

DIAGNOSTIC VALUE OF PLAIN ABDOMINAL RADIOGRAPH IN NON TRAUMATIC CAUSES OF ACUTE ABDOMEN

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ABSTRACT

- **BACKGROUND :** *Abdominal pain is a common presentation to emergency department. Preoperative diagnosis of acute abdomen is crucial to minimize the morbidity and mortality where the diagnostic facilities are limited. Plain abdominal films are usually recommended for conditions like perforation of GI tract, intestinal obstruction & ureteric calculus on clinical assessment. In India, where availability of MRI & CT in remote areas & affordability of these investigations by poor patients become hindrance to achieve early diagnosis in acute abdominal conditions.*
- **METHODS :** *A total of 336 cases of clinically suspected acute abdomen (non-traumatic) underwent routine plain x-ray abdomen. Study was performed between August to October 2018. X-rays were carried out on Allengers 350mA, 500mA & 800 mA machine.*
- **RESULTS :** *Our study showed that among 336 clinically suspected cases of acute abdomen , PAR was positive in 63.4 % cases. It was normal or inconclusive in rest 36.6 % cases of clinically suspected acute abdomen. In our study, from total 136 cases of clinically suspected renal or uretreic calculi, 120 (88%) had positive x-ray findings. Further evaluation like ultrasound or CT scan was done of these patients & x ray were true positive in about 90 cases(77%) . In clinically suspected 45 cases of intestinal obstruction , 40 cases (88%) had x ray findings to suggest intestinal obstruction. In follow up of these patients, from 40, 38 patients (95%) were true positive for intestinal obstruction on CT scan. In our study, x rays were 100 % confirmatory for perforation. But , in clinically suspected cases like pancreatitis & cholecystitis only 13% & 23% respectively had positive findings on x-rays. Thus, this study shows that x-rays are confirmatory for cases of perforation. Though , it is reliable for intestinal obstruction & renal stones, it is not confirmatory. Other imaging modalities are necessary to confirm the diagnosis.*
- **CONCLUSION :** *Plain abdominal radiographs(PAR) in cases of acute abdomen are most widely used first imaging modality. It is noninvasive, low cost first line modality & easy to*

perform imaging modality that can be used in every patients presenting to casualty. PAR are most useful in cases with perforation , intestinal obstruction & renal / ureteric / vesicoureteric junction / urinary bladder calculi.

INTRODUCTION :

- The term ‘acute abdomen’ consists of all those conditions that present with clinical features of short duration (arbitrarily within 24 hours) which might indicate a progressive intra-abdominal condition that is threatening to life or is causing severe morbidity.¹ Our study is basically to evaluate the diagnostic value of plain abdominal radiograph in various causes of acute abdomen. The causes of acute abdomen are renal or ureteric calculi, acute appendicitis, acute cholecystitis, peritonitis, intestinal obstruction, acute pancreatitis, severe gastritis, intususception, perforation of hollow viscus, gastric and colonic volvulus, paralytic ileus , colitis, intraabdominal abscess, ovarian torsion in females & trauma.² This study is pertained to nontraumatic causes of acute abdomen only . Though x- rays are routine investigations, it has limitations as among all these acute conditions only some causes of acute abdomen are detected on plain radiographs & x-rays are not specific for every conditions of acute abdomen.^{3,4,7,8} Majority of causes of acute abdomen found positive on plain abdominal radiograph in our study are renal or ureteric calculi, intestinal obstruction and perforation. It is most sensitive for detection of pneumoperitoneum & intestinal obstruction. 5. Thus, Plain x-ray abdomen gives a valuable clue to the clinicians to carry out further investigation. Preoperative diagnosis of acute abdomen is crucial to minimize the morbidity and mortality where the diagnostic facilities are limited. On Plain Abdominal radiographs(PAR): (kv:60-65, short exposure time) & Supine abdominal radiograph-distribution of gas, calibre of bowel, displacement of bowel & obliteration of fat line can be made out. Erect abdominal radiograph air-fluid levels and free gas are detected. Horizontal-ray films(erect or lateral decubitus)-free intra-abdominal air, fluid levels & on Lateral abdominal radiograph-demonstrate calcification in an aortic aneurysm.

