International Surgery Journal
*Deherkar JA. Int Surg J. 2019 Sep;6(9):3122-3127*
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20194043

**Original Research Article**

# Co-relation between pre-operative imaging findings and per-operative findings in acute abdomen

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**Received:** 18 July 2019
**Revised:** 20 August 2019
**Accepted:** 21 August 2019

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## ABSTRACT

**Background:** The term acute abdomen refers to a sudden, severe abdominal pain that is less than 24 hours in duration. It is in many cases an emergent condition requiring urgent and specific diagnosis and/or surgical interventions. Abdominal pain can be just one of the symptoms. Most frequently its cause is benign and/or self-limited, but more serious causes may require urgent intervention. Many new diagnostic and management aids have been introduced into the surgical decision-making process over the past decade or so to improve clinical performance. Correct pre-operative diagnosis of acute abdomen remains challenging despite good history taking and clinical examination, and improvement in new imaging techniques including computer-aided diagnosis, ultrasound imaging, computed tomography and laparoscopy. These imaging techniques need sophisticated equipment and specialist expertise round the clock which is not feasible always. Hence, we have tried studying the accuracy of clinical correlation between these newer modalities of diagnosis and intraoperative diagnosis.
**Methods:** Patients were clinically diagnosed, and then a pre-operative diagnosis was made based on radiological investigations and was then compared with the intra-operative findings for its accuracy.
**Results:** The newer modalities of radiological diagnostic techniques proved to be more accurate in diagnosing the cases of acute abdomen.
**Conclusions:** There was a huge range of correlation between newer diagnostic modalities and our clinical and pre- and post-operative findings.

**Keywords:** Acute abdomen, Perforative peritonitis, Gangerene, Meckel's diverticulum

## INTRODUCTION

The combination of improved diagnostic tools, safe anaesthesia, better preoperative assessment with thorough knowledge of clinical and laboratory findings and operative management has decrease the morbidity and mortality of patients of acute abdomen. Previous studies have demonstrated that management errors can be significantly reduced by accurate preoperative diagnosis in acute abdomen.

Many new diagnostic and management aids have been introduced into the surgical decision-making process over the past decade or so to improve clinical performance.[1,2] This has been stimulated because of the fact that in many instances decision of an exploratory laparotomy or indiscriminate period of observation and/or investigation is no more than a gamble; this is particularly so for the condition often referred to in common parlance as "query appendicitis". For example, even if 25 per cent for the rate of removal of a normal appendix is not uncommon, though continuing evidence that the complications which follow such an operation are not insignificant. With the patients welfare at stake and alternative aids available to improve clinical decision-making, the old adage that, a certain percentage of normal appendices must be

removed if one is not to miss an acute/perforated, is no longer acceptable.

Correct pre-operative diagnosis of acute abdomen remains challenging despite good history taking and clinical examination, and improvement in new techniques requiring sophisticated equipment and specialist expertise all the time, making it a difficult job most of the times.

## METHODS

### *Patients*

All the patients attending Bharati Vidyapeeth Hospital Pune's accident and emergency department between the period of august 2008 to august 2010 with the clinical feature suggestive of non-traumatic acute abdomen within in the study period were included. A well designed proforma had been used that recorded all the detailed history, including present complaint, past history, drug and treatment history, other relevant history.

Detail clinical findings and investigation results were also included. At that time the preoperative diagnosis is made which is recorded and subsequently the preoperative finding also recorded after performing surgery.

### *Clinical assessment*

*History*

Detailed history was recorded at the time of initial examination at the Emergency and Casualty Department. Characteristics of abdominal pain such as time of onset, mode of onset, duration, character, site, shifting, radiation. Referred pain, relation to different activities, aggravating factor and relieving factors were recorded. Other detail history of vomiting, bowel habits, past history with particular reference to previous laporotomy, previous similar symptoms, and other relevant on-going diseases were also recorded.

*Clinical examination*

Clinical examination was carried out initially and re-examination performed as necessary. Examination was done under following headings such, a) general examination, b) vitals, c) systemic examination including cardiovascular, respiratory and central nervous system and d) local examination of abdomen (including inguino-scrotal and rectal examination).

### *Investigations*

*Total leucocytes count and differential leucocytes count*

Values defined by Wintrobe et.al was taken as standard with upper limit of normal reference for Total Leucocytes Count as 11x 10 9 /L and Differential Count. Values above the upper limit of normal referred range were taken as abnormal.

*Plain abdominal radiography*

Plain X-ray of the abdomen (erect, supine or lateral decubitus) was taken and abnormalities such as any radio-opacity, dilated bowel loops, air-fluid levels, free gas in the peritoneal cavity were recorded.

