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ROLE OF FOCUSSED ASSESSMENT SONOGRAPHY TRAUMA (FAST) AND CT SCAN IN ABDOMINAL TRAUMA

Radiodiagnosis

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ABSTRACT

Background: Diagnosis of abdominal trauma is a real. Diagnostic tools that help the treating doctor in optimum management of abdominal trauma include; Focussed Assessment Sonography for Trauma (FAST), Diagnostic peritoneal lavage (DPL) and CT scan.
Objectives: the aim of this communication is to define the recent role of FAST and CT scan of the abdomen in the diagnosis of abdominal trauma.
Findings and conclusions: FAST is useful as the initial diagnostic tool for abdominal trauma to detect intraabdominal fluid. With proper training and understanding the limitations of ultrasound, the results of FAST can be optimized. DPL is indicated to diagnose suspected internal abdominal injury when ultrasound machine is not available, there is no trained person to perform FAST, or the results of FAST are equivocal or difficult to interpret in a haemodynamically unstable patient. In contrast, in haemodynamically stable patients the diagnostic modality of choice is CT with intravenous contrast. It is useful to detect free air and intraperitoneal fluid, delineate the extent of solid organ injury, detect retroperitoneal injuries, and help in the decision for conservative treatment. Helical CT is done rapidly which reduces the time the patient stays in the CT scan room. Furthermore, this improves sagittal and coronal reconstruction images which are useful for detecting ruptured diaphragm.

KEYWORDS

FAST, CT, Hematoma, Tear, Injury , Collection, Trauma, Hemoperitoneum

INTRODUCTION:

Diagnosis of abdominal trauma is a real challenge . The clinical findings are usually not reliable. Abdominal examination is compounded by different factors like fractures of lower chest ribs, contusion and abrasions of the abdominal wall, presence of fractured lumbar vertebrae with retroperitoneal haematoma, and reduced level of consciousness. Diagnostic tools that help the treating doctor to take critical decisions like the need for laparotomy or conservative treatment are mandatory if we aim for a favorable outcome. Diagnostic peritoneal lavage (DPL) had been the gold standard to detect intraperitoneal fluid since the sixties. Use of Focussed Assessment Sonography for Trauma (FAST) and helical CT scan have dramatically changed our methods for diagnosing blunt abdominal trauma, refined our decisions, and enabled us to select patients for conservative treatment. The choice of a particular modality depends on the haemodynamic stability of the patient, the reliability of physical examination, the severity of associated injuries, and the availability of a particular diagnostic modality. The aim of this communication is to define the recent role of FAST and CT scan of the abdomen in the diagnosis of blunt abdominal trauma.

The Evaluation Of The Patient With Abdominal Trauma Is Done By Following Steps:

FAST - Focused abdominal sonography for trauma FAST is a rapid screen for intra-abdominal injury and can be performed in less than 3min. FAST is noninvasive, may be easily performed and can be done concurrently with resuscitation. In addition, the technology is portable and may be easily repeated if necessary. Like DPL, it can determine the presence of hemoperitoneum but can make no determination as to the etiology of the hemoperitoneum[1]. FAST is clearly operator-dependent and requires true expertise for reliable use. Like DPL, FAST is ineffective for imaging the retroperitoneum. The amount of fluid necessary for a positive FAST remains unclear. In general, several hundred cubic centimeters of fluid/blood are necessary to be clearly visible using FAST, but FAST cannot tell whether fluid is blood, bile or clear fluid.[2].FAST examination cannot be used to reliably grade solid organ injuries. FAST is generally performed in four areas: The ultrasound probes are placed in four locations

1. Right upper quadrant—Morison's pouch
2. Epigastric area (pericardial)
3. Left upper quadrant (perisplenic)
4. Suprapubic area—pouch of Douglas

No matter which organ is injured, the perihepatic view is most commonly positive. Blood pools in Morison pouch, the most dependent portion of the abdomen. The pericardial views can be extremely helpful, although pericardial tamponade is rare after blunt abdominal injury. The ability of FAST to determine the need for laparotomy is questionable. McKinney et al. have encouraging data that suggest that their scoring system can predict the need for laparotomy[3]. In the hemodynamically stable patient, a follow-up CT scan should be obtained if nonoperative management is contemplated.Clearly, FAST has limitations. Its ability to detect small amounts of fluid is questionable, even in skilled hands. In addition, a single FAST cannot absolutely exclude intra-abdominal injury. A recent international consensus conference concluded that prudent evaluation would involve two FAST exams performed at least 6 h apart supplemented with serial physical exams to avoid missing an injury.

