International Journal of Surgery (2008) 6, 91–95

INTERNATIONAL JOURNAL OF SURGERY

www.theijs.com

EDITORIAL

Blunt abdominal trauma: Back to clinical judgement in the era of modern technology

Available online 24 October 2006

KEYWORDS
Blunt abdominal trauma;
Clinical evaluation;
Scoring systems;
Auxiliary investigations

Abstract *Background and methods:* Abdominal trauma poses a diagnostic challenge to most trauma surgeons. This study evaluates a clinical scoring system in 476 blunt abdominal trauma patients treated by the author over a period of 92 months. Patients were sorted into three groups according to the score results. Priority I group (160 patients) was subjected to an immediate laparotomy. Priority II group (200 patients) was treated according to the results of auxiliary investigations. Priority III group (116 patients) was kept under observation. The treatment outcome was used as a gold standard for the evaluation of the results.
Results: In priority I and III groups (276 cases) the management was only dependent on the proposed clinical score with a 100% specificity, 88% sensitivity, 90% positive predictive value, 100% negative predictive value and an overall accuracy of 94%.
Conclusions: This scoring system (CASS) is helpful in ensuring rapid diagnosis and treatment, reduces time, costs and mortality that may result from improper and/or delayed diagnosis.

Introduction

During the year 2002, the total admissions at Kasr-El Aini Teaching Hospital's Trauma and Emergency Unit was 17,514 cases, of them trauma cases represented 38% (6668 cases). Isolated head, skeletal and chest injuries together were observed in 5293 cases (79.4%). Polytrauma cases (1213 cases) represented 18.2%, while isolated abdominal injuries represented 2.4% (162 cases) of all trauma admissions. Among the polytrauma subjects, 102 cases (8.4%) had an associated abdominal injury. Accordingly, abdominal trauma was observed in 264/1375 cases which represent 19.2% of the general surgery trauma cases. This one-year statistics represents the significance of abdominal injury among trauma cases admitted at one of the largest hospitals in the middle east.

Blunt trauma produces a spectrum of injuries from minor, single-system injury to devastating multi-system trauma. This may pose a significant diagnostic challenge to the most expert trauma surgeon, who must have the ability to detect the presence of intra-abdominal injuries across this entire spectrum. While a carefully performed physical examination remains the most important method to determine the need for exploratory laparotomy, there is little level I evidence to support this tenet. In fact, several studies have highlighted the inaccuracies of the physical examination in blunt abdominal trauma,[1–5] especially in the presence of altered mental status from associated head trauma. [6] Accordingly, injury may be under-estimated or not detected at all resulting in otherwise preventable mortality due to