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A Prospective Study to Assess the Accuracy of Diagnostic Focussed Abdominal Sonography For Trauma (Fast) In Blunt Abdominal Trauma Among the Patients Presenting To Govt Rajaji Hospital Madurai

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Abstract
Background & Objective: *In view of increasing number of road traffic accidents and blunt abdominal injury and its lethal & fatal complications ,FAST is an essential and necessarycomponent of trauma management.Hence this study is undertaken. The ObjectivesOf Our Study Were To Asses The Diagnostic Acuracy Of Focussed assessment with sono graphy in detecting intra abdominal free fluid after blunt abdominal injuries..*
Methods: *Govt.Rajaji hospital ,Madurai, admits all the victims of Blunt Abdominal Trauma in Trauma ward. 50 consecutive patients with history of blunt abdominal trauma attendingor taken to our hospital 01/01/2016 to 31/12/2016 were included in the study. Inclusion and exclusion criteria were defined,and applied to all patients.All the 50 patients wereunderwent FAST protocol examination for evidence intra-abdominal free fluid.Patients were grouped in to 2 categories based on presence of free fluid (FAST +ve) and absence of free fluid (FAST -ve).FAST findings were compared with gold standards like laporatomy findings and in conservatively teated patients , with CT scan findings. Stastical analysis was done by Sensitivity and Specificity.*
Results: *50 patient with history of blunt abdominal truama were included in the study , out of which 36 wre males and 14 wre females.Most of the petients in the age group of 20-50 yrs.RTA was the most comman mechanism of trauma seen in 35 patients.30 patients presented with hypotention . FAST findings were positive in 38 patients and negative in 12 patients.34 patients were underwent laparotomy and 16 patients were treated conservatively. Specificity of FAST was 100% in comparison with laparotomy findings and 60% when compared to CT findings.The sensitivity was 84% comparison with laparotomy findings and 72% when compared to CT findings. FAST has +ve predictive value of 100% and 80% in comparison with laparotomy and CT Scan findings respectively.The negative predictive value of FAST found to be 16% and 50% in comparison with laparotomy and CT Scan findings respectively.*
Keywords: *Blunt abdominal injury, focussed abdominal sonography,ultrasonography.*

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I. Introduction

FAST (Focused Abdominal Sonography for Trauma) or focused assessment with sonography in trauma is an emergency Ultra sound investigation, done by the radiologist, emergency physician, and trauma surgeon for the patients with Blunt Abdominal Trauma. The need of diagnostic ultra sonography to assess the blunt injury patients for abdominal trauma has been realised. But only after late 90's that surgeons doing abdominal scan for a trauma as an emergency tool was first executed. After that, many prospective studies have illustrated the usage and merits of using abdominal scan in the earlier work-up of the blunt injury patient. After that, increasing interest in this scanning has developed among trauma care surgeons, emergency physician, and nurses. Many results on abdominal Ultra sonography in injury has insisted its use in earlier investigating tool, a screening modality, or an additive study adjunct to CT scan or diagnostic peritoneal lavage (DPL). A few surgeons with good knowledge

in the utility of Ultra sonography in trauma using it almost indulgly as a diagnostic modality for assessing the injury.It may be that as trauma care surgeons attain good knowledge in their own sono graphic skills, they purely rely on admission and first scan as the best diagnostic tool for the acute abdomen due to trauma.

Focussed abdominal sono graphy for trauma patients (FAST) depends on the identification of free fluid either haemoperitoneum or gastro-intestinal contents to detect patients with trauma. Blunt abdominal injury patients with intra abdominal insult those not having haemo peritoneum, or those having haemo peritoneum unidentifiable on admission, may be a missed injury or a delayed diagnosis. The objectivs of our study is to assess the diagnostic accuracy of Focussed Abdominal sono graphy for Trauma in indentifying the intra-abdominal fluid following blunt abdominal trauma. and to define the usage of FAST in the Imaging and utility protocols of the blunt injury victims.