AIMS & OBJECTIVES :

- To establish diagnostic value of plain x-ray abdomen in acute abdomen
- To know the various pathologies recognised by plain x-ray abdomen
- To know age & gender wise distribution of cases for acute abdomen
- To help clinician in initial management of patients

METHODS & MATERIALS :

This study was performed for 3 months period between august to October 2018. Informed consent was taken. Patients with suspected clinical diagnosis of renal or ureteric calculi, intestinal obstruction & perforation or the other causes of acute abdomen were included. X-rays were taken on allengers 350 mA, 500 mA & 800 mA machine. Plain abdominal

radiographs taken were supine abdominal radiographs, erect abdominal radiographs, horizontal ray radiographs & lateral decubitus in some cases. The patient was kept in a given position for 10 minutes before the horizontal-ray radiograph to allow time for any free gas to rise to the highest point. The bladder was emptied before the supine radiograph was taken and the area from the diaphragm to the hernial orifices was included in the film. These Plain x-rays were evaluated by a blinded (DS) radiologist. The images were interpreted with only the knowledge that patients presented with abdominal pain. A proforma was prepared consisting of the patient's demographic features, clinical presentation, variables pertaining to the plain abdominal radiograph and other tests involved in the investigative algorithm. Other investigations performed to arrive at the correct and final diagnosis for a patient with acute abdominal pain were also measured. These data were analysed manually to meet the objectives of the study. Patients undergoing surgical procedures had the type of surgery and surgical findings recorded.

RESULTS :

TABLE 1 : AGE WISE DISTRIBUTION OF CASES ACCORDING TO FINAL CLINICAL DIAGNOSIS

AGE IN YEARS	RENAL STONES /COLIC	INTESTINAL OBSTRUCTION	PERFORATION	INTUSSUSCEPTION	PANCREATITIS
0-10	-	02	-	02	-
11-20	04	04	-	-	-
21-30	15	08	09	-	02
31-40	32	07	09	-	05
41-50	33	10	11	-	06
51-60	37	10	04	-	01
>60	15	04	02	-	01

Most patients of acute abdomen presented to our hospital were of 41 to 50 years of age. Among which renal colic was most common cause of acute abdomen in this age group. Least affected age group for acute abdomen was 0-10 years. Renal colic was most common finding seen in 51-60 years age group. Intestinal obstruction was mostly seen in 41 to 60 years of age group. Perforation was most common finding seen in 41-50 years of age. Intussusception was commonest finding in 0-10 years age group. Pancreatitis was commonest in 41 – 50 years age group.

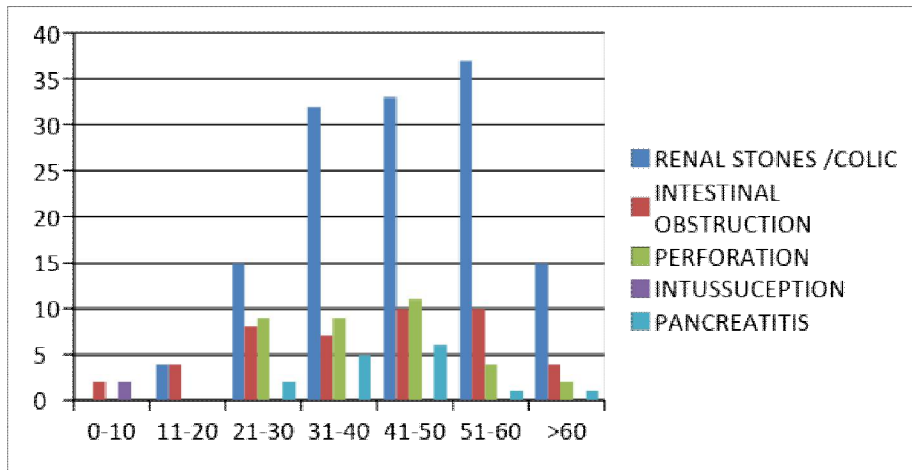


TABLE 2 : CLINICAL SUSPECTED DIAGNOSIS OF CASES

CLINICAL DIAGNOSIS	CASES
Renal/ureteric colic	136(40%)
Intestinal obstruction	45(13%)
Peritonitis	15(4.4%)
Intussuception	02(0.5%)
Pancreatitis	15(4%)
Paralytic ileus	18(5%)
Volvulus	02(0.5%)
Acute cholecystitis	23(6.8%)
Foreign body	08(2.3%)
Others	72(21%)
Total	336

From total 336 clinically suspected cases of acute abdomen, most cases were of renal colic (40%) followed by intestinal obstruction (13%) . Least cases were of intussuception & volvulus (0.5%).