Investigations done in selected groups of patients

*Ultrasonography-abdomen*

Abdominal ultrasonography was done in patients who had features suggestive of biliary or pelvic pathology, pancreatitis or any abdominal mass with acute presentation and the abnormalities recorded.

*Computed tomography (CT) of abdomen*

CT scan of abdomen was done only in few cases where any of other investigation was inconclusive. The abnormalities reported were recorded.

*Four quadrant tap of abdomen*

Four quadrant abdominal tapping was carried out in patients to diagnose or rule out peritonitis or haemoperitoneum.

*Diagnostic laparoscopy*

Diagnostic laparoscopy was carried out in doubtful situations

*Pre-operative details*

After thorough work-up of the case of acute abdomen, the pre-operative diagnosis made and recorded and proceeded for laporotomy.

*Operative details*

The patient undergone laporotomy with the diagnosis of acute abdomen. Per-operative findings were recorded.

Pre-operative diagnosis and per-operative diagnosis were compared and recorded.

### *Statistical analysis*

Quantitative data is presented with the help of Mean and Standard deviation. Comparison among the study groups is done with the help of unpaired t test as per results of normality test. Qualitative data is presented with the help of frequency and percentage table. Association among the study groups is assessed with the help of Fischer test, student 't' test and Chi-square test. 'p' value less than 0.05 is taken as significant.

## RESULTS

More acute abdomens were seen in male patients than in females in our study.

The commonest condition of acute abdomen in males and females were appendix, males having a larger ratio.

X-rays were more diagnostic in intestinal obstruction cases where as CT scan was the most useful diagnostic modality in all cases where CT scan could not be conducted other investigative modalities like diagnostic laparoscopy and dye study in kids were the most imp tools.

These newer diagnostic modalities gave a 100% accuracy in our study.

**Table 1: Sex wise distribution of acute abdomen cases.**

| Gender | No. of patients (%) |
|---|---|
| **Male** | 62 |
| **Female** | 38 |

**Table 2: Sex wise distributions of cases of acute abdomen.**

| Cases of acute abdomen | Male | Female | Total % |
|---|---|---|---|
| **Acute appendicitis** | 26 | 20 | 46 |
| **Perforation** | 14 | 06 | 20 |
| **Intestinal obstruction** | 16 | 10 | 26 |
| **Gangrenous small bowel** | 02 | 02 | 04 |
| **Meckel's diverticulum** | 03 | 01 | 04 |
| **Ovarian torsion** | -- | 02 | 02 |

**Table 3: Correlation of investigations with different etiologies of acute abdomen.**

| Cases of acute abdomen | No of cases | X-ray | % | USG | % | CT scan | % | Other investigations | % |
|---|---|---|---|---|---|---|---|---|---|
| **Acute appendicitis** | 46 | 01 | 02 | 36 | 78 | - | 00 | 04 | 9 |
| **Perforation** | 20 | 14 | 70 | 12 | 60 | - | 00 | 03 | 15 |
| **Gangrenous bowel** | 04 | - | 00 | - | 0 | - | 00 | - | 0 |
| **Intestinal obstruction** | 25 | 12 | 48 | 14 | 56 | 03 out of 04 cases | 75 | 04 | 16 |
| **Ovarian torsion** | 02 | - | 00 | 02 | 100 | - | 00 | - | 0 |
| **Meckel's diverticulum** | 04 | - | 00 | - | 00 | - | 00 | - | 0 |
| **Total** | 103 | 27 | | 64 | | 03 | | 11 | |

**Table 4: Corelation between pre-op and post-op diagnosis of acute abdomen.**

| Preoperative diagnosis | Correct pre-op diagnosis | Correct (%) |
|---|---|---|
| **Acute appendicitis** | 46 | 46 |
| **Perforation peritonitis** | 20 | 20 |
| **obstruction** | 26 | 26 |
| **Meckel's diverticulum** | 04 | 04 |
| **Ovarian torsion** | 02 | 02 |
| **Gangrenous bowel** | 04 | 04 |

## DISCUSSION

Acute abdomen has been the most common emergency in a surgeon's life and also most interesting and challenging job. In spite of clinical knowledge and all the old and new techniques of investigations sometimes it still becomes difficult to diagnose. Over a period of time imaging techniques and other investigations have helped surgeon to reduce negative laparotomy rate drastically.

In our present study we have followed up 100 cases of acute abdomen. Along with clinical diagnosis we investigated them with different imaging techniques to reach the preoperative diagnosis. This was then correlated with intraoperative findings.

This study was carried out in Bharati Hospital and Research center in Pune, over a period of two and half years. During the study the patients were admitted, thoroughly examined and a baseline clinical diagnosis was achieved. Routine blood investigations were sent and different modalities of imaging techniques were carried out as per the availability, necessity and affordability of the patients. X-rays and ultrasonography of abdomen were carried out in every patient in our study.