Focussed abdominal son ography in Trauma (FAST) is the useful investigation of choice in many trauma care centers for blunt abdominal trauma . Since from 1995,there are many reports that justify the many merits and the well known fit falls of D P L (Diagnostic peritoneal lavage and C-T Scan , have led to a increasing interest in FAST Examination in many trauma care centers in western countries. After their novel contribution in evaluating Fast many trauma centers in America and Canada Has done prospective studies in FAST. Their study concluded that FAST in trauma centers is an accurate in assessing intra abdominal organ injury. Further, their reports have analysed and gave a suggestion that FAST is an extra ordinary screening tool that could be easily learnt and reliably be performed by non radiologists like trauma physicians , surgeons ,etc,. Even though these studies favour the usage of FAST is accurate still it needs some training programmes in non radiologist[1]. Emergency trauma care physician and trauma surgeons, can perform this ultra sound as it is a focussed, and limited easy technique to give answer for one simple and important question , That is the presence of free fluid in the abdomen or not. The Key tool in this study is simply the evidence of free fluid in abdominal cavity not merely answering the grade of organ injury or type of injury and the specific organ injury.

But USG is not much useful in early identification of perforaton in hollow visceral injury , or laceration in solid organs .Also the mere absence of collection of fluid won't exclude the serious intra-abdominal injury.

Ultra sonogram has the merits of Being

1. non-invasive,
2. can be rapidly performed, 3.readily repeatable,
4. Cheap

Further medical or surgical management is decided according to the clinical condition of the patient whether stable or unstable. Now there is An increasing interest among the trauma care providers regarding Ultra sono gram (FAST) training, acquiring the skills, and are utilising US in their routine investigatory tools for blunt trauma abdominal assessment

The identification of abdominal injury after polytrauma Still remains a major diagnostic challenge. The FAST has been accepted as a useful and reliable screening test in many trauma centers in North America.The FAST has been found to be a Quick, costless, portable, and an accurate test.But still many countries diagnostic peritoneal lavage (DPL) and computed tomography (CT) remains the gold standards in assessing the blunt abdominal injuries. D P L (Diagnostic peritoneal lavage) is an invasive procedure with it's own recognized contraindications and complications and still it is occasionally more sensitive than FAST in certain conditions.In addition ,C-T Scan exposing the person for radiation that is contraindicated in pregnant patients Also the need of costly and nephrotoxic radiographic contrast, is time-consuming and expensive, and is limited only to stable patients. Because of the perceived merits of FAST and the demerits of DPL and C-T have led to a increasing interest in FAST in many trauma care centers[2].

Trauma causes an estimated 10% of the worldwide deaths and is the 3rd commonest cause of death in first four decades of life (1-44 yrs) and potentially the leading cause of loss of life years. FAST (Focussed assessment with the sono graphic examination of the trauma patient) protocol examination reviewing abdo minal quadrants for collection free fluid is an reliable tool in the initial evaluation of the acute abdomen patients[3].In view of increasing number of vehicular accidents and blunt abdominal injury and its lethal & fatal complications, FAST is an essential and necessary component of trauma management. Hence this study is undertaken.

To date," many studies of abdominal Ultra sonogram have been inconclusive for several reasons, including the frequent lack of a gold standard test, the inclusion of both penetrating and blunt injuries, the use of small sample sizes, and the study of patients with a low severity of injury". Hence a more precise evaluation of FAST was required and forms basis for this study. The purpose of this prospective study was to compare FAST, aimed at the identification of free intra peritoneal fluid, to the other gold standards, i.e., Laparotomy findings in operated patients and CT scan findings in conservatively treated patients of blunt abdominal trauma.

II. Aims & Objective

Patients with history of blunt abdominal trauma present with variable clinical manifestations and will have diagnostic dilemma in detecting significant intra-abdominal injury and in decision making for the requirement of urgent surgical intervention so, a standard and cost effective investigation or screening test is to be identified, its accuracy has to be defined and later implemented on the trauma victims. This background has formed the aim of this study. Purpose of this study is to assess the accuracy of FAST (Focussed Abdominal Sonography in Trauma) protocol examination for the identification of fluid in the abdominal cavity. (haemoperitoneum / intestinal contents) following blunt trauma to abdomen.

III. Methodology

Govt Rajaji Hospital Madurai admits all the victims of trauma, which includes the trauma victims with an blunt injury abdomen. Pt's with history of blunt injury abdomen attending or taken to Govt Rajaji hospital from o1/01/2016 to 31/12/2016 where included in this study. A verbal consent was taken from the conscious patients and unconscious patients Directly entered this study without any consent of the patient's attender's consent. The sample size was 50.all the consecutive patients presenting with blunt abdominal trauma were included in the study. Inclusion and exclusion criteria for Including and excluding the patients in the study were defined and were applied to the patients.

Study design ---An Analytical study.

