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ORGINAL ARTICLE

Clinical Abdominal Scoring System in Predicting the Necessity of Laparotomy in Blunt Abdominal Trauma

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ABSTRACT

Background: Trauma has been called the neglected disease of modern society and the most common cause of death under 45 years. The majority of cases, being non-penetrating, are blunt abdominal trauma (BAT). Abdominal findings may be absent in 40% of patients with hemoperitoneum as long as radiological investigations are overpriced or not available all the time. Therefore, there is an essential need for a rapid evaluating method to define patients requiring surgical intervention based on clinical signs as called CASS (CLINICAL ABDOMINAL SCORING SYSTEM).The aim of the study is to evaluate the accuracy, sensitivity, and specificity of CASS in predicting of the necessity of laparotomy in BAT.

Methods: This study was carried out in the Emergency Unit of Department of General surgery Zagazig University Hospitals in the period from November 2017 to May 2018 on 46 patients with only BAT. The CASS contains the following criteria; time of presentation after trauma, pulse rate, systolic blood pressure, Glasgow coma scale and abdominal clinical finding. Patients were grouped into three categories: Priority (1): 12 or above (14 patients) , Priority (2) :9-11 (16patients) & Priority (3) :8 or less (10 patients) according to the CASS compared to the results from radiological investigations: U/S, CT, and X-ray.

Results: We found that CASS shows both higher sensitivity and specificity over other modalities such as; U/S and CT scan in BAT patients.

Conclusions: According to our data results, we highly recommend the CASS in prediction of necessity of laparotomy in BAT patient as it shows both high sensitivity and specificity over other modalities such as; U/S and CT scan

Keywords
CASS; BAT; Scoring System; Trauma

INTRODUCTION

Despite its close companionship with man, trauma has been called the neglected disease of modern society, the leading cause of death and disability in developing countries, the most common cause of death under 45 years, and the 7th cause of mortality worldwide. Abdomen is the 3rd most common injured region. Abdominal injuries require surgery in about 25% of cases and 85% of abdominal trauma are of blunt character [1].

The majority of cases, being non-penetrating, are called blunt abdominal trauma (BAT). The main causes are motor vehicle accidents, direct trauma, and fall from height. Industrialization and modernization of the urban population increase the incidence of abdominal trauma, as well as the significance of its evaluation [2]. Blunt abdominal trauma is a puzzling undertaking to manage even to the best of traumatologists. Injuries range from single organ to mutilating multi-organ trauma. Abdominal findings may be absent in 40% of patients with hemoperitoneum [3].

The organs most frequently involved in blunt abdominal trauma are the liver, spleen, bowel, and kidney respectively [4].

In 2010, the absolute monetary expense of engine vehicle crashes in the United States was $242 billion, which is equal to roughly $784 for each individual living in the United States and 1.6% of the United States growth domestic product (GDP). This speaks to the present estimation of lifetime financial expenses for 32,999 fatalities, 3.9 million nonfatal wounds, and 24 million harmed vehicles. These figures incorporate both police-detailed and unreported accidents. At the point

when personal satisfaction assessment is considered, the absolute estimation of societal damage from street car crashes in 2010 was $836 billion. The lifetime financial expense to society for every casualty is $1.4 million. Over 90% of this sum is inferable from lost working environment and family efficiency and lawful expenses [5].

The National Health Service in Egypt faces management problems as a result of the limited resources available for health care, and the continuous increase in the number of population and traffic accidents. This threat restores the priority of the clinical judgment in screening and planning the management of patients, There will not be enough time or equipment to use the more sophisticated modalities of investigations [6]. So, how to clarify the patients in need of laparotomy in BAT? Frequently, (FAST) is used. However, its ability in determining necessity of laparotomy has been blurred, besides the fact that emergency sonography is not always available especially in developing countries. Therefore, there is an essential need for a rapid evaluating method to define patients requiring surgical intervention based on clinical signs therefore the need for the CASS has emerged [7].