Medical, urological, acute cholecystitis and acute pancreatitis were excluded from this study. Though we have encountered cases of acute pancreatitis, not a single case of pancreatitis developed pancreatic necrosis which requires laparotomy and necrosectomy.

Once patient admitted and baseline clinical diagnosis was achieved, blood investigations were sent and patient was then clinically stabilized. IV access was secured; IV Fluids and appropriate IV antibiotics were delivered. Ryle's tube and Foleys were inserted in indicated cases and then imaging techniques were carried out.

***X-ray abdomen errect***

It is done by establishing the projection of the film, virtually every abdominal X-ray is an AP film, i.e., the beam passes from the front to the back with the film behind the patient, who is lying down with the X-ray machine overhead, but these are frequently accompanied by erect or even decubitus views (also APs).

The radiographer will mark the film with a badge or write on it by hand 'SUPINE' or 'ERECT' to guide us. A standard 35/43 cms cassette is used for an adult to include diaphragm to groins. Whereas in obese patients' cassettes may have to be used transversely, i.e., in landscape or larger size plate.

We had done X-ray erect abdomen in all the cases, and we found that in perforation 70% of X-rays were significant in giving an accurate preoperative diagnosis followed by intestinal obstruction 48%s. In cases of acute abdomen only one case in favour of acute appendicitis due to facility visualized in the X-ray with sensitivity of 2.17% only. Similarly, gangrenous bowel, Meckel's diverticulum and ovarian torsions could not be appreciated on x-ray erect abdomen. Thus, X-ray erect abdomen proved to be the diagnostic imaging modality in cases of acute perforative peritonitis and relatively diagnostic in acute intestinal obstruction. Similarly, in study by Chhetri et al it was found that plain X-ray abdomen showed the highest specificity (88.8%) and positive predictive value (88.6%) in diagnosing acute abdomen.[3,4] It being highly diagnostics in bowel obstruction (82.4%) and hollow viscous perforation was (69%). In our study we too found X-ray to have high sensitive (70%) as in them it was (88.8%).

We routinely carried out erect–ray abdomen in every case of acute abdomen. Erect X-ray abdomen were found to be inconclusive in our study in cases of acute appendicitis , meckel's diverticulum, gangrenous bowel and ovarian torsion cases(sensitivity being 2.17%, 00%, 00%, 00% respectively), we totally agree with the study done by Harpole et al and team who came to a conclusion that in response to evidence-based critiques providers they were reluctant to cancel their order to carry out erect X-ray abdomen routinely in acute abdomen, but were more willing to change to different views.[7] Similar study was also carried out by Simpsons et al and Eisenberg et al who had come to similar conclusion.[8-10]

***Ultrasonography of abdomen/pelvis***

It has an increasingly important role in the initial evaluation of the acute abdomen. Many trauma centres recognize the value of ultrasound as a first-line investigation in properly trained hands. Small portable scanners now offer bedside assessment that can speed the process, whereas higher-specification scanners enable the experienced operator to diagnose detailed pathology in the acute abdomen. There is little doubt that the accuracy of the ultrasound scan is directly attributable to the skill and experience of the operator and the underlying pathology

In our study we carried out USG in every patient of acute abdomen, and we found that it was significantly diagnostic in cases of acute appendicitis (78%) followed by intestinal perforation (60%) and intestinal obstruction (56%) whereas we had come across only two cases of ovarian torsion and both the cases were detected on ultrasonography alone (100%). Cases like intestinal obstruction and perforation were more readily picked up on an X-ray itself, and USG gave an added confirmation for the same. But cases like ovarian torsion were diagnostic only on USG and plain-ray abdomen failed to diagnose the same.

In a study done by Wade et al and his team it was concluded that the efficacy of ultrasonography using the simple criteria was superior to that of the surgeon's initial clinical impression and that their ultrasonography criteria for the diagnosis of appendicitis are simple to use and efficient, similarly in our study we found out that ultrasonography was definitely a relatively efficient diagnostic modality for appendicitis, perforation and obstruction cases after clinical assessment.[11] Whereas ovarian torsions were diagnostic only on ultra-sonography.