Source of Data: 50 Consecutive patients presented with history of blunt abdominal trauma to Govt Rajaji Hospital, Madurai based on comprehensive history and physical examination, subjected to FAST Examination and later taken up for

Surgery or managed conservatively.

Sample size: – 50 patients with history of blunt abdominal trauma.

Inclusion criteria :

1. Patients presenting with h/o blunt injury to abdomen were included.
2. Pt's with a h/o of Blunt injury abdomen associated with intra abdominal injuries (polytrauma) were also included.

Certain patients in whom some adverse factors, which affect the view quality Of ultra sonography, and influence the outcome of results were excluded from the study.

Exclusion crieteria :

1. Known cases of ascites.
2. Previous history of liver abscess or anyother intra-abdominal abscess/cysts.
3. Post-operative cases (3 months)
4. Pregnant women

In our study we performed FAST protocol examination in 50 consecutive patients with blunt abdominal trauma. the ultrasound machine (mindray6600) situated in the casuality, with which the FAST scans are performed as bedside procedure for patients with Blunt abdominal trauma All the patients with the History of BAT were screened by FAST Examination for Evidence of intra-Abdominal free fluid .The FAST Scan was performed in the casuality during resuscitation .FAST scan will not disturb the management of patients.

IV. Statistical Analysis

Fast Findings / Examination	Intra Operative/Ct Findings For Free Fluid		
	Positive	Negative	Total
Positive	A	B	
Negative	C	D	
Total			

About fifty patients with blunt abdominal injury are studied with Fast examination. Based on the existence of free fluid patients are divided into FAST positive or FAST negative. They are compared with intra operative findings of free fluid and ct scan findings of free fluid in conservatively treated patients.

Thesensitivity= a// (a+c) x 100 =_____%
I.e., fast +ve / lap +ve =true positive.
The specificity = d //(b+d) x 100 =_____%
I.e., fast –ve / lap –ve = true negative
The+ve predictive value= a// (a+b) x 100 =_____%
I.e., lap +ve / fast +ve
The-- ve predictive value = d// (c+d) x 100 =_____%
I.e., lap –ve / fast –ve

Results Will Be Compared By Calculating Sensitivity And Specificity.
Sensitivity:
It is considered as a statistical index of Diagnostic accuracy of a given test. It is defined as the ability to identify correctly all those who have the disease.(TRUE POSITIVE) .
Specificity:
It is defined as the ability to identify correctly all those who have not the disease.(TRUENEGATIVES).

Predictive value:
The performance of a screening test is measured by its "predictive value "which reflects the diagnostic power of the test. This depends upon the sensitivity specificity ,and prevalence of the disease.The more the prevalence the more will be the accuracy of the predictive value of positive screening test

V. Results

Table No.01: Sexwise Distribution Of Pt's With Blunt Injury Abdomen

Sex	No Of Cases	Percentage (%)
Males	36	72
Females	14	28
Total	50	100

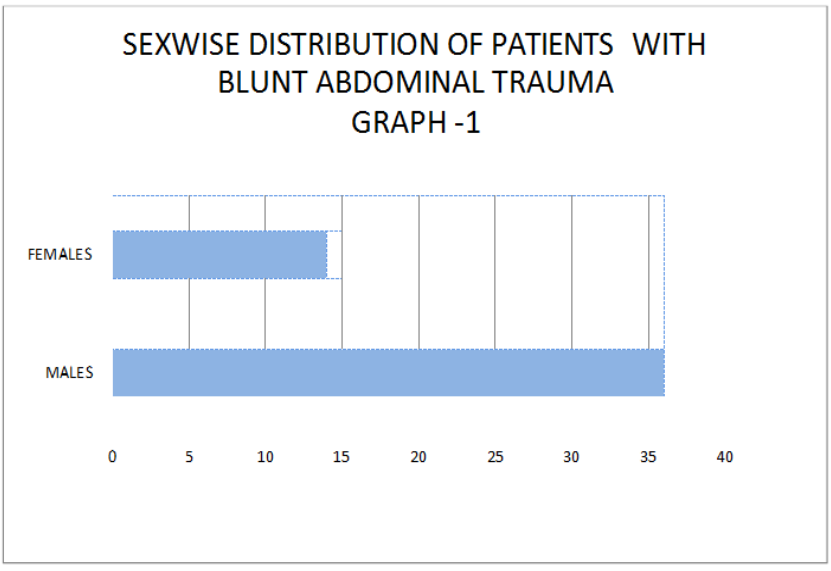

Table No.02: Agewise Distribution Of Patients With Blunt Abdominal Trauma

Age	No Of Cases	Percentage (%)
0-10 Yrs	4	8%
11^{th}-20^{th} Yrs	9	18%

21st-30th Yrs	16	32%
31st-40 Yrs	10	20%
41st-50 Yrs	5	10%
51st-60 Yrs	2	4%
61st-70 Yrs	4	8%