E-FAST(Extended FAST) includes two more scans for better assessment :

1. Right paracolic gutter
2. Left paracolic gutter.

CT SCANNING

With the marked decrease in the use of diagnostic peritoneal lavage [4,5], diagnosis of abdominal injuries now relies almost exclusively on the accurate interpretation of findings from adequately performed CT examinations acquired in a timely fashion. In patients with multiple trauma, the "panscan" (CT of the head, neck, chest, abdomen, and pelvis) has become the necessary step to enable physicians to diagnose and ascertain the severity of the injuries and to determine the order in which these should be treated. CT is superior to clinical evaluation and diagnostic peritoneal lavage for diagnosing important abdominal injuries [6,7]

Shortly after its introduction into clinical practice nearly 3 decades ago, CT scan redefined our understanding of the appearance and importance of abdominal organ injuries [8]. Subsequently, helical CT technology improved the accuracy and expanded the applications of CT imaging [9, 10]. Recent hardware and software developments, especially multidetector technology [11, 12] have further potentiated the methods used to evaluate the polytrauma patient in multiple facets: diagnostic capability, speed, and patient safety.

CT scan often provides the most detailed images of traumatic pathology and may assist in determination of operative intervention .[13] Only CT scanning can make the diagnosis of organ-specific abdominal injury. CT scanning images both the abdomen and the retroperitoneum. CT can quantitate the amount of blood in the abdomen.[14] Drawbacks of CT scanning relate to the need to transport the patient from the trauma resuscitation area, the additional time required to perform CT scanning compared to FAST or DPL and it is more expensive. The best CT scan imagery requires both oral and

intravenous contrast. Some controversy has arisen over the use of oral contrast and whether the additional information it provides negates the drawbacks of increased time to administration and risk of aspiration[15].The oral contrast material often produces nausea and vomiting and must be administered while the spine remains immobilized. The intravenous contrast material has a small incidence of allergic reactions. Some advocate that oral contrast is unnecessary for abdominal CT during the initial assessment. This requires further study before it is likely to gain widespread acceptance. No definitive answer exists at this time to the value of oral contrast in diagnosing bowel injury.

There are some patients who require CT scanning despite a normal FAST. Chiu et al have shown that 28 percent of selected patients may have intra-abdominal solid visceral injury without hemoperitoneum. These include those with abrasions or tenderness in the lower chest, abdomen, or pelvis. Other findings mandating CT are pelvic fractures or thoraco-lumbar spine fractures.

DPL – DIAGNOSTIC PERITONEAL LAVAGE

DPL was introduced by Root in 1965 as a rapid and accurate method to identify the presence of intra-abdominal hemorrhage following trauma. Subsequent studies have confirmed the efficacy of DPL in diagnosing abdominal hemorrhage as well as its superiority over physical examination alone. DPL is rapid, safe, and inexpensive. There is approximately a 1 percent incidence of major complication.

A positive DPL, based on microscopic analysis of lavage fluid, has been defined as $> 10^5$ RBC/mm3. A positive DPL does not necessarily mandate immediate laparotomy in the hemodynamically stable patient. Laparotomy based solely on a positive DPL for red cells results in a non-therapeutic procedure approximately 30 percent of the time. It has been recommended that patients with RBC counts in the equivocal range (i.e., 25,000 –75,000 RBC/mm3) undergo additional diagnostic testing, such as CT scanning. It is more accurate than CT for the early diagnosis of hollow visceral and mesenteric injuries, but it does not reliably exclude significant injuries to retroperitoneal structures. False positive results may occur in the presence of pelvis fractures. Hemodynamically stable patients with equivocal results are best managed by additional diagnostic testing to avoid unnecessary laparotomies.

FAST's diagnostic accuracy generally is equal to that of diagnostic peritoneal lavage (DPL).

MATERIAL AND METHOD

This study aims evaluating patients coming to the radiology department of Dhiraj general hospital from SEPT 2018 to OCT 2019, by using USG and CT scan so as to achieve aims and objectives outlined. This study comprised of 50 patients.

INCLUSION CRITERIA:

1. Only those patients who are willing to participate in study will be included.
2. Patients referred to the radiology department for X-ray, USG and CT Scan. Already diagnosed cases of abdominal trauma, which need follow up radiological investigations and are referred to our radiology department, will be included in study.
3. Patients coming for X ray, USG and CT Scan for other diseases, and are accidentally found to have abdominal lesion due to trauma, will be included in this study.
4. Sample size will be of 50 patients.

EXCLUSION CRITERIA:

1. Patients presenting to Radiology Department having abdominal lesions due to trauma in the past and are cured completely are excluded from the study.
2. Patients not consenting for the investigation.
3. Patients who are unable to cooperate for the procedure.

