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EVALUATION OF BLUNT ABDOMINAL TRAUMA, ULTRASOUND VERSUS DPL:

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ABSTRACT:

Background: Evaluation and management of patients with blunt abdominal trauma provide one of the challenging task to a general surgeon.
Currently Focused Abdominal Sonar for Trauma (FAST), Diagnostic Peritoneal Lavage (DPL) and emergency CT-Scan of abdomen are used as primary diagnostic modalities in the evaluation of patients with suspected Blunt Abdominal Trauma (BAT). This prospective study has been designed to determine the sensitivity, specificity and accuracy of emergency ultrasound (EUS) and Diagnostic Peritoneal Lavage (DPL)in the assessment of blunt intra-abdominal injuries.
Patients and Methods: This study was carried out on trauma victim patients who reported in the accident and emergency department of G.M.C/Civil Hospital Khairpur Mir's.The purpose of this study was to compare the accuracy of diagnostic ultrasound and DPL in the patients with blunt abdominal trauma.
Results: This study was carried out on 84 patients,the mean age was (33.88%),and male/female ratio was 6:1.
Ultrasonography was done in 60 patients where sensitivity was found (80%), specificity (66.6%) and accuracy (76.6%).
Diagnostic peritoneal lavage (DPL) was done in 24 patients where over all sensitivity was calculated 75%, specificity 60.66% and accuracy 70.83%.
Conclusion: Ultrasonography is superior to DPL in primary evaluation and follow up of blunt abdominal trauma,DiagnosticPeritoneal Lavage(DPL) in an effective screening tool and should be reserved only for haemodynamically stable patients.

Key words: Blunt abdominal trauma diagnosis,ultrasonography DPL.

INTRODUCTION:

Blunt abdominal trauma is a common surgical problem faced in the accident and emergency department of many general hospitals. The abdomen is the third common injured region, where the intensity of injuries require operationsin about 20% of civilian trauma[1] ·Unrecognizable injury to intra-abdominal organs remains a frequent cause of preventable death. The symptoms and signs of these injuries are sometime unreliable and often masked,ifassociated with head injuries, pelvic fractures and other concomitant problems. The blunt force cause a sudden increase in intra-abdominal and intraluminal pressure with disruption of hollow viscus, similarly shearingforce may damage the mesentery[2]. The importance of repeated assessment of a patient with suspected intra-abdominal injury cannot be overemphasized. Early recognition of blunt abdominal trauma in patients with multiple injuries and in state of shock is of utmost importance and requiresrapid screening tool. Failure to detect intra-abdominal injury in the patients with blunt trauma may result in significant morbidity and mortality[3].The diagnostic modalities have a profound effect on management and decision making, because number of patients are

now selectedfor non-operative treatment with less emphasis on immediate surgical intervention.

Focused Abdominal Sonar for Trauma (FAST) and Diagnostic Peritoneal Lavage (DPL) play important role in the diagnosis of intra-abdominal injuries,so many trauma centreshave included the diagnostic ultrasonography as mandatory investigation to their trauma management.Lot ofrecent studies are conducted for prospective trials on the use of emergency ultrasound and DPLin evaluation of blunt abdominal trauma, their clinical outcomes were classified according to their efficacy and diagnostic accuracy. In this study we also have tried to measure the sensitivity, specificity and accuracy of both the diagnostic methods with acceptable results.

MATERIALANDMETHODS:

This study was carried out on 84 patients who reported with blunt abdominal trauma in the accident and emergency department of Sardar Ghulam Mohammad Mahar Medical College/Civil Hospital Khairpur Mir's between 1st August 2011 to 31st December 2012 (18 Months). The purpose of this comparison study is to find out the: sensitivity, specificity and accuracy of emergency ultrasonography (EUS) and diagnostic peritoneal lavage (DPL) in detecting and predicting nature and extent of organ damage in the cases of blunt abdominal trauma. Each patient underwent thorough physical examination to find out the injuries of head,neck,thorax,abdomen, spine and extremities. Rectal examination was also done to detect any blood in rectum. All possible measures were taken to maintain airway of injuredpatient and his intra venous line was established with ringer lactate solution. Nasogastric tube was passed to decompress stomach and to detect any blood in it. Foley's self retaining urethral catheter was passed,provided no obvious sign of urethral trauma was present, likebleeding per urethra or perineal haematoma. X-ray chest, abdomen erect and supine, pelvis were routinely done in every case. In those cases where there was suspicious of head injury and long bones fractures, simultaneously x-rays of skull and limbs were also done. Serum amylase was checked in those patients who have upper abdominal injury with possible trauma to pancreas. In addition to above, certain specificinvestigations werealso carried out in entire series of cases like:

i. Ultrasound abdomen in 60 patients.

ii. DPL (Diagnostic peritoneal lavage) in 24 patients.