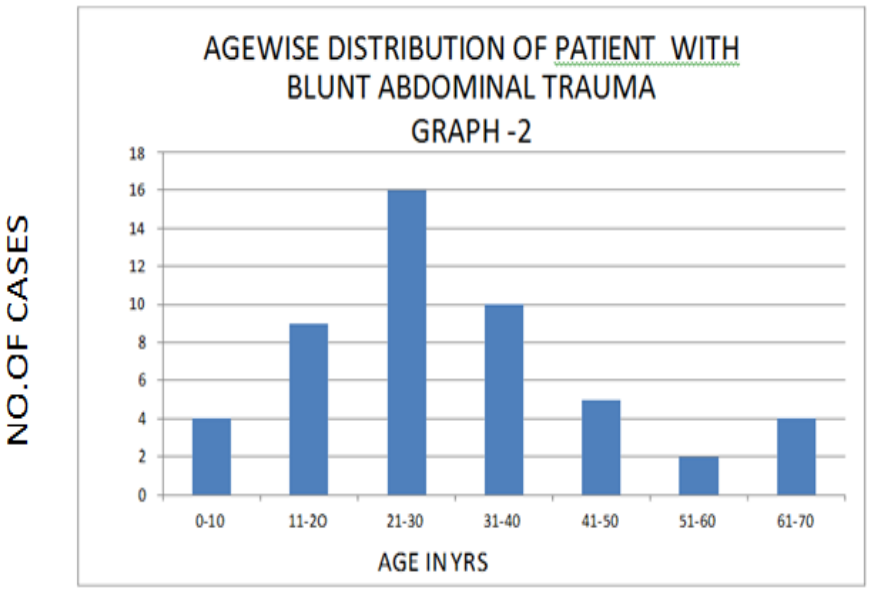

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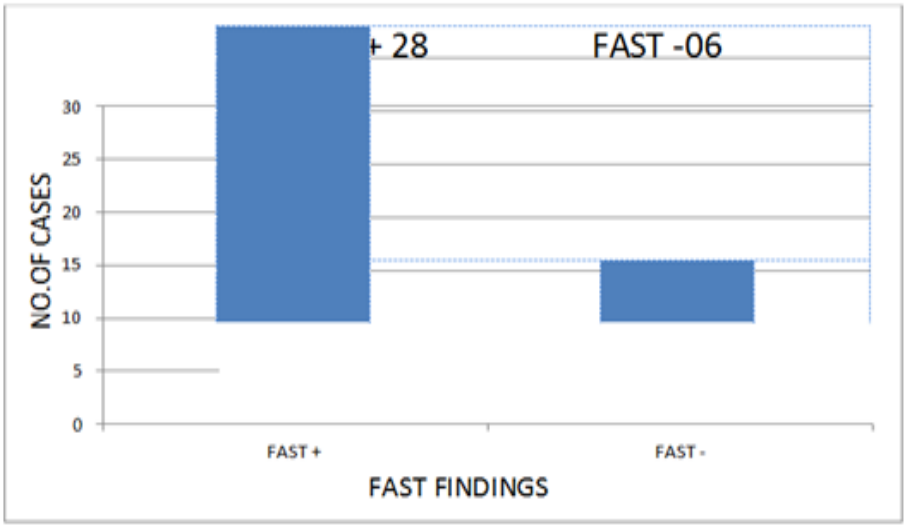
Table No.03: Distribution Of Patients With 'Blunt Abdominal Trauma' Depending On The Mechanism Of Trauma

Mechanism Of Trauma	No Of Cases (N=50)	Percentage (%)
Rta	35	70
Accidental Fall	08	16
Assault	07	14
Others	00	00



Graph 04: Distribution Of Patients Based On Presence Or Absence Of Free Fluid In Operated Cases

Graph 05: Distribution Of Patients Based On Evidence Of Free Fluid In Non-Operated Cases