In a study by John et al, it was observed that out of 84 patients in 52 patients USG showed some abnormality (62%25). It had high specificity; positive predictive value and negative predictive value in patients of acute appendicitis whereas it was not helpful in evaluating patients with intestinal obstruction.[12] X-ray abdomen had more predictive value in case of peritonitis than USG abdomen. In comparison to this study we found X-ray more sensitive to perforation cases (70%) where USG showed less sensitivity (60%), and in intestinal obstruction X-rays showed sensitivity (48%) and USG showed (56%) but cases of appendicitis did have high sensitivity to USG (78%).Thus USG does hold an golden standard as an adjunct to clinical diagnosis of acute appendicitis. Study of Ramchandra et al, Crihton et al, and Puyaert et al also concluded the same.[13-15] Thus USG has proved to be the adjunct diagnostic imaging modality to clinical diagnosis in cases of acute appendicitis.

***CT scan abdomen/pelvis***

Computed tomography uses X-rays to make detailed pictures of structures inside of the body. During the test, patient is made to lie on a table that is attached to the CT scanner, which is a large doughnut-shaped machine. The

CT scanner sends X-rays through the body area being studied. Each rotation of the scanner takes less than a second and provides a picture of a thin slice of the organ or area. All of the pictures are saved as a group on a computer. They also can be printed. An iodine dye (contrast material) is often used to make structures and organs easier to see on the CT pictures. The dye may be used to check blood flow, find tumors, and look for other problems. The dye can be used in different ways. It may be put in a vein (IV) in your arm (IM), or it may be placed into other parts of your body (such as the rectum or a joint) to see those areas better. For some types of CT scans, you drink the dye. CT pictures may be taken before and after the dye is used. A CT scan can be used to study all parts of your body, such as the chest, abdomen, pelvis, or an arm or leg. It can take pictures of body organs, such as the liver pancreas, intestines, kidneys, bladder, adrenal glands, lungs, and and heart. It also can study blood vessels, bones, and the spinal cord. Fluoroscopy CT is a special test that is not widely available. It uses a steady beam of X-rays to look at movement within the body. It allows the visualization organ movements or to guide a biopsy needle or other instrument into the right place inside your body.

In our study we have done eight CT scans abdomen or pelvis where diagnosis was uncertain on erect X-ray abdomen and USG abdomen/pelvis. Out of which in six CT scan correct diagnosis could be made preoperatively and it had a diagnostic accurity of 75% whereas four correlated along with X-ray and USG findings along with the intraoperative findings (50%) of cases were positively diagnosed. Thus, the study revealed that at places where X-ray and USG were insignificant or biased about making a diagnosis we underwent CT scan and came up with a conclusive preoperative diagnosis (sensitivity 75%). Thus, time and again CT scan has proved itself to be of help in diagnosing an acute abdomen where simple imaging modalities failed diagnose and/or correlate with the clinical diagnosis just like the studies done by Taourel et al and Adam et al.[16,17] But at the same time CT scan also helped us to know the grades of trauma to the organs by which it helped us to decide whether to operate or conserve in traumatic acute abdomen cases. Similar conclusion was drawn in a study done by Sutton et al.[18]

### *Dye study*

In paediatric age groups where X-rays were inconclusive and USG or CT scan could not be done, (due to poor socio-economic status and/or exposure to radiation due to series of X-ray's) a dye study was carried out in which the intestinal obstructions were diagnosed. We carried out dye study (with thin contrast material) on three babies in this study and it was noticed to be 100% sensitive in diagnosing intestinal obstruction due to intussusception.[19]

### *Non-imaging invasive techniques*

Non-imaging and invasive techniques like four quadrants tapping and diagnostic laparoscopy were carried out in few cases having inconclusive diagnosis and where CT scan could not be done due to low socioeconomic status of the patient.

In this study it was also found that where CT scan failed to diagnose the clinically suspected case of perforative peritonitis, and where patient could not be given an erect position for X-ray abdomen and lateral decubitus X-ray failed too (for e.g., in cases of polytrauma), we carried out a non-imaging invasive technique of four quadrant tapping, which was bilious in one case and feculent in the other and proved our clinical and intraoperative diagnosis to be strongly positive for perforation peritonitis.

Whereas places where CT scan could not be carried out for e.g., in low socioeconomic class of people visiting our hospital and where our clinical diagnosis was not going hand in hand with the other imaging modalities we underwent an non-imaging invasive technique of diagnostic laparoscopy to have a pre-operative confirmed diagnosis of acute surgical abdomen to avoid the least possible chance of negative laparotomy.[20-22]

## CONCLUSION

Thus from our study we conclude that X-rays can be used as diagnostic modality for intestinal obstructions and dye study in paediatric age group intussusception cases. In all acute abdomen CT scan proved to be the diagnostic test and only where it was not possible Diagnostic laparoscopy helped. Thus we had 99% correlation seen in imaging modalities and intraoperative findings as the reporting of the test is a subjective issue.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

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**Cite this article as:** Deherkar JA. Co-relation between pre-operative imaging findings and per-operative findings in acute abdomen. Int Surg J 2019;6:3122-7.