (109/250) \times 100$
$= 43.6\%$

$$Utilization\ Rate\ of\ Emergency\ Abdominal\ X-RAY = \frac{No.\ of\ Reported\ Radiograps}{Total\ No.\ of\ Radiographs} \times 100\%$$

= (203/250)×100
= 81.20%

However,
Non-utilized Emergency Abdominal Radiograph
= (100-81.20)%
= 18.80%

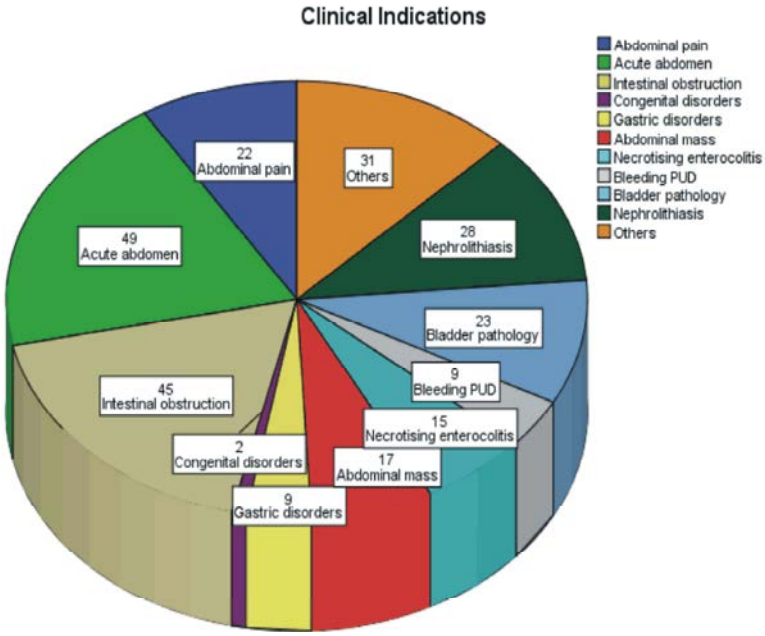

Fig. 1: Pie Chart Showing the Distribution of the Clinical Indications

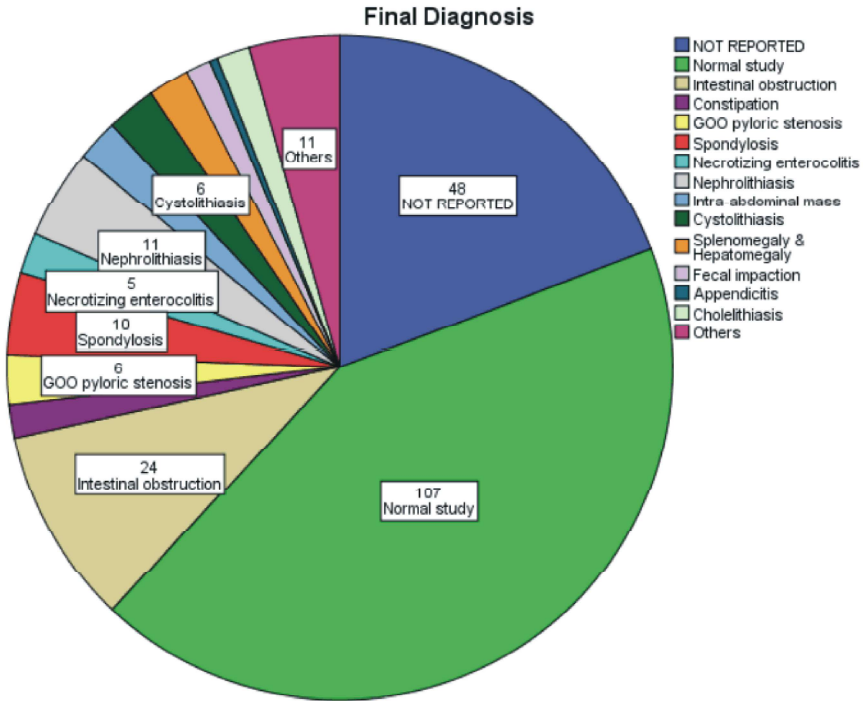

Fig. 2: Pie Chart Showing the Distribution of the Final Diagnosis

DISCUSSION

The results of the research work showed that more males (53.2%) than females (46.8%) were referred for emergency abdominal x-rays at the centers within the study period. The sex distribution of the patients was similar to that reported by Morris-stiff *et al.* [13] which is consisted of 161 males (63.89%) and 91 (36.11%) females with a total of 252 subjects who underwent abdominal x-ray performed for diagnostic purpose.