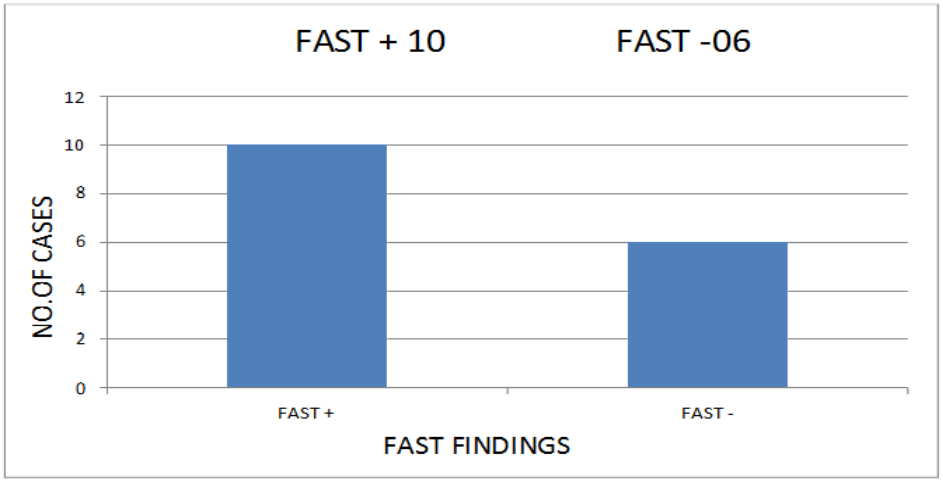


Table No.04: Fast Examination Observation In Detecting Free Fluid In Abdomen In Comparision With Intra Operative Findings

FAST EXAMINATION FINDINGS	INTRA OPERATIVE FINDINGS		
DISEASE	POSITIVE	NEGATIVE	TOTAL
POSITIVE	28	00	28
NEGATIVE	05	01	06
TOTAL	33	01	34

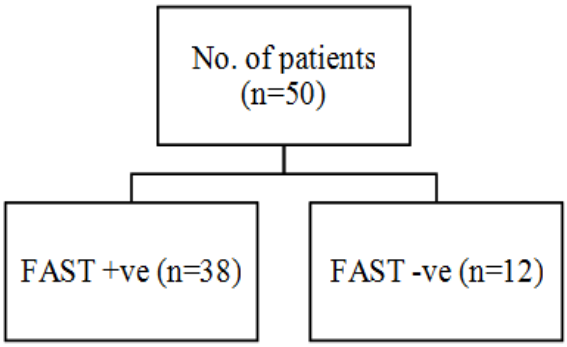
Sensitivity : 84%
Specificity : 100%
Positive Predictive Value : 100%
Negative Predictive Value: 16%

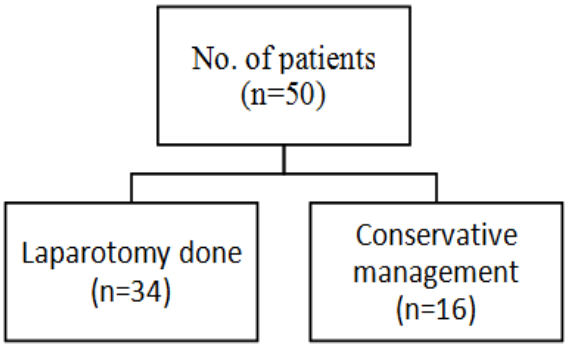
Table No.05: Fast Examination Observation In Detecting Free Fluid In Abdomen In Comparision With Ct Scan Findings

FAST EXAMINATION FINDINGS	CT SCAN FINDINGS		
DISEASE	POSITIVE	NEGATIVE	TOTAL
POSITIVE	08	02	10
NEGATIVE	03	03	06
TOTAL	11	05	16