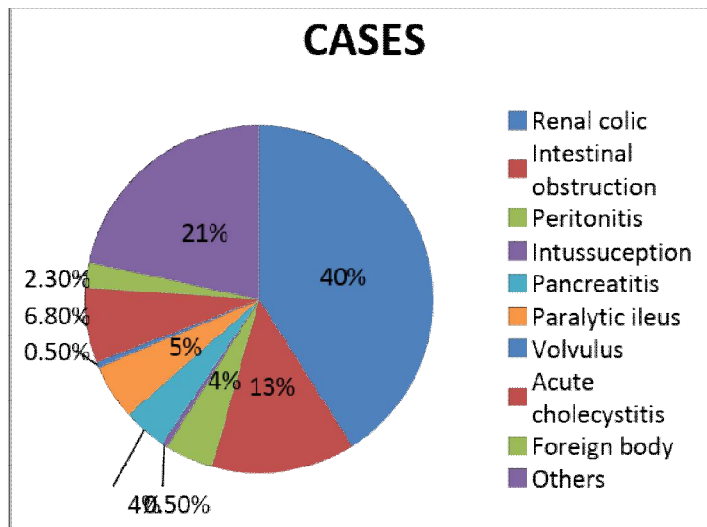


TABLE 3 : DISTRIBUTION ACCORDING TO SYMPTOMS

	RENAL COLIC	INTESTINAL OBSTRUCTION	PERITONITIS	INTUSSUSCEPTION	PANCREATITIS
GENERALISED ABDOMINAL PAIN	28	02	28	-	-
FLANK PAIN	90	-	-	-	-
ABDOMINAL DISTENSION + VOMITING + CONSTIPATION	-	36	02	02	-
HEMATURIA	02	-	-	-	-
EPIGASTRIC PAIN	-	-	05	-	02

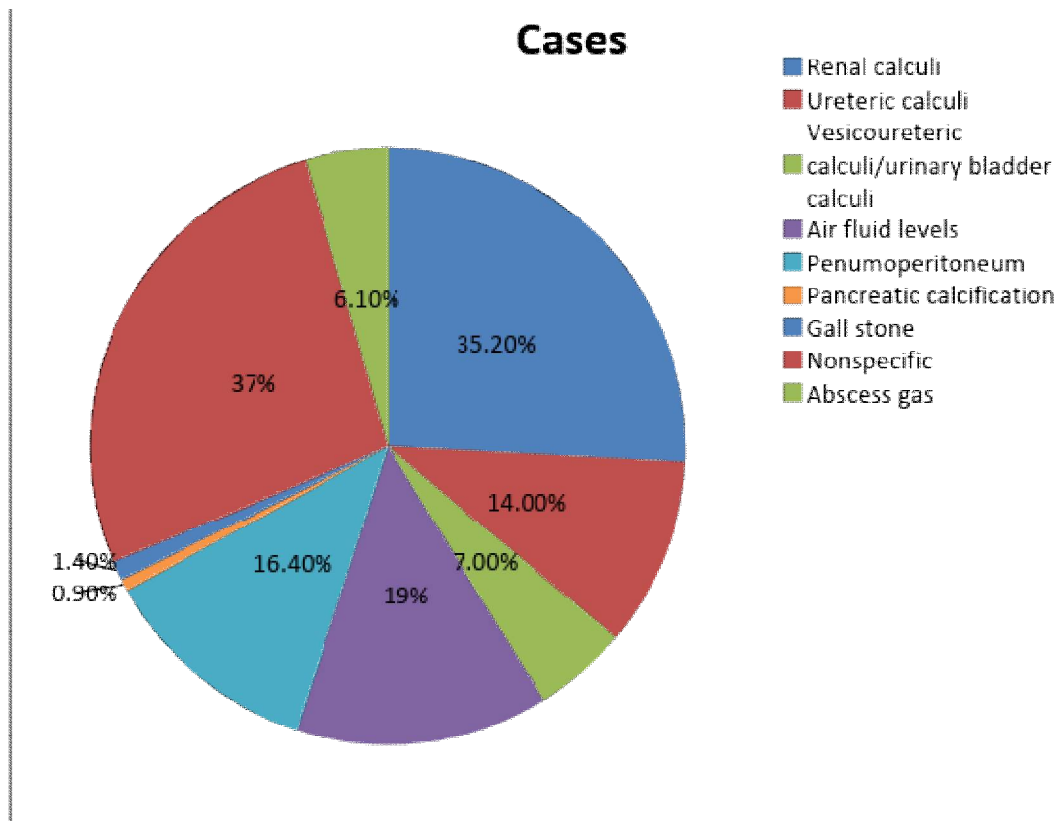
Most of the patients had symptoms of flank pain (90) followed by generalized abdominal pain (58). Least symptom found was hematuria (02).