METHODS

This study is a prospective cohort study carried out on 46 patients who were admitted to the hospital with only BAT as they had met the inclusion criteria in the Emergency Unit of Department of General surgery Zagazig University Hospitals in the period from November 2017 to May 2018. Assuming that incidence of laparotomy in CASS score ≥ 12=60, incidence of laparotomy in CASS score <12 1%, confidence level 95% , power 80% so total sample size is 24 calculated by open EPI.

Inclusion Criteria: Age ≥18 years old, both sexes, traumatized patient with no extra abdominal injury and direct blunt trauma to the abdomen

Exclusion Criteria: Age <18 years old, penetrating abdominal injury, refusal to join the study, patient not hospitalized, presence of any extra abdominal injury from the start, pregnant women with gestational age > 3 months, patients on warfarin & patients with no reliable history

Withdrawal Criteria: Presence of any extra abdominal injury discovered in 2ry survey

Ethical Considerations: Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans

Abdominal injury was suspected under the conditions of RTA, FFH and direct trauma. Patients were complaining of abdominal pain, discomfort, shock and bruises of abdominal wall. Patient evaluation: A pre-designed format was used to collect data which include the following: on admission history taking: name, age, sex, past medical history, and mechanism of trauma.

Total score range: 5-15 classified into 3 groups: Priority (1): with a score of ≥12, in which patients underwent immediate lifesaving laparotomy following an initial phase of resuscitation. Priority (2): with a score of 9-11, in which patients underwent auxiliary investigations in the form of abdomino-pelvic U/S, CT scan& X-ray. Final management was decided according to the observed findings. Priority (3): with a score of ≤8, in which patients were kept under observation with no auxiliary investigations for an average of 24hr. for the suspected abdominal injury. Reevaluation of the score was determined 6 hr after admission and before discharge to avoid any missed injuries. Laparotomy was considered negative if the operative findings showed no abnormalities or the findings required no surgical intervention for its correction, such as, retroperitoneal and mesenteric hematomas. The result of the treatment was used as a gold standard for the evaluation of the proposed scoring system.

Statistical Analysis: The collected data were analyzed by Statistical Package for the Social Sciences (SPSS version 20.0) software for analysis. Chi square test (X^2) was utilized for qualitative variables. Comparison between quantitative variable were done by one way ANOVA, followed by Pearson's correlation. P value <0.05 was significant and p<0.001 was highly significant.

RESULTS

The CASS contains the following criteria; time of presentation after trauma, pulse rate, systolic blood pressure, Glasgow coma scale and abdominal clinical finding as shown in table (1). Spleen is the most common injured organ as shown in fig. 3, 4, 5 and 5 then intestinal injury came in 2nd fig. 7. Score ≤8 N=10, Score = 9-11 N=21 & Score ≥12 N=9 then after 6hours reevaluation was taken place and 5 patients were transferred from priority 2 to priority 1 due to change in there vitals and abdominal Findings (table (2). We included 46 patients in this study, 6 were excluded after resuscitation due to presence

of extra-abdominal injuries. 40 Patients met the inclusion criteria as shown in fig. (1).

As shown in the table (3, 4& 5) the sensitivity and specificity of the CASS is higher than those of the radiological means such as; C.T, U/S & X-ray. CASS after 6hrs is more sensitive than CASS on admission which indicates that follow up & reevaluation is crucial as shown in table (6).

Advantage of CASS: More sensitive, specific, and cheap (costs nothing at all) so, no burden on the economy. Feasible (any one can perform with a preliminary medical training). Help in triage in disasters and war zones while needs no infrastructure. So, CASS should be standardized in all health care facilities.