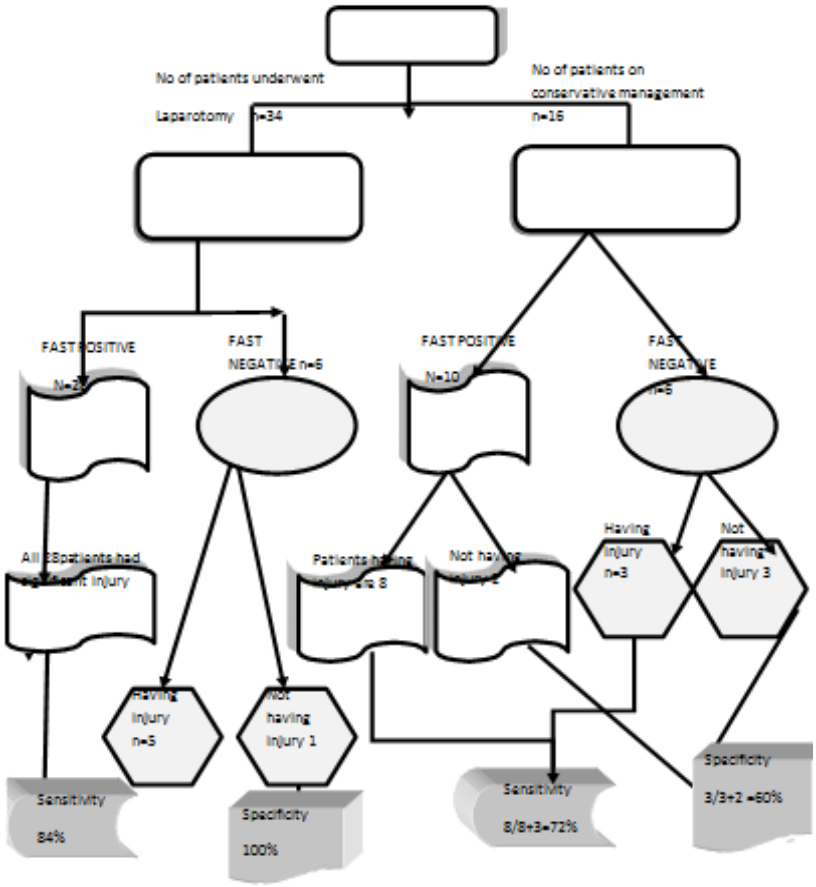
Sensitivity : 72%
Specificity : 60%
Positive predictive value : 80%
Negative predictive value: 50%

VI. Results





Results



- 50 patients with history of blunt abdominal injury were included in the study, conducted from 01-01-2016 to 31-12-2016, out of which 36 were male and 14 were females. Mostly the patient were in the age of 20-50 yrs.
- RTA was the most common mechanism of trauma seen in 35 patients. 35 patients presented with hypotension and hemodynamic instability.
- FAST findings were positive in 38 patients and negative in 12 patients. 34 patients underwent laparotomy and 16 patients were treated conservatively. Out of 34 patients who underwent laparotomy, 28 patients were FAST positive and 6 were negative.
- All 28 patients had significant intra-abdominal injury & among 6 FAST negatives, 5 patients had injuries and 1 patient did not have any injury(True negative).
- Splenic and hepatic injury were the most common organ injury. Among 16 conservatively treated patients, 10 were FAST positive and 6 were FAST negative.
- Out of 10 FAST positives, patients having injuries are 8 and patients not having injuries are 2 ..
- Out of 6 FAST negatives, Patients having injuries are 3,and patients not having injuries are 3 .
- Average time taken for each FAST Scan was 10 minutes.
- Specificity of FAST was 100% in comparison with laparotomy findings and 60% when compared to CT scan findings. The Sensitivity was 84% in comparison with laparotomy findings and 72% when compared to CT scan findings.
- FAST has the +ve predictive value of 100% and 80% in comparison with laparotomy and CT scan findings respectively. The negative predictive value of FAST was found to be 16% and 50% in comparison with laparotomy and CT scan findings respectively.

VII. Discussion

In our study FAST was done in 50 patients with blunt abdominal trauma were included . of which 38 patients have free intra peritoneal fluid (FAST POSITIVE).Among the FAST +ve only 28 had significant intra abdominal organ injury in 34 laparotomy patients . The sensitivity was found to be 84 % . This implies the diagnostic aauracy of FAST. FAST NEGATIVE patients were 6 and they are put in to conservative management. These patient's results are compared with C-T scan findings .Among 6 patients 5 patients have minor intra abdominal injury but one patient did not have any injury. The specificity was found to be 100%. That is the diagnostic efficacy in detecting the true negatives (those who do not having the injury) When comparing this study with another study (Soffer et al)(2006) Which showed USG to have 89% sensitivity and 97 % specificity. This almost consistent with our study.