TABLE 4 : X-RAY FINDINGS OF EXAMINED CASES

X-RAY FINDINGS	CASES
Renal calculi	75(35.2%)
Ureteric calculi	30(14%)
Vesicoureteric calculi/urinary bladder calculi	15(7%)
Air fluid levels	40(18.7%)
Pneumoperitoneum	35(16.4%)

Pancreatic calcification	02(0.9%)
Gall stone	03(1.4%)
Nonspecific	123(36.6%)
Abscess gas	13(6.1%)

Among 336 cases of clinically suspected acute abdomen, 213 (63.4%) cases had positive x-ray findings to suggest the underlying pathology of acute abdomen and remaining 123(36.6%) cases had nonspecific or nonconclusive findings on x-rays. From positive 213 findings, most common finding was renal calculi (35.2%) followed by air fluid levels(18.7%). Least common finding was pancreatic calcification(0.9%).



IMAGES :



Image 1

Image 2

Erect PAR showing large amount of bilateral round radio-

Subdiaphragmatic free air.
p/o enterolith

PAR showing well defined

Opacity in right hemipelvis,



Image 3

Erect PAR showing multiple air fluid levels, filled small

Suggesting intestinal obstruction.



Image 4

PAR showing distended gas

Bowel loops



Image 5- showing few well defined round to oval radioopacities at level of L1 & L3 vertebrae on right side suggesting renal calculi. multiple well defined round to oval organised radioopacities noted at level of L2 & L3 vertebrae, possibility of ureteric calculi. DJ stent noted on left side at level of D12 & L1 vertebrae. Fragment of DJ stent noted in pelvis.

DISCUSSION :

Plain abdominal radiography remains an important diagnostic tool if it is restricted to certain surgical conditions, especially those pertaining to intestinal obstruction and pneumoperitoneum.^{10,11,12} Abdominal radiography has historically been the first imaging examination performed in the emergency department in evaluating abdominal pain. It is easily available, cheapest, easy to perform, noninvasive & widely used first imaging modality. It is the quickest imaging modality that can

diagnose pneumoperitoneum⁶ & further investigations may not be required, thus reducing time, cost & morbidity & thus helpful for both patient & surgeon. Radiation hazards wise, it gives least radiation exposure to patient as compared to CT & fluoroscopy. However, it has limitations such as it can't be performed in pregnant patients & it provides suboptimal information in case of obese patients. In our study, Urinary tract pathology was accounting for a high number of positive findings on plain abdominal radiograph(PAR) (56%), corresponding closely with the findings of Eisenberg and colleagues.⁸ Although urinary calculi might be visible, there is a possibility of false positive and false-negative reporting. This could be due to the fact that radioopaque ureteral stones are infrequently identified on PAR and could easily be confused with other abdominal or pelvic calcifications. In our study, from total 136 cases of clinically suspected renal or ureteric calculi, 120 (88%) had positive x-ray findings. Further evaluation like ultrasound or CT scan was done of these patients & x ray were true positive in about 90 cases(77%) . Only radioopaque stones are visible on PAR. PAR has disadvantage that radiolucent calculi are not visualized. For radiolucent calculi, further investigations are required. In clinically suspected 45 cases of intestinal obstruction, 40 cases (88%) had x ray findings to suggest intestinal obstruction. In follow up of these patients, from 40, 38 patients (95%) were true positive for intestinal obstruction on CT scan. In our study, x rays were 100 % confirmatory for perforation. But, in clinically suspected cases like pancreatitis & cholecystitis only 13% & 23% respectively had positive findings on x-rays. Thus, this study shows that x-rays are confirmatory for cases of perforation. Though, it is reliable for intestinal obstruction & renal stones, it is not confirmatory. Other imaging modalities are necessary to confirm the diagnosis. In our study, percentage in diagnosing pneumoperitoneum and intestinal obstruction was nearly 100 % & 95% respectively which is nearly similar to Gupta K et al.⁵. The most frequent sign in perforation which we found was crescent shaped free air beneath the diaphragm which is similar to study of Marija Frkovic.⁹ Our study showed that among 336 clinically suspected cases of acute abdomen, PAR was positive in 63.4 % cases. It was normal or inconclusive in rest 36.6 % cases of clinically suspected acute abdomen. This high yielding positive data may be due to the fact that this study was oriented on clinically suspected cases of acute abdomen. In a retrospective study of 1000 patients with nontraumatic acute abdominal pain, Ahn et al concluded "abdominal radiographs are not specific in the evaluation of adult patients presenting to the emergency department with nontraumatic abdominal pain."^{3,4} Other series have also concluded that abdominal radiography is of limited use in the assessment of patients with acute abdominal pain.^{7,8} Our study data shows that PAR is most useful in patients with suspicion of pneumoperitoneum, intestinal obstruction & renal or ureteric stones. Our study also shows that PAR is not useful in other nontraumatic causes of acute abdomen like pancreatitis, volvulus, cholecystitis & intussusception etc which is similar to other series study.^{4,5} Thus, this study can help the clinician to carry out further management & narrow down the diagnosis.