Table (1): Items of CASS

Item	Score
Time of presentation after trauma:	
Less than 2 hours	1
From 2-6 hours	2
More than 6hours	3
Systolic Blood pressure:	
More than 120 mmHg	1
90-119 mmHg	2
Less than 90 mmHg	3
Pulse rate:	
Less than 90 beat/min	1
90-110 beat/min	2
More than 110 beat/min	3
Glascow coma scale (GCS) :	
13-15	1
9-12	2
Less than 9	3
Abdominal clinical findings:	
Pain	1
Gaurdening	2
Tenderness and rigidity	3

Table (2): Score class in both time

		Score on admission		Score at 6 hours		X^2	P
		N	%	N	%		
Score	≤8	10	25.0	10	25.0	1.76	0.41
	9-11	21	52.5	16	40.0		
	≥12	9	22.5	14	35.0		
	Total	40	100.0	40	100.0		

Table (3): Association and agreement of detection and prediction of intervention by US, ERECT, CT and score

			Outcome operation needed		Total	X^2	P	Kappa agreement
			No	Needed				
US	No	N	21	12	33	1.039	0.308	0.13
		%	87.5%	75.0%	82.5%			
	Recommend operation	N	3	4	7			
		%	12.5%	25.0%	17.5%			

			Outcome operation	needed	Total	X^2	P	Kappa agreement
ERECT	No	N	24	13	37	4.86	0.027*	0.28
		%	100.0%	81.2%	92.5%			
	Recommend operation	N	0	3	3			
		%	0.0%	18.8%	7.5%			
CT	No	N	21	7	28	8.75	0.003*	0.54
		%	87.5%	43.8%	70.0%			
	Recommend operation	N	3	9	12			
		%	12.5%	56.2%	30.0%			
Score at admission	No	N	24	7	31	17.41	0.00**	0.67
		%	100.0%	43.8%	77.5%			
	Recommend operation	N	0	9	9			
		%	0.0%	56.2%	22.5			
Score at 6h	No	N	23	3	26	25.07	0.00**	0.79
		%	95.8	18.8%	65.0			
	Recommend operation	N	1	13	14			
		%	4.2%	81.2%	35.0			
Total		N	24	16	40			
		%	100.0%	100.0%	100.0%			

*p<0.05& **p<0.001

Table (4): Validity of detection and prediction of intervention by US, ERECT, CT and score

	Sensitivity	Specificity	+VE predictive	-VE predictive	Accuracy
US	25.0%	87.5%	57.1%	63.6%	62.5%
ERECT	18.8%	100.0%	100.0%	64.8%	67.5%
CT	56.2%	87.5%	75.0%	75.0%	75.0%
Score at admission	56.2%	100.0%	100.0%	77.4%	82.5%
Score at 6h	81.2%	95.8%	92.8%	88.4%	90.0%

Table (5): Post Hoc test

	Score	Score	P
SPB	≤8	8-11	0.026*
		≥12	0.00**
	9-11	<8	0.026*
		≥12	0.021*
DBP	≤8	8-11	0.037*
		≥12	0.00**
	9-11	<8	0.037*
		≥12	0.00**

	Score	Score	P
PULSE	≤8	8-11	0.007*
		≥12	0.00**
	9-11	<8	0.007*
		≥12	0.00**
GCS	≤8	8-11	0.090
		≥12	0.001**
	9-11	<8	0.090
		≥12	0.029*

*<0.05 **<0.001

Table (6): Decision according to score

		Score at admission		Score at 6 hours		X^2	P
		N	%	N	%		
Score	No	31	77.5	26	65.0	1.52	0.21
	Recommend intervention	9	22.5	14	35.0		
	Total	40	100.0	100.0			