In other study detecting free intra abdominal fluid when comparing with Diagnostic peritoneal lavage and C-T scan & laparotomy, Fast's sensitivity is 85%, specificity is 96% and -ve prediictive value is 96%(16 study, 6354 patients, 1994 to 2002)[7,8,9]The Amount of fluid that can be detected (minimal ml) is 75 ml.[10] There is always an inadequate and in accurate clinical examination of abdomen in a case of abdominal injuries due to altered levels of consciousness, patients various reactions to the clinical examination in intra abdominal injuries. Hence a prompt screening and best diagnostic test is mandatory in the management of B A T. That test should be easy to work, reliable in interpretation, and that should give an efficient discrimination Whether to operate or not on the patient. Speedy USG screening test to detect the mere presence or absence of intraperitoneal free fluid and intra pericardial free fluid comprising the focused assessment with sono graphy for trauma (FAST) testing. FAST is becoming a gold standard diagnostic test in emergency trauma care centers. The advantage of FAST in trauma centre lies in it's rapidity ,portablility , noninvasiveness, and best even in the hands of trained personnals also include the repeatability in detecting the intra cavitory heamorrhge and internal organ leak. Bouelenger and associates reported that FAST examination has occupy the position of D P L in many of the trauma care centres The aim (or) goal of Fast is to identify the free fluid in the abdominal cavity as a standard pointer of intra abdominal injuries . Recently in trauma care practice FAST has been taken for a two cogrous role .

First one is it's rapid identification of internal injury in a very unstable patient and the need for an emergency laparotomy. The second one is that even though a controversial one, it excludes the stable one for further imaging modalities like C T Scan with or without contrast enhancing. Instituitional trauma care centers have accepted fast's has the role of both. Hence fast + ve unstable Pts were operated and fast's –ve Pt's were put in the protocol of conservative management.

The results of Fast's are interpreted according to the findings of sonogram and history taking and abdominal examination. Recently authors uses the H H FAST (Hand Held FAST)[4]. This Porrtable hand – held (H-H) ultrasonography (U-S) machines becoming more popular and easily available for emergency physicians.This aids better , easy ,and acceptable tool in an emergency ward and in mass casuality [4] In an international meet, emphasized that the role of portable and compact USG unit.in the diagnosis of organ damage in abdominal trauma.Krikpatric et . Al have reported about their role in fast using a Hand Held USG unit in the assessment of trauma in various Amerrican centers. But care should be taken that this Hand Held units should be accompanied by a floor unit in certain situations. Interpretation of results includes the best clinical examination and history taking. Fast examination has been utilized exclusively for indentifying the intra peritoneal free fluids. Various studies have mentioned about the efficacy of Fast by emergent- logists, radio-logists and the trauma surgeons in detecting the intra peritoneal fluid with higher degree of accuracy[5]. Lethal intra-abdominal injuries may occur without the existence of free fluid within the peritoneal cavity. 'Their study asked, How good are both examinations at finding fluid, did this fluid correlate with injuries, and did these injuries require intervention?'.Blunt trauma pilot cohorts of 46 patients from Vancouver and 61 patients from Detrroit, as well as a separate penetrating abdominal cohort have previously been reported[6].Some time potentially dangerous injury can occur even without the collection of free fluid. some study evolving in to the efficacy in detecting the fluid and it's correlation with the organ injury.

The Summary of FAST –vs- CT Scan -vs- Diag. Peritoneal Lavage.

Quickness(speed)	:FAST>> D PL>>C-T Scan
The Sensitivity	: DPL>>C-T Scan & FAST scan
The Specificity	:C-Tscan>>FAST>>DPL
Identifying the injury	:CT>>FAST>>DPL
Easy/portability	: FAST>>DPL>>C- Tscan
Safety	:FAST>>C-Tscan>>D P L
Cost	:DPL<<FAST<<C-Tscan

VIII. Conclusion

1) 'Blunt abdominal trauma' is commonly seen in male population.
2) 'Blunt abdominal trauma' is commonly seen in the age group of 20-50.
3) The most frequent risk factor or mechanisms causing blunt abdominal injury are Road Traffic Accidents.
4) The usual clinical presentation of Pt with Blunt Injury abdomen with history of blunt abdominal , pain abdomen and hypotension. In our study almost all of the patients presented with pain abdomen and 35 patients out of 50 were presented with hypotension.
5) The average time taken for FAST Scan was 10 minutes.
6) Splenic and liver injury were the most frequent organ injury.
7) The sensitivity of FAST Scan is 84% (No of true positives) i,e,. those wno are having intra abdominal organ injury when compared to laparotomy findings in FAST positive patients. and 72% of patients in comparison with CT scan findings in conservtively treated patients who were opted for C-T Scan.
8) The specificity of FAST Scan is 100% (true negative patients i.e., those patients who are not having any injury) in comparison with laparotomy and 60% in comparison with CT scan findings of free fluid in conservatively treated patients..
9) The positive predictive value of FAST Scan is 100% when compared to laparotomy findings and 80% in comparison with CT scan findings.
10) The negative predictive value of FAST Scan is 16% when compared to laparotomy findings and 50% in comparison with CT scan findings.