Description of Tools:

1. X-Ray Machine:	600 mA Siemens
	500 mA Siemens
	300 mA Siemens
CR system:	Kodak/AGFA
2. USG	Philips HD 7
	Philips HD 9
3. CT scan Machine:	Siemens emotion 16 slice MDCT

RESULT AND DISCUSSION

The challenge in the imaging of abdominal trauma is to accurately identify injuries that require early exploration and at the same time avoid unnecessary operative intervention in cases that can be managed conservatively.

In recent years CT and US have to a great extent replaced all other modalities of investigation. But both have their limitations. In spite of diagnostic superiority, availability of CT is still limited and it also requires stable patients. On the other hand, inability to consistently detect pancreatic, bowel and mesenteric injuries and inability to functionally assess the kidneys and frequent interference by gaseous distension and associated bone or soft tissue injuries are major limitations of US .

This prospective study of fifty cases of blunt abdominal trauma was carried out by,

USG(real time ultrasound) and CT (computed tomography).

Forty six (46%) patient were in the age group of 21-40 years, which is the most active span of life.

The incidence of trauma was much among and most common made of trauma was road traffic accident, followed by fall from height.

Of all the patient, 45 had abdominal organ injury and hemoperitoneum. The most common organ injured were spleen and liver followed by kidney.

X-rays raised suspicion about left upper abdominal injury, probably spleen or left kidney, but were not accurate in diagnosing splenic injury. Splenic injuries can be detected on ultrasound, While CT remains an accurate method of identifying, classifying and quantifying it, but decision of laparotomy remains on hemodynamic stability of patients. USG showed sensitivity of 64.7% and specificity of 97% in diagnosing splenic injury. CT scan remained the gold standard modality for diagnosing the splenic injury.

For diagnosis of liver injuries, ultrasound is efficient in detecting liver injuries with sensitivity of 64.7% and specificity of 100%, but CT plays important role in detecting organ injury, characterize its type, location and extent of injury, which influences treatment plan. For patient treated conservatively, ultrasound is valuable in follow up studies.

For diagnosis of pancreatic injuries USG and CT scan play important role and compliments each other. USG showed sensitivity of 66.7% and specificity of 100%. CT will be better modality and characterization of injury and also for follow up studies.

Renal injuries can be efficiently diagnosed on USG but functional assessment cannot be done with it.USG had sensitivity and specificity of 45.5% and 92.3% respectively . On the other hand, CT detects renal injuries, its type, extent and also demonstrates renal functions with higher sensitivity and specificity. For follow up, Ultrasound is an efficient modality.

For detection of other abdominal and pelvic organ injuries such as ureter, CT is a better modality in sensitivity and specificity than USG.

For the detection of urinary bladder injury, USG showed 25% sensitivity and 100% specificity. CT scan was 100% sensitive and 100% specific. CT scan provides additional assessment of bony pelvic trauma.

For detection and characterization of bowel and mesenteric injuries, CT scan is moderately sensitive and specific but USG is much less sensitive and specific. The presence of free intraperitoneal fluid on USG in the absence of solid organ injury should raise possibility of bowel and mesenteric injury.

CT has an upper hand over ultrasound for diagnosis of retro peritoneal hematoma and it also detects injuries to adjoining bony structures.

For detection of free intra peritoneal fluid USG showed sensitivity of 93.3% and specificity of 100%%, USG was not been able to find the eitiology of free fluid though, while CT scan showed 100% sensitivity

and 100% specificity in detecting intra peritoneal free fluid .

For detection of pleural injury, CT scan showed 100% sensitivity and 100% specificity in diagnosing pleural injuries.

In this study, USG showed sensitivity of 100%, specificity of 62.5% and overall accuracy of 94% as compared to that of CT, which showed sensitivity of 100%, specificity of 100% and accuracy of 100% in detection of free intra peritoneal fluid.

CT scan showed an upper hand in diagnosing retro peritoneal hematoma and pso as hematoma.

CT scan diagnosed all the solid organ injuries except in 1 patient of diaphragmatic injury, CT raised a suspicion of diaphragmatic injury in the form of detecting subphrenic collection and raised dome of the left diaphragm and in another patient CT scan missed mesenteric tear but had diagnosed ileal perforation in the same patients. CT scan also gave details about basal consolidation and lung window better than X-ray or USG.CT scan gave details about vertebral fractures which were missed on X-ray.

Hence , it was calculated from my study, USG showed overall sensitivity 57.48%, specificity 97.77%, positive predictive value 88.9125, negative predictive value 97.185 and accuracy of 90.75%.

CT scan showed highest sensitivity of 95.35%, specificity of 100%, positive predictive value of 100%, negative predictive value 77.78% and accuracy 96%.