Ultrasound abdomen was done in those patients who have abdominal trauma and found in stable as well as unstable condition. This was done in the emergency department by an experienced sonographer present on duty, using a 3.5 MHz transducer machine. Ultrasound was considered positive when it reported free peritoneal fluid or intra-abdominal solid and hollow viscus disruption. All said findings were confirmed and recorded after exploration of abdomen. In other group of patients where ultrasound did not show significant intra-abdominal finding, were admitted in surgical ward for next 3 days and were kept in close observation and managed non operatively.

DPL (Diagnostic Peritoneal Lavage) was done in selected group of the patients who were found stable at the time of arrival andtheir physical signs were inconclusive. This test was carried out either in the minor operation theatre of the emergency room or main operation theatre before exploring the patients. In those cases where surgery was performed, findings were recorded carefully. In this series open technique of DPL was used, the patients laid supine with empty stomach and urinary bladder,one liter of normal saline was drained in peritoneal cavity, with the help of foley's two waycatheter after making 02cms infra-umbilical hole.

After this, patient was tilted on either sides and fluid was siphoned back in empty urinary bag placed on ground and collected sample of lavage was immediately sent to laboratory for cellular count and gram's staining.

CRITERIA FOR POSITIVE DPL:

(i) Aspiration of 10ml or more of gross blood or intestinal contents.

(ii)RBC count > 100,000/mm^3.

(iii)WBC count > 5000/mm^3.

(iv)Turbid fluid with presence of bacteria on microscopic examination.

Exploratory laparotomy was done in the lavage positive patients and the operative findings were recorded on particular proforma, prepared for every patient who wasincluded in this study.

Guidance and help was sought from expert statisticianand standard epidemiological-statisticsbooks for analysis, preparation and solution of collected data[4-5].

RESULTS:

In this study84 patients were included and admitted in the ward. Seventy patients underwent exploratory laparotomy and fourteen patients were treated conservatively. Eight patients expired, out of which sixcases were postoperative and two cases were pre-operative,both of them had pelvic fractures. In those sixpatients,cause of death wasdisseminated intravascular coagulum, haemorrhage and shock, twopatients died due to septicaemia.

Ages: 24 patients (28.75%) were between 15-25 years, 28 patients (33.33%) between 26-35 years, 24 patients (28.57%) between 36-45 years, 4 patients (4.76%) between 46-55 years and 4 patients (4.76%) between 56-65 years of age (table-1) Mean age was 33.88 years.

There were 72 males (85.75%) and 12 females (14.28%). Male to female ratio was 6:1. Motor vehicle accident in 52 patients (61.9%) was most common cause of blunt trauma to the abdomen. Majority of the victims were passengers of commercial and public vehicles.20 patients (23.80%) received blunt abdominal trauma due to fall from height.

12 Patients (14.28%) were hit by a heavy object to their abdomen. Isolated abdominal trauma was reserved to 38 patients (35.18%) and in rest of patients multiple organsand body regions were involved.

At the time when patients were first received in the emergency room, their vitals were checked and recorded routinely. The pulse rate of 12 patients (14.28%) was in between 60-80 per minute, 24 patients (28.57%) was in between 81-100 per minute, 36 patients (42.85%) was in between 101-120 per minute, in 8 patients. (9.52%) it was more than 120/min. and 4 patients (4.76%) did not have palpable pulse. (Table-2).

Systolic blood pressure was 80mmHg in 6 patients (7.14%), in between 81-100 mmHg in 40 patients (47.61%) 101-120 mmHg in 20 patients (23.80) and more than 120 mmHg in 14 patients (16.66%). It was not recordable in 4 patients (4.76%).

Variousintra-abdominal organ injuries were found at the time of exploration, and they were systematically recorded in terms of their frequency. Out of 70 operated cases 30 patients were found to have single organ injury, while in rest of the cases multiple organ injuries were present.

Gastrointestinal tract was involved in 20 cases (22.22%), spleen

TABLE 1.
AGE & SEX WISE DISTRIBUTION

Age in years	Male		Female		Total	
	n	%	n	%	n	%
15-25	22	26.19	2	2.38	24	28.57
26-35	24	28.57	4	4.76	28	33.33
36-45	20	23.81	4	4.76	24	28.57
46-55	4	4.76	0	0.00	4	4.76
56-65	2	2.33	2	2.38	4	4.76
Total	**72**	**85.71**	**12**	**14.29**	**84**	**100**

TABLE 2.
PATTERN OF VITALS (PULSE RATE & BLOOD PRESSURE) AT THE TIME OF PRESENTATION OF PATIENTS IN CASUALTY

Pulse Rate Per Min.	Frequency	Percentage
60-80	12	14.28%
81-100	24	25.57%
101-120	36	42.85%
> 120	8	9.52%
Not palpable	4	4.76%
B.P. (Systolic) mmHg		
< 80 mmHg	6	7.14%
80-100	40	47.61%
101-120	20	23.80%
> 120	14	16.66%
Non-recordable	4	4.76

TABLE-3.
INCIDENCE OF INTRA-ABDOMINAL ORGAN INJURIES

S.No.	Organ	No. Of Patients	Percentage
1	**Gut:** Stomach + duodenum Small gut Large gut	20 2 16 2	22.22%
2	Spleen	18	20%
3	Liver	12	13.35%
4	Diaphragm	8	8.88%
5	Kidney	4	4.44%
6	U.Bladder + Urethra	4	4.44%
7	Pancreas	8	8.88%
8	Retroperitoneal haematoma	16	17.79%

in 18 cases (20%), retroperitoneal haematoma in 16 cases (17.77%), liver in 12 cases (13.33%) urinary tract injuries were present in 8 cases (8.88%) and pancreas in 8 cases (8.88%).

Out of 20 gut injuries, 2 patients had stomach and duodenal injuries, 16 had jejunum and ileal injuries and 2 patients were found with caecal injuries. Urinary tract injuries were present in 8 cases, 4 renal injuries, 2 urinary bladder and 2 urethral injuries. (Table-3)

Out of 60 patients ultrasound abdomen was positive in 45 patients and negative in 15 patients.

Among 45 positive ultrasound, 36 results were true +ve and 9 results were false +ve. On other hand 15 negative ultrasound,10 results were true -ve and 5 were false -ve. In this negative group of 15 patients, 5 patients were later on operated and showed intra-abdominal injuries, so they were considered as false -ve results (Table-4).

All the true positive results were those, where ultrasound reported free intraperitoneal fluid or organ disruption. But in certain cases these findings were overstated and exploration did not confirmed the said injuries (false +ve results).

However Ultrasound can miss the gut injuries, 5 false negative results were those cases where duodenal with pancreatic and caecal injuries were not picked up,but latter on they developed symptoms of peritonitis and required exploration.

Overall ultrasound was 80.0% sensitive, 66.6% specific and 76.6% accurate in diagnosis of abdominal injuries in this study.

In this series DPL(Diagnostic Peritoneal Lavage) was carried outupon 24 patients who were haemodynamically stable and did not need urgent surgical intervention. Out of 24 patients 12 patients showed positive DPL and it was negative in remaining 12 patients. Among 12 positive patients 9 results were true positive and 3results were false positive. All the 9 true positive cases were those, where gut perforationand mesenterictear was present, sotheDPL treated fluid showed gut contents or blood stained effluent. Out of 12 negative DPLresults, 07 results were true negative and 05 results were false negative. Overall DPL was 75% sensitive, 60.66% specific and 70.83% accurate. False negative results were those where

TABLE-4.
RESULT OF DIAGNOSTIC ULTRASOUND ABDOMEN

No. of patients	+ve findings	-ve findings	True +ve (a)	False +ve (c)	True –ve (d)	False –ve (b)
60	**45**	**15**	**36**	**9**	**10**	**5**
RESULT OF DIAGNOSTIC PERITONEAL LAVAGE						
No. of patients	**+ve findings**	**-ve findings**	**True +ve (a)**	**False +ve (c)**	**True –ve (d)**	**False –ve (b)**
24	**12**	**12**	**9**	**3**	**7**	**5**

there were kidney injuriesand retroperitoneal haematoma. 02urinary bladder injuries were also missed by DPL. (Table-4)

DISCUSSION:

This study shows some important aspects of the patients involved in the blunt trauma of abdomen. In our setup we have different social, geographical and financial problems, like we have poor conditions of roads and civilian vehicles. In over crowded cities, large number of vehicles and inadequate traffic system results various types of road traffic accidents. The present study reveals certain interesting observations and results of commonly used modalities in our practice. In this study the mean age group was 33.88 years and the male female ratiowas 6:1. This indicates that young males are more vulnerable to accidents because in our society this is common age group which earns for his family. The most common cause of blunt abdominal trauma was motor vehicle accident (62%), the second common cause was fall from height (23%) and in the rest of the cases industrial accidents and assault on abdomen with some heavy object like iron bars and in some cases concrete blocks were responsible forabdominal trauma. Hot climate, pollution in the atmosphere and drug addiction among the vehicle drivers are other possible causes of increasing road traffic accidents. In this study 38 out of 84 patients (35.20%) were found to have isolated abdominal injuries, remaining cases were associated with injuries to other parts of body as well.

At the time when patients were received in accident and emergency department, 80% of the patients were those, whose pulse rate was more than 90 beats per minute and 55% of thepatients showed their systolic blood pressure less than 100 mmHg. This indicates that majority of these patients present with signs of hypovolemia and shock. Obviously above were those patients who have significant intra-abdominal organ injury,especially to spleen, liver and kidney. In another series elsewhere, patients with blunt abdominal trauma approximately 65% had systolic blood pressure below 80 mmHg on admission to emergencyroom[6].

A rising pulse rate with falling blood pressure, is an extremely important sign of intra-abdominal injury,these patientsshould be carefully handled and properly monitored.

In this series of the patients most common injured organ was gastrointestinal tract. Out of 70 cases which were explored, gut was involved in 20 cases. Isolated injury to only gut was found in 10 cases, rest of them were associated with other organ injuries. This is uncommon because largergroup of series inworld shows spleen as a common organ injured[7]. In this study spleen is next common organ injured, it is involved in 18 cases out of which 12 cases have isolated splenic trauma. Retroperitoneal haematoma is the third common injury present in 16cases,they were also associated with kidney and pancreatic injuries. Urinary bladder and urethra rupture was found in 4 cases both were associatedwith pelvic bone fractures. This observation gives the idea that pelvic fractures have greaterchances to be associated with bladder and urethral injuries.

We examined the efficacy and role of ultrasonography which is now termed as focused abdominal sonar for trauma (FAST) is a technique where ultrasound image is used to access the presence of free blood in six areas: around the liver and the spleen, the left and right pericolic gutter, peritoneal space in the pelvis and the pericardium[8].

Out of 60 patients ultrasound was positive in 45 patients and negative in 15 patients.36 results were true positive and 9 results were false positive. Among 15 negative results 10results were true negative and 5 were false negative. This study has also been compared with multiple World Series studies where ultrasound was done as first choice modality in evaluation of blunt abdominal trauma. In thoseseries result of sensitivity, specificity and accuracy of ultrasound was higher (Sensitivity 89 to 91%, Specificity 96 to 97% and Accuracy 94 to 96%)[9,10,11].

However it is entirely operator experience dependenttest,especiallywhen the patients are obese and bowel is full of gases. Focused abdominal sonar for trauma (FAST) is accurate to detect even a small quantity (more than 100 ml) of free blood in the peritoneal cavity[12].

In this study we have tried to find out the efficacy and role of DPL (Diagnostic Peritoneal Lavage) as well,in the diagnosis of blunt abdominal trauma. Although DPL has been replaced by FAST (focused abdominal sonar for trauma), but still it remains the standard in those institutions where ultrasound facility is not frequently available or the ultra-sonographersare not present in emergency due to any reason.In this series DPL was carried out upon 24 patients who were haemodynamically stable and did not need urgent surgical intervention. Overall DPL was 75% sensitive, 60.66% specific and 70.83% accurate. These results were compared with the other studies of world where the result were found better to series of this study (Sensitivity 98% to 100%, specificity 97% to 99% and Accuracy 94% to 99%)[13,14,15]. Reason behind this difference might be that in our setup we do not perform the DPL as a regular tool for the evaluation of blunt abdominal trauma as compared to other centers where they keep this modality as first choice for the evaluation of closed abdominal injuries. Our experience of doing DPL and its interpretation is still limited. But inspite of these factors over all DPL shows satisfactory results and can be trusted in evaluating the patients with blunt abdominal trauma. This study shows that DPL has high diagnostic sensitivity for hollow and solid intra-peritoneal viscus injuries but less accurate in retroperitoneal and urinary organstrauma.

CONCLUSION:

The diagnosis of intra-abdominal injury in the patients who are victims of blunt trauma is often problematic. Reliable positive physical examination with signs of hypovolemia are highly indicatorsfor possible intra-abdominal injury. Ultrasonography is reliable, cost efficient non-invasive modality and superior to DPL in primary evaluation and follow up of blunt abdominal trauma. Diagnostic peritoneal lavage is an effective screening tool and may be reserved for haemodynamically stable patients.

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