Overall it was noted in the study that FAST has the high specificity that is, it is useful in detecting the patients who do not have the disease, in our studyIt can be concluded that FAST is a useful diagnostic modality in patients with blunt abdominal injury with haemodynami instability. Patients with FAST findings positive for free fluid and haenodynamic instability should be taken up for urgent operative intervention that is Exploratory Laparotomy and proceed. But in stable patients CT scan is the investigation of choice and the patients can be observed and managed non operatively.

IX. Summary

The clinical assessment of blunt abdominal injury in an acute emergency ward still a major diagnostic problem. Per Abdominal examination does not yield a proper diagnosis In all case, especialy in a severely injured and unconscious patient. Various investigations used are diagnostic peritoneal lavage (DPL) and C- T scan both of which have disadvantage. The reliable, and perfect preoperative tool in the treatment of patients with blunt abdominal trauma is to assess whether To operate or notice necessary and not the exact organ of injury.– BY Polk Presence of free fluid in trauma patients could best be assessed by focuses abdominal USG. And mostly the Fluid is blood in cases of trauma .due to internal organ injury and bleeding. Various meta analysis reported that surgeons , emergency physicians , and Trauma nurses can do a best and accurate USG in the assessment of Fast in BAT if properly trained.

Interpretation & Conclusion

In our study we noted that the most common cause or mechananism of trauma causing blunt abdominal trauma was Road traffic accidents. Males were most commanly affected. The average btime taken for FAST examination was 10 minutes . Most of the patients prewsented with pain abdomen and hypotension Splenic and Liver laceration were the most common organ injury. FAST has the 84% diagnostic accuracy in detecting the organ injury in blunt abdominal trauma. We conclude that the advantage of FAST protocol is harmless ,non-invasive quick,portable,accurate, repeattable and can be done during resuscitation.It does not interfere with other investgations especially in hemo dynamically unfit patients.

The diagnosis of internal organ injury in trauma patients is still a difficult thing.And it aids in the prompt management and it gives a better trauma outcomes.Avoiding the negative laparotomies .Diagnotic peritoneal lavage is outdated as there is still a chance of injury to the intra abdominal organ injury& is time consuming.Also fluid introduction in to the peritoneal cavity may interfere with further imaging modalities.But used to the type of fluid collection intra peritonealy whether urine in bladder injury , blood in solid organ injury ,bilious in small bowell injury , fecculant in large bowel injury.With this knowledge we could try with conservative treatment in a stable patients.In CT scan it can visualize the intra abdominal pathology in detail, but the diaadvantage of ct scan is its location, It is uaually located at a distance from the emergency department, the patient has to be stabilized before transferring. When using a double contrast medium, it usually consumes time of about 40 mins to 1 hour for scanning.

The protocol for FAST examiantion has been followed in the United States. Four view scanning techniques has been utilized by them. The four views are as follows, sub-xiphisternum, morrisons pouch, left upper quadrant, and suprapubic. Some other protocols has been developed to image the parcolic gutters. But there is no much significant benefit by including the paracolic gutters in fast. The main aim of FAST scan to identify the evidence of free fluid in the abdomen. But a –ve scan wont rule out any internal organ injury.Presence of fluid indicates massive intra abdominal bleeding Conclusion from this study includes the FAST examination as one of the precious tool in the resuscitation process. The reports will not be shown to the trauma team members and will not contribute to patient management decisions.

In our study we noted that Road Traffic Accidents was found to be the most common cause for B A T. The average time taken for FAST Examination was 10 minutes. Pain abdomen and hypotension was found to be the most common presentation. Most of the patients presented with Splenic injury, which is the most common organ injury. We conclude that the advantages of FAST Protocol are that it is non invasive,quick, portable, accurate and could be done during resuscitation. Its use doesn't have a higher hand over other investigations especially in hemodynamically unstable patients.

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