Figure (1): Framework of the study

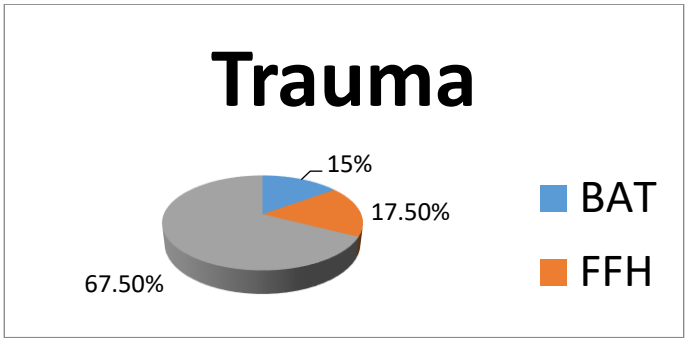

Figure (2): Trauma distribution among the studied group

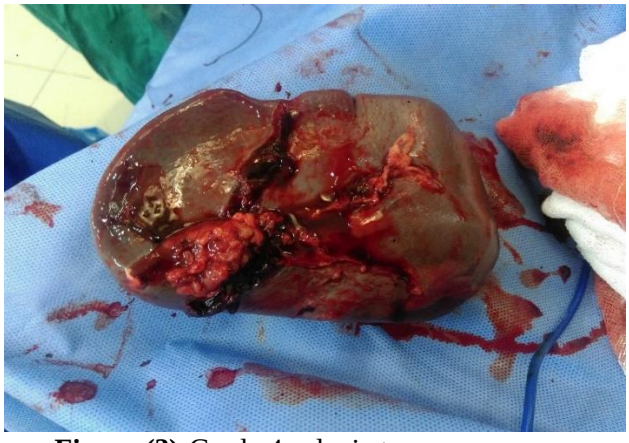

Figure (3): Grade 4 splenic trauma

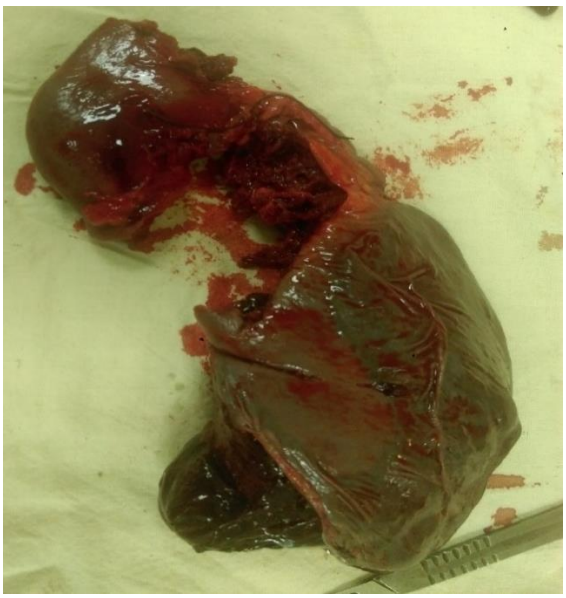

Fig.(4): Complete transection of small bowel down to its mesenteric root

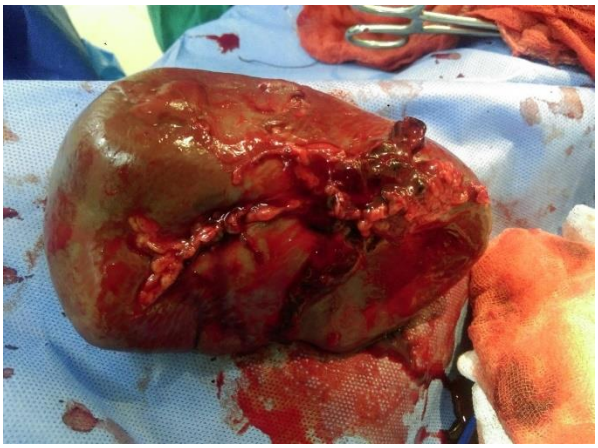

Figure (5): Grade 4 splenic injury

Figure (6): Grade 5 splenic injury

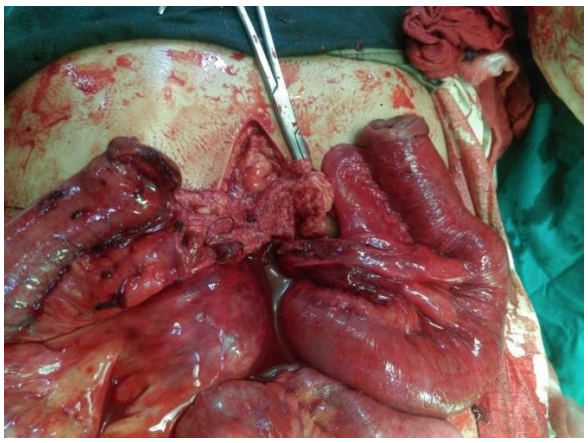

Figure (7): Grade 5 splenic injury

DISCUSSION

Abdominal injury is the third most common cause of death from trauma. Early diagnosis and treatment can reduce mortality up to 50%. Delayed diagnosis of BAT can have serious consequences and may lead to preventable death [8]. This study was carried on 40 patients suffering from BAT and found that the most common age affected was between 20-40 years about 27 patients (67.5%) were affected, followed by 8 patients between (18-20) years 20%, while 5 patients were affected above 40 years 12.5%. These findings were in agreement with [2]. U/S recommended laparotomy in 7 cases (17.9% of cases) with 25% sensitivity and 57.1% +ve predictive value which show lesser accuracy level (62.5%) compared to the CASS score at admission with (82.5%) accuracy with recommended intervention in 9 cases at admission, and 14 cases at 6 hours, at the same time U/S showed non-significant association with U/S and recommended operation in our study as shown in table (2, 3& 4).

In another study which used physical examination with FAST showed increase strength of score (BATSS) score, this research showed results similar to results obtained by C.T scan [9]. As regarding [10] comparing CASS with BATSS in predicting the necessity of laparotomy showing that CASS score has an overall accuracy of 94%, sensitivity of 100% and specificity of 88%, which correlates with our study. But our results showed 9 cases (22.5%) of patients who needed operative intervention similar to CASS score ≤ 12 with accuracy 75%, sensitivity of 56.2% and specificity of 87.5%, with highly significant association between C.T scan and recommended operation. So U/S alone showed non-significant association between recommended operation and operation actually needed. As regarding, [9] evaluation of the patients within 6 hours following admission which correlate with our protocol, but with the exception that repeated evaluation were needed in patients ≥9 and ≤11, but as regarding [9] continued observation for a week after trauma independent of the evaluation or attempted procedure which is considered prolonged time with exhaustion of surgical team and time consuming.

In our analysis, systolic blood pressure, diastolic Blood pressure, pulse rate And GCS results showed a significant difference in patients with different scores priority. The time of presentation to the E.D ranged from half an hour and a maximum of 8 hours, showing non-significant difference which may be explained as rapid evaluation and intervention with the majority of patients score 9-11, ≤ 8 which can stand observation, but in time of presentation to the E.D after trauma showed significant correlation to laparotomy findings. The difference may be related to the difference in the sample size between both studies (400) in [2] and 40 in our study and may be due to the fact that our study evaluated only patients with pure abdominal trauma without any extra-abdominal trauma, unlike Avini [2] which included extra-abdominal trauma. At the same time evaluating CASS in patients with BAT can exclude further investigations for cases with CASS ≤ 8 (N = 10 = 25 %) and ≥ 12 (N = 14 = 35%).

This study found that diagnostic CT which was performed for all patients detected solid organ injury as following liver injuries in 4 cases (10%), splenic injuries in 8 cases (20%) and IPFF in about (60%) of all patients. CT was the best radiologic tool in detection of the grade and extent of parenchymal injury. These findings correlate with findings of [11], who performed CT in about 29 patients and found that the spleen is mostl commonly affected in (38.7%) of their patients and detect importance of CT in diagnosis of solid organ injury [11]. This study found that conservative mode is predominant than surgical

mode in management of blunt abdominal trauma as only 14 (35%) patients were managed surgically, while rest of all patients 26 (65%) were successfully managed by conservative mode. These findings were in agreement with findings of [11].

CONCLUSION

It is not about cheap or expensive, it is about optimum or not. According to our data results we highly recommend the CASS in prediction of necessity of laparotomy in BAT patient as it shows both high sensitivity and specificity over other modalities such as; U/S and CT scan

Conflict of interest: The authors declare no conflict of interest.

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