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General Surgery

A STUDY COMPARING THE BLUNT ABDOMINAL TRAUMA SEVERITY SCORING (BATSS) WITH CLINICAL ABDOMINAL SCORING SYSTEM (CASS) IN PREDICTING THE NECESSITY OF LAPAROTOMY IN CASES OF BLUNT ABDOMINAL TRAUMA

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ABSTRACT **Introduction:** Trauma is one of the common causes of mortality and morbidity encountered in routine practice. Abdominal injury is common after extremities and head injury. Early diagnosis and treatment can reduce mortality in abdominal injury by up to 50%. In this regard this study is done to determine Blunt abdomen traumas patient's signs, as well as para-clinical data, and to compare the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS) , in predicting whether a Blunt abdomen trauma patient needs laparotomy or not. **Aims and objectives** To determine Blunt abdomen traumas patient's signs, as well as para-clinical data, and to compare the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS) in predicting whether a Blunt abdomen trauma patient needs laparotomy or not.To evaluate the most common cause of blunt abdominal trauma.To evaluate the impact of blunt abdominal trauma on intraperitoneal organs like liver, spleen and hollow viscera like stomach, small and large intestine.To evaluate various modes of presentation in abdominal trauma. **Materials and methods:** This study was conducted at the Department of General Surgery,MGMGH, Trichy, Tamil Nadu. This study was conducted among patients who sustained blunt injury abdomen and admitted in trauma ward at MGMGH, Trichy. This study was conducted among 100 patients. The study was conducted between October 2020 and September 2021. **Results:** A prospective study was conducted among 100 patients with history of blunt injury abdomen in a tertiary care hospital, Trichy to determine the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS), in predicting whether a Blunt abdomen trauma patient needs laparotomy or not. **Conclusion:** This scoring will help in better triage of the trauma patient on arrival and reduce the need for further imaging and reduce the time interval between arrival and surgical intervention.

KEYWORDS : Blunt trauma,laparotomy,surgery,hemoperitoneum,shock

Introduction:

Trauma is one of the common causes of mortality and morbidity encountered in routine practice. Abdominal injury is common after extremities and head injury[1]. Early diagnosis and treatment can reduce mortality in abdominal injury by up to 50%. The common causes for blunt trauma abdomen includes motor vehicle crashes, direct trauma and fall from heights[2]. Abdominal trauma can be classified basically into two types: penetrating (open) and blunt (closed**)**. The penetrating referred to the entry of the aggressive objects into the peritoneal cavity occurs, in most cases a firearm projectile (gunshot) or a laminated object (stabbing) and it affects directly the viscera. The incidence of abdominal trauma increases with industrialization and rapid development of the rural area thus early and timely evaluations plays significant role in its management. Reports show that more than 50% of mortalities due to blunt trauma abdomen are preventable and hence precise management and in time laparotomy plays a critical role in reducing mortality rate[3].

The knowledge in the management of Blunt Abdominal Trauma has progressively increasing due to the inpatient data gathered from different parts of the world. In spite of the best techniques and advances in diagnostic and supportive care, the morbidity and mortality remains at large. The reason for this could be due to the interval between trauma and hospitalization, delay in diagnosis, inadequate and lack of appropriate surgical treatment, post-operative complications and associated trauma especially to head, thorax and extremities. The diagnosis of abdominal injury by clinical examination is unreliable.

Imaging along with others means of investigation plays a vital role in arriving at a precise diagnosis in most of the cases. However, non-availability of sophisticated investigations with lack of experienced radiologist may be limiting factors in arriving at a timely precise diagnosis. This explains the utmost need for an accurate and handy method for evaluation of such patients who require further surgical interventions.

Trauma-scoring systems have been developed to provide an objective criterion for predicting the morbidity and mortality in trauma patients, which in turn helps in deciding the optimum management strategy including appropriate resource allocation. In hemodynamically stable patients with blunt abdominal trauma, laparoscopy safely and effectively identifies bowel injuries[4]. Early recognition of these injuries and timely surgical treatment offers the best prognosis[5]. In this regard this study is done to determine Blunt abdomen traumas patient's signs, as well as para-clinical data, and to compare the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS) , in predicting whether a Blunt abdomen trauma patient needs laparotomy or not.

Aim and Objectives:

- To determine Blunt abdomen traumas patient's signs, as well as para-clinical data, and to compare the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS) in predicting whether a Blunt abdomen trauma patient needs laparotomy or not.
- To evaluate the most common cause of blunt abdominal trauma.
- To evaluate the impact of blunt abdominal trauma on intraperitoneal organs like liver, spleen and hollow viscera like stomach, small and large intestine
- To evaluate various modes of presentation in abdominal trauma

Materials and Methods

Study setting:

This study was conducted at the Department of General Surgery, MGMGH, Trichy, Tamil Nadu.

Study Population:

This study was conducted among patients who sustained blunt injury abdomen and admitted in trauma ward at MGMGH, Trichy.

Study design:

This study was taken up as an observational study.

Sample Size estimation:

This study was conducted among 100 patients.

Sampling technique:

Convenience sampling

Study Period:

The study was conducted between October 2020 and September 2021

Inclusion Criteria:

Blunt abdominal trauma due to road traffic accidents, accidental fall and direct blunt trauma such as kickbacks

Exclusion Criteria:

- Pregnant women with greater than 3 months of gestational age

- Patients with age less than 18Patients suspected to have penetrating abdominal injury along with blunt abdominal trauma

Brief Procedure:
This study was carried out in the Department of General Surgery,KAPV Government Medical College, Trichy and MGM Government Hospital, Trichy from 2020 to 2021 among patients who sustained blunt injury abdomen and admitted in trauma ward.

The following were the steps of data collection from the patients
- Informed consent was obtained from patients. Detailed history and clinical examination was done for all blunt injury abdomen patients.
- After initial resuscitation of the trauma victims, a careful history was taken to document any associated medical problem.
- Routine blood and urine tests were carried out in all the patients.
- Documentation of patients, which included, identification, history, clinical findings, diagnostic test, operative findings, operative procedures, complications during the stay in the hospital and during subsequent follow-up period, were all recorded on a proforma specially prepared.
- Demographic data collected included the age, sex, occupation and nature and time of accident leading to the injury.
- After initial resuscitation and achieving, hemodynamic stability, all patients were subjected to careful examination, depending on the clinical findings, the clinical abdominal scoring system score (CASS) was calculated
- All patients undergo USG and plain radiograph of chest and abdomen scan and Blunt abdominal trauma severity score (BATSS) is calculated then.
- Decision was taken for further investigations and CT scan if the patient is stable. If patient is hemodynamic unstable the patient is resuscitated and planned for emergency surgery if indicated Patients are followed up for a week to determine their possible need for laparotomy The decision for operative or non-operative management depended on the outcome of the clinical examination and results of diagnostic tests
- Patients selected for non-operative or conservative management were placed on strict bed rest, were subjected to serial clinical examination which included hourly pulse rate, blood pressure, respiratory rate and repeated examination of abdomen and other systems.
- The details of the CASS and BATSS and their scorings are as follows

THE CLINICAL ABDOMINAL SCORING SYSTEM (CASS)[6]:
The clinical abdominal scoring is only a clinical 15 -point scoring system based on clinical parameters like: time of presentation, history of abdominal pain, pulse rate, systolic blood pressure Glasgow Coma scale and abdominal examination findings like tenderness, guarding, rigidity.

Patients are classified into three groups based on the score:
- Low risk up to 8;
- Medium risk 9 to 11;
- High risk 12 and above.

Time of presentation after trauma (hours)	< 2 hr=1 2-6 hr=2 >6 hr=3
Pulse rate	<90=1 90-110=2 >110 = 3
Systolic blood pressure	>120 = 1 90-120 =2 <90=3
Glasgow coma scale	13-15 = 1 9-12 =2 <9=3
Abdominal clinical findings	Pain = 1 Guarding = 2 Tenderness and Rigidity =3

BLUNT ABDOMINAL TRAUMA SEVERITY SCORE7:
This is a 24 - point blunt abdominal trauma scoring system and was formulated based on factors like abdominal pain, abdominal tenderness, Systolic blood pressure, pulse rate, chest wall sign, pelvic fracture.

VARIABLES	Score
PULSE RATE	> 100 bpm:1
SBP	<100mm Hg:4
Abdominal Pain	Absent: 0 Present: 2
Abdominal tenderness	Absent: 0 Present: 2
Chest wall	Absent: 0 Present: 1
Pelvic Fracture	Absent: 0 Present: 5
FAST	0 – 8

Patients are classified into three groups based on the score:
- Low risk: less than 8
- Medium risk: 8 to 11

High risk: 12 and above.

Statistical analysis:
Data entry was done using MS Excel 2013 and data analysis was done using SPSS version 23.0. Descriptive statistics were interpreted in frequency and percentage. Chi-square test and Fishers exact test were used to find out the significance of association between the variables. A p value <0.05 was considered statistically significant. Sensitivity, Specificity, Positive predictive value and Negative predictive value were calculated to find out the diagnostic accuracy.

Ethical Considerations:
Institute ethical committee clearance certification was sought and obtained before the study was begun. Informed written consent was obtained from all patients before including them in the study.

RESULTS:

Table 1. Distribution of study participants based on age (n=100)

Age (in years)	Frequency	Percentage
<20	7	7
20-30	46	46
30-40	29	29
40-50	13	13
50-60	3	3
>60	2	2
Total	100	100.0

Maximum of the study participants were in the age group of 20 - 30 years (46%) followed by 30-40 years (29 %)

Table 2. Distribution of study participants based on gender (n=100)

Gender	Frequency	Percentage
Male	84	84
Female	16	16
Total	100	100.0

Majority of the study participants were males (84%), while 16 % of them were females.

Table 3. Distribution of study participants based on the mode of injury (n=100)

Mode of injury	Frequency	Percentage
Fall	23	23
RTA	67	67
Assault	10	10
Total	100	100.0

Maximum of the participants had RTA (67%) as the cause of blunt injury followed by fall (23 %) and Assault (10%)

Table 4. Distribution of study participants based on CASS score (n=100)

CASS score	Frequency	Percentage
≤ 8	62	62
9- 11	21	21
≥ 12	17	17
Total	100	100.0

CASS score of less than or equal to 8 followed by CASS score of 9-11 (21%) and more than or equal to 12 (17%)

Table 5. Distribution of study participants based on USG findings (n=100)

Organs injured	Frequency	Percentage
Kidney	2	2
Liver	17	17
Spleen	14	14
Free fluid	25	25
NAD	42	42
Total	100	100.0

Among the study participants on ultrasound examination 42 % of the participants had no significant findings on USG where as 25% of the participants had free fluid. Among the organ injury liver (17%) was the most common injury followed by spleen and kidney (2%)

Table 6. Distribution of study participants based on BATSS score (n=100)

BATSS score	Frequency	Percentage
≤ 8	60	60
9- 11	12	12
≥ 12	28	28
Total	100	100.0

Among the study participants around 60 % of the participants had a BATSS score of less than or equal to 8 followed by BATSS score of more than or equal to 12 (28%) and 9-11 (12%)

Table 7. Distribution of study participants based type of management (n=100)

Management	Frequency	Percentage
Conservative	64	64
Operative	36	36
Total	100	100.0

Among the study participants 64% underwent operative management and the rest 36 % had conservative management as they had no signs of peritonitis or hemoperitoneum and without any hemodynamic instability.

Table 8. Distribution of study participants based on CASS score and type of management (n = 100)

CASS score	Management		Total n(%)	p value*
	Operated n (%)	Conservative n (%)		
≤ 8	2 (6)	60 (94)	62 (62)	<0.00
9- 11	17 (47)	4 (6)	21 (21)	
≥ 12	17 (47)	0 (0)	17 (17)	
Total	36 (100.0)	64(100.0)	100(100.0)	

* Fishers exact test was applied to test statistical difference in proportions Among the operative management patients 47 % of the participants had aCASS score of either 9 to 11 or more than to 12. The association was found to be statistically significant (p value <0.00)

Table 9. Distribution of study participants based on BATSS score and type of management (n = 100)

BATSS score	Management		Total n(%)	p value*
	Operated n (%)	Conservative n (%)		
≤ 8	0 (0)	60 (94)	60 (60)	<0.00
9- 11	8 (32)	4 (6)	12 (12)	
≥ 12	28 (78)	0 (0)	28 (28)	
Total	36 (100.0)	64(100.0)	100(100.0)	

* Fishers exact test was applied to test statistical difference in proportions Among the operative management patients 78 % of the participants had a BATSS score of more than to 12 followed by 9 to 11 (32%). The association was found to be statistically significant (p value <0.00)

Table 10. Association between CASS score and BATSS score (n = 100)

CASS score	BATSS score		Total
	>12	<12	
>12	17 True positive	0 False positive	17
<12	11 False negative	72 True negative	83
Total	16	70	100

DISCUSSION

A prospective study was conducted among 100 patients with history of blunt injury abdomen in a tertiary care hospital, Trichy to determine the accuracy, sensitivity, specificity, positive and negative predictive value of Blunt abdomen trauma severity scoring system (BATSS) with clinical abdominal scoring system (CASS), in predicting whether a Blunt abdomen trauma patient needs laparotomy or not.

Socio- demography:

In our study we found that the maximum of the study participants were in the age group of 20 - 30 years (46%) followed by 30-40 years (29%) and majority of the study participants were males (84%), while 16 % of them were females. Similar findings were found by Majid et al where around 47 % patients were in the age group of 21- 30 years and more than 80 % of the patients were male[9].

But in contrast to our study findings a similar study done by Peyman et al[1] where they found, out of the 400 patients 62.5 % were females and 37.5 % were males and the Mean age was (33.52± 13.84) years, ranged from 11 to 75 years. Another study done by Afifi et al had majority of our patients as women (62.5%), unlike our studies that indicate more men were involved in BAT possibly due to their career status[10].While in another study they had 50 males (50%) and 50 females (50%).Their ages ranged from 18.0 to 60.0 years (mean ±SD 38.53 ± 12.11); included majority of cases from 20 to 40 year (54%)[8].
In agreement with our findings, a study done at Madurai[5] reported that the majority of the patients belonged to 21-30 years age group, followed by 31-40 years age group and In the 100 cases studied, 88 cases were males, with females accounting for only about12 cases. The retrospective study of Arumugam et al reported that 15% had abdominal trauma and the majority was males (93%)[11].

A study done by Kumar et al in Karnataka had majority of the patient belongs to the age group of 21-30 years, around 16 of 42 constituting about 38.1% followed by 31-40 years constituting (9 of 42) 21.4%, together constituting around 59.5%, thus forming the major bulk of the cases among which 81 % males and 19% females[2].

Mode of injury:

In the present study maximum of the participants had RTA (67%) as the cause of blunt injury followed by fall (23 %) and Assault (10%). Similar findings were found by Peyman et al found that the common mechanisms of trauma were fall from height in 59 patients (14.8%), motor vehicles-motor vehicle crashes in 102 patients (25.5%), car-pedestrian crashes in 221 patients (55.2%),motorcycle-pedestrian crashes in 14 patients (3.5%) and direct trauma in 4 patients(1.0%)[1].

Afifi's et al in their study found the most common cause of BAT was car-pedestrian crashes (55.2%), followed by motor vehicle-motor vehicle crashes (25.5%), which expressed the important role of traffic in the etiology of blunt injury abdomen[52].

Likewise in another study Road traffic accident was responsible for 19% of cases, while assault from others accounted for 30% of cases and fall from height was responsible for 19% of injuries[46]. Kumar et al also found RTA was the most common mode of injury with 78.6% of subjects sustaining injury followed by fall from height with 14.3% and the remainder being other mode which includes assault, bull butt injury[2].

Organs involved:

On USG, 42 % of the participants had no significant findings on

USG where as 25% of the participants had free fluid. Among the organ injury liver (17%) was the most common injury followed by spleen and kidney (2%). Similar study by Beltagy found 19% had perforated gut, 32% had spleen hematoma, 14% had Retroperitoneum, 13% had liver tear, only 1% had kidney hematoma, and 1% had shattered spleen. 19.5% had spleen grade 3, 19.5% had Ileal perforation, 17% had Jejunal perforation, 12.2% had Liver laceration, 9.8% had spleen grade 4, 9.8% had colon perforation, 4.9% had bladder tear, and only 4.9% had Stomach perforation[8].

In study by Kumar et al[2], the most common injured was spleen with 31% of cases followed by liver with 14.3% and then bowel 11.9% which is similar to Singh et al where spleen (28%) >liver (18%) >bowel (16%) were injured[54]. But as per Srivastava et al most commonly injured organ is bowel followed by spleen and liver[55]. The reason for more solid organ injury compared to hollow viscus was explained by Yogesh et al who said it is because of crushing injury. Intra-abdominal contents are crushed between the anterior abdominal wall and the vertebral column or posterior thoracic cage. This produces a crushing effect, to which solid viscera (e.g. spleen, liver, and kidneys) are especially vulnerable.

Management:

Among the study participants 64% underwent operative management and the rest 36 % had conservative management as they had no signs of peritonitis or hemoperitoneum and without any hemodynamic instability. Similar study had 59% undergone Conservative method, 41% was undergone different surgical procedures[8]. In contrary to our findings, Howes et al included all blunt torso trauma patients admitted and observed that only 8% of blunt abdominal trauma patients required laparotomy[14].Karamercan et al. (2010) reported that emergency laparotomies were performed in 13% of the blunt abdominal trauma cases[15].

Mortality:

In the present study the percentage of mortality was 7 % whereas Peyman et al in their study had a mortality of 1% among the patients admitted due to blunt injury abdomen despite intensive medical management[1].Another study reported 1% was died[8] and a study of Vanitha and Prasanth showed that the mortality is 8%[5].

CASS score:

In our study we found that 62 % of the participants had a CASS score of less than or equal to 8 followed by CASS score of 9-11 (21%) andmore than or equal to 12 (17%). Among the operative management patients 47 % of the participants had a CASS score of either 9 to 11 or more than to12. The association was found to be statistically significant (p value <0.00) Similarly in another study the measured CASS values were less than 9 in252 (63%) patients, 9-11 in 131 (32.75%) patients and more than 11 in 17 (4.25%) patients, respectively. Mean CASS score in the group with positive need for laparotomy was 9.97±1.48, in comparison to 7.00±1.29 in the group with negative need for laparotomy, which indicated a significant *P* value of less than 0.001[1].Kumar at al found a specificity, sensitivity, PPV and NPV were 84.62%, 99.2%, 33.3% and 100% respectively[2].

BATSS score:

In the present study we found 60 % of the participants had a BATSS score of less than or equal to 8 followed by BATSS score of more than or equal to 12 (28%) and 9-11 (12%). Among the operative management patients 78 % of the participants had a BATSS score of more than to 12 followed by 9 to 11 (32%). The association was found to be statistically significant (p value <0.00)Likewise a study done by Majid et al found that Patients were divided into three groups including low (score<8),moderate(8≤score<12) and high risk (score≥12). In high risk group immediate laparotomy should be done, moderate group needs further assessments, and low risk group should be kept under observation. Low risk patients did not show positive CT-scans (specificity 100%). Conversely, all high risk patients had positive CT-scan findings (sensitivity100%). The receiver operating characteristic curve indicated a close relationship between the results of CT scan and BATSS (sensitivity=99.3%)[9].While a study by Beltagy et al found 64% were high risk (≥12) according to blunt abdominal trauma severity score, 26% was of medium risk (8 – 11), and only 10% was of Low risk (< 8), and Mean ± SD. of blunt abdominal trauma severity score was 12.66 ± 3.72[8].

Efficacy of CASS:

In the current study the sensitivity and specificity of CASS score is 60.7 % and 100 % and the positive and negative predictive values are 100% and 86.75 % respectively.But a study done by Peyman et al found that CASS had an accuracy of 94%, sensitivity of 100%, specificity of 88%, positive predictive value of 90% and negative predictive value of 100%in determining the necessity of laparotomy in BAT patients. The difference might be due to the higher sample size in the later study[1].In priority I and III groups (276 cases) the management was only dependent on the pro-posed clinical score with 100% specificity, 88% sensitivity, 90% positive predictive value, 100%negative predictive value and an overall accuracy of 94%[52].Interestingly, in the current study, there was a statistical significant difference between procedure done and blunt abdominal trauma severity score, which was supported by the study of Prasanth et al who recommend that, in the high risk group (score more > 12), immediate laparotomy should be done, moderate group needs further assessments, and low risk group should be kept under observation. Low risk patients did not show positive CT-scans (specificity100%), and reported a significant relation between type of surgery and severity of BAT score[5].

Strengths and Limitations:

- Assessing all the blunt abdomen injury patients with CASS and BATSS scoring is one of the strengths of the study.

Limitations:

- Sample size is one of the limitations of the study

Conclusion:

- Based on the findings of the present study, it can be concluded that the CASS and BATSS score system can be used as an initial screening to predict blunt abdominal trauma outcome and can be the basis of management in patients who experience blunt abdominal trauma.This scoring will help in better triage of the trauma patient on arrival and reduce the need for further imaging and reduce the time interval between arrival and surgical intervention.
- With reduction in need for further imaging, it also provides additional
- benefit by reducing exposure to unnecessary radiation, administration of contrast and reduction in costs, overcrowding of casualty departments and possibility of immediate referral to a tertiary care trauma centre due to inadequate infrastructure to manage a case of blunt abdominal trauma. The role of diagnostic laparoscopy may also be included in further studies as there has been significant proliferation of laparoscopic training amongst general surgeons and will extend the scope of this study We conclude by stating that the both CASS and BATSS are excellent predictor of intra- abdominal injury and can be used as a tool by physicians/paramedics in referral/monitoring of high risk patients in a resource limited setting.

Recommendations:

- Future similar studies should be carried on a large sample size in different governmental hospitals to reveal patterns of abdominal trauma
- Developing strategies that necessitate training the doctors and nurses on how to use abdominal trauma scoring systems for frequent assessment of patients' heath statue from first day of admission to prevent further complications.

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