CONCLUSION :

Plain abdominal radiographs(PAR) in cases of acute abdomen are most widely used first imaging modality. It is noninvasive, low cost first line modality & easy to perform imaging modality that can be used in every patients presenting to casualty. PAR are most useful in cases with perforation, intestinal obstruction & renal / ureteric / vesicoureteric junction / urinary bladder calculi. PAR helps clinician to narrow down the diagnosis & helps in further management of the patients. PAR rules out emergency surgical conditions like perforation & intestinal obstruction & thus significantly reduces morbidity & mortality. So, PAR are arbitrary in every patients with acute abdominal pain. Our study showed that among 336 clinically suspected cases of acute abdomen, PAR was positive in

63.4 % cases. It was normal or inconclusive in rest 36.6 % cases of clinically suspected acute abdomen. In our study, x-rays were 100% confirmatory for pneumoperitoneum, 95 % for intestinal obstruction, 77 % for renal or ureteric calculi & were less confirmatory for other conditions, so these conditions require further investigations.

REFERENCES :

1. Spigelman AD. Acute abdominal conditions. In: Henry MM, Thompson JN editors. Clinical surgery 2nd edition. China: Elsevier Saunders. 2005. 365-366.
2. MacKersie AB, Lane MJ, Gerhardt RT, Claypool HA, Keenan S, Katz DS et al. Nontraumatic acute abdominal pain: Unenhanced helical CT compared with three-view acute abdominal series. *Radiology* 2005 Oct; 237:114-22.
3. Ahn SH, Mayo-Smith WW, Murphy BL, Reinert SE, Cronan JJ. Acute nontraumatic abdominal pain in adult patients: abdominal radiography compared with CT evaluation. *Radiology* 2002; 225:159-164
4. Joshi MS. Ultrasonography of the acute abdomen [online]. 1997 [cited 2009 May 5]; Available from: [url:http:// www. Star-program.de/data--star-program/upload/ star_abstracts_180_joshi-acute-abdomen .pdf](http://www.Star-program.de/data--star-program/upload/star_abstracts_180_joshi-acute-abdomen.pdf)
5. Laing FC. The gall bladder and bile duct. In: Carol MR, Stephanie RW, William C, editors. Diagnostic ultrasound. 2nd ed. St. Louis: Mosby; 1998. 186-190.
6. Svanes C, Salvesen H, Bjerke Larsen T, Svanes K. Trends in value and consequences of radiologic imaging of perforated gastroduodenal ulcer.
7. Ng KH, Rassiah P, Wang HB, et al. Doses to patients in routine x-ray examinations in Malaysia. *Br J Radiol* 1998;71:654-60.
8. Eisenberg RL, Heineken P, Hedgcock MW, et al. Evaluation of plain abdominal radiographs in the diagnosis of abdominal pain. *Ann Surg* 1983;197:464-9.
9. Diagnostic value of pneumoperitoneum on plain abdominal film. Marija Frković, Tajana Klapan, Ines Moscatello, Marijan Frković
Clinical Institute of Diagnostic and Interventional Radiology Rebro, Clinical Hospital Center Zagreb, University of Zagreb, Zagreb, Croatia. *Radiol Oncol* 2001; 35(4): 237-42.
10. Levine MS. Plain film diagnosis of the acute abdomen. *Emerg Med Clin North Am* 1985;3:541-62.
11. Brazaitis MP, Dachman AH. The radiological evaluation of acute abdominal pain of intestinal origin. A clinical approach. *Med Clin North Am* 1993;77:939-61.

12. Gupta H, Dupuy DE. Advances in imaging of the acute abdomen. *Surg Clin North Am* 1997;77:124563.