An observation was made from the clinical indications of necrotizing enterocolitis of which patients less than 1 year had the highest occurrence (12), 11-20 years had 2 and 31-40 years had just 1 case while it was confirmed from the final diagnosis that less than 1 year had 4 and 11-20 years had 1 and 31-40 years had none in occurrence. Judging from the report of Hunter *et al*. [14] with that gotten from the age group less than 1 year (4), necrotizing enterocolitis affects 1 in 2000 to 4000 births or premature infants but is rare in full term infants. The result from less than 1 year age group (4) is therefore very high compared to 1 in 2000 to 4000 births. This could be because:

- Feeding a premature infant with formula as opposed to breast milk within the first 2weeks of life.
- Invading bacteria in the immature intestine of premature infants.
- Glucose-6-phosphate dehydrogenase deficiency.
- Infants who feed enterally and packed red blood cell transfusion.

While that of the only case recorded in the 11-20 years age group as reported by Katara [15] is a rare case in adults with few cases recorded in history since it occurs more in children as regard to 4 cases he added that had the most common organisms isolated being *E. Coli* and *Klebsiella*. When necrotizing enterocolitis occurs in patients older than infants, it is called adult necrotizing enterocolitis. This can be caused by;

- Chronic smoking
- Regular alcohol consumption
- Non-vegetarian lifestyle
- Frequent eating from unhygienic places
- *E. coli* and *Klebsiella* bacteria

The results also show that patients greater than 60 years (20%) had less occurrence in the clinical indications when compared to a previous research by Anyanwu [16] on the same topic of study on the same age group in University of Nigeria Teaching Hospital, Ituku-Ozalla, Enugu State, Nigeria had 30% occurrence. This may be as a result of;

- Regular health check, care and management
- Good nutrition
- Good hygiene

The patients that presented with acute abdomen 49 (19.6%) were the major reason for clinical referral while congenital disorders 2 (0.8%) was the least common reason for referral of patients for emergency abdominal x-rays. However, patients less than 1year of age 64 (25.6%) formed the age group of patients that had the highest incidence of clinical indications whereas patients between 1-10 years 8 (3.2%) formed the age group with the least incidence of clinical indications.

From the final diagnosis, above 1 year of age had no congenital disorders. Age groups less than 20 years had no incidence of nephrolithiasis. From age group 30 years down to a year there was no incidence of abdominal mass. Furthermore in patients above 20 years, there was no occurrence of necrotizing enterocolitis. Lameris *et al.* [2] and so on [3, 4, 17] in their respective studies had a common conclusion that severe abdominal pain was one of the common causes for emergency abdominal x-ray thus this is line with the findings of this study.

An estimated diagnostic yield of emergency abdominal x-rays done for the study showed that n = 95 (38.00%) was positive while n=108 (43.20%) was negative, hence n = 47(18.80%) radiographs was not reported with no known reason. This findings is in accordance with the study by Kellow, *et al.* [18], their results revealed that 34% (n=300) was normal indicative of a negative estimated diagnostic yield. However the results of the respective studies done by Bohner *et al*. [19] (15.8%) as well as Van Randen *et al*. [20] (50%) showed significant disagreement with the findings of this work thus this discrepancies could be attributed to difference in geographical and demographic location as the above studies also showed individual variations in their results.

A cross tabulation results of the Pearson's chi-square test done to determine If there is a significant relationship or association between radiographic diagnostic outcome and gender showed that the P value was 0.237 (with a degree of freedom of 4) implying that there is no significant association between the two variables (for significant association $P > 0.05$).

In a related cross tabulation result obtained to determine if there is a significant relationship between diagnostic outcome and age revealed that with a 28 degree of freedom (df), the P value was 0.324 signifying that the relationship is infinitesimal thus no correlation between the two variables.

Again, mathematical calculation was done for the study to determine the rate of adherence of referring clinicians to the guidelines by the Royal College of Radiologist for emergency abdominal x-rays. However, the result showed a 49.23% adherence rate, this figure disagrees in close range to the result obtained by Feyler *et al*. [21] (12%), Morris-stiff *et al.* [13] (32%) and Kahnzanda *et al*. [22] (30%) thus there was an observed increase percentage in positive findings in referrals in accordance to the RCR guidelines.

Finally, the utilization rate of emergency abdominal x-rays revealed that 76.92% (n = 100) of the radiographs reviewed were adequately reported and findings documented and used for diagnosis. However only 23.08% (n = 30) of the radiographs were not reported which was probably not used for diagnosis and treatment plan.

CONCLUSIONS

The use of plain abdominal x-rays in emergency conditions cannot be underestimated or overemphasized amidst the challenges associated with it as regards its sensitivity, accuracy and diagnostic yield. However, it still remains the first line of diagnostic work up in evaluating patients with non-specific abdominal disorders. Furthermore, in the course of the study, several findings including those of reviewed literatures all point towards the fact that plain abdominal radiography especially in emergency situations though sometimes can be of little diagnostic value but is really an important modality in making differential diagnosis when compared with other imaging modalities which may be of higher sensitivity, specificity and accuracy. Hence, the findings of this study also suggest that more efficient precision and precautions be taken by referring clinicians in order to avoid unnecessary and unjustified radiation exposure to the patient as well as the radiographers who are also advised to employ all the necessary technique and manipulations that could achieve an image of diagnostic quality and details [16].

REFERENCES

1. Field, S., 1984. The role of plain film in the management of acute abdomen. Clinical Gastroenterology, 13(1): 3-40.
2. Lameris, W., A. Van Randen and E.S.HW. Van, 2009. Imaging strategies foe detection of urgent conditions in patients with acute abdominal pain: diagnostic accuracy study. The British Medical Journal, l338: 24-31.
3. Lee, P.W.R., 1976. The plain x-ray in acute abdomen-a surgeon's evaluation. The British Journal of Surgery, l63: 763-766.
4. De Lacey, G.Y., B.K. Wignall, S. Bradbrooke, J. Reidy, S. Hussain and B. Crame, 1980. Rationalizing abdominal radiography in accident and emergency department; Clinical Radiology, 31: 453-455.
5. Hayward, W.M.J., C. Hayward, W.R. Ennis and C.J. Roberts, 1984. A pilot evaluation of radiography in acute abdomen; Clinical Radiology, l35: 289-291.
6. Yaghmai, V., M.P. Rosen and T. Lalani, 2014. ACR appropriateness criteria. Acute (nonlocalized) abdominal pain and fever or suspected abdominal abscess.http://www.acsearch.acr.org/docs/69467/Narrative/.[Accessed June 14, 2014 at 9am].
7. Abujudeh, H.H., R. Kaewlai and P.M. McMahon, 2011. Abdominopelvic CT increases diagnostic certainty and guides management decisions. A prospective investigation of 584 patients in a large Academic Medical Center, 196(2): 238-243.
8. Kellow, Z.S., M. Macinnes and D. Kurzencwyg, 2008. The role of abdominal radiography in the evaluation of the nontrauma emergency patient. Radiology, 248(3): 887-893.
9. Stoker, J., A. Van Randen, W. Laméris and M.A. Boermeester, 2009. Imaging patients with acute abdominal pain. Radiology, 253(1): 31-46.
10. Pines, J.M., 2009. Trends in the rates of radiography use and important diagnoses in emergency department patients with abdominal pain. Medical Care, 47(7): 782-786.
11. Smith, M.P., D.S. Katz and M.P. Rosen, 2014. ACR appropriateness criteria. Right lower quadrant pain-suspected appendicitis. https://www.acsearch.acr.org/ docs/69357/Narrative/. [Accessed June 14, 2014 at 2pm].
12. Kim, K., Y.H. Kim and S.Y. Kim, 2012. Low-dose abdominal CT for evaluating suspected appendicitis. The New England Journal of Medicine, 366(17): 1596-1605.

13. Morris- stiff, G., R.E. Stiff and H. Morris- stiff, 2006. Abdominal radiograph requesting in the setting of acute abdominal pain: temporal trends and appropriateness of requesting; Annals of The Royal College of Surgeons of England, 88: 270-4.
14. Hunter, C.J., B. Podd, H.R. Ford and V. Camerini, 2008. Evidence Vs Experience in neonatal practices in necrotizing enterocolitis, Journal of Perinatology, 28 Suppl 1: S9 -S13 DOI : 10.1038/jp.2008.43.
15. Katara, A.N., V.A. Chandiramani, R. Soman, A. Bhaduri and D.C. Desai, 2004. Necrotising enterocolitis in adults. A study of four cases. Indian Journal of Surgery, 66: 115-8.
16. Anyanwu, I., 2013. Evaluation of the common findings of emergency abdominal x-rays in University of Nigeria Teaching Hospital Ituku-Ozalla, Enugu State, Nigeria.
17. Centers for Disease Control and Prevention, 2014. National ambulatory medical care survey. http:// www.cdc.gov/nchs/ahcd/web_ tables.htm.[Accessed June 14, 2014 at 6pm].
18. Kellow, Z.S., Meghan mac. innes, David kurzencwyg, sapna Rawal, Rehana Jaffer, Bojan Kovalina and Lawrence A. Sten, 2008. The role of abdominal radiography in evaluation of the non-trauma emergency patient; Radiology, 248(3): 715-716.
19. Bohner, H., Q. Yang and C. Franke, 1998. Simple data from history and physical examination help to exclude bowel obstruction and to avoid radiographic studies in patients with acute abdominal pain. European Journal of Surgery, 164: 77-84.
20. Van Randen, A., W. Lameris and J.S.K. Luitse, 2011. The role of plain radiographs in patients with acute abdominal pain at the emergency department. American Journal of Emergency Medicine, 29(6): 582-589.
21. Feyler, S., V. Williamson and D. King, 2002. Plain abdominal radiographs in acute medical emergencies: an abused investigation?; Postgraduate Medical Journal, 78: 94-96.
22. Kahnzada T.W., A. Samad and I. Zulffiqar, 2007. Abuse of plain abdominal radiographs in abdominal pain: Rawal Medical Journal, 32: 48-50.