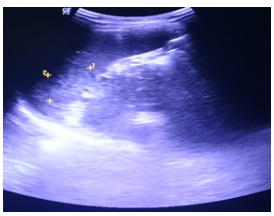
We conclude that X-rays findings if negative do not suggest that there is no abdominal trauma and could be replaced by CT scanning of abdomen and lower thorax , but cost-effectiveness remains the main issue, USG gave us an fair information about most of the solid organ injuries and could be easily used in pregnant females and is cost-effective , but USG could not give the extent of the injury in lot of patients, USG also could not give any information about the bony injury cuts or lower lung injury and could not help classify the injury.

CT scan was the most sensitive and most specific modality in the patients with abdominal trauma patients. CT scan helped in classifying the injury and thus helped in management of these patients, prevented lot of unwanted laprotomies and saved lot of lives by giving a correct classification and thus timely laprotomies.

CONCLUSIONS

FAST is useful as the initial diagnostic tool for abdominal trauma to detect intra abdominal fluid. Indications for diagnostic peritoneal lavage are becoming more restricted. In haemo dynamically stable patients, the diagnostic modality of choice is CT scanning. These three modalities are complementary and not competitive. Their usefulness is maximized when they are applied properly within defined clinical algorithms.

CASE: 1



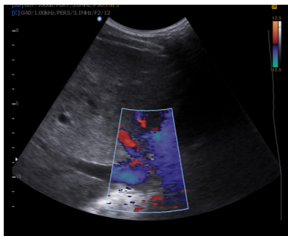
Case 1:USG of patient showing splenic contusion at the inferior pole of the spleen

CT scan(axial and coronal) of the same patient showing grade III splenic injury.

X-rays of this patient were within normal limits.

CASE: 2

USG of the patient showing acute hematoma

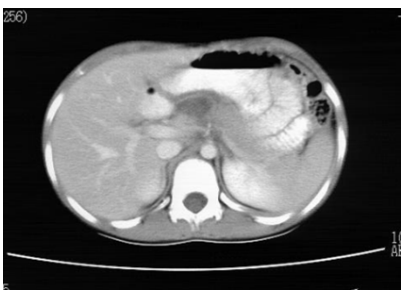


Doppler USG of the same patient , showing hematoma extending to middle hepatic veins.

CT scan of the same patient showing grade V liver injury and hemo peritoneum.

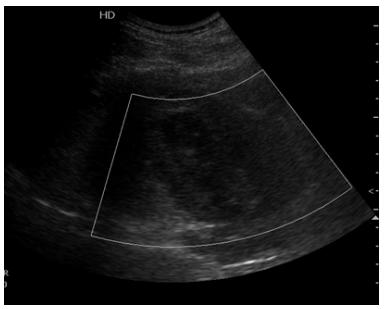
CASE: 3

USG of this patient shows collection of fluid in the pancreatic head region.

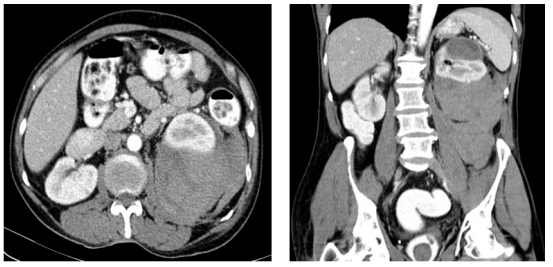


CT scan of the same patient shows fracture of head of pancreas. grade V pancreatic injury.

CASE: 4

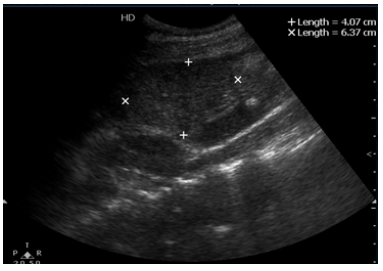


Case 4 :USG of the patient showing subcapsular collection , compressing the kidney causing page kidney.



CT scan(axial and coronal) of the same patient showing grade II renal injury(extensive subcapsular and perirenal hematoma)extending toleft psoas muscle and causing compression of the left kidney. X-rays of this patient were under normal limits.

CASE: 5



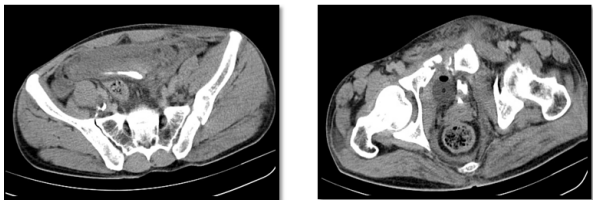
Case 5: USG showing retroperitoneal hematoma

CT scan(Axial cuts) of the same patient showing retroperitoneal hematoma and perinephric fat stranding.

CASE: 6

Case 6: X-ray of pelvic with both hips shows multiple pelvic fractures and pelvic diastasis.

USG of the same patient showed free fluid in the pelvis.



CT scan of the same patient (Axial cuts) showed both intraperitoneal as well as extraperitoneal bladder rupture , that is grade V bladder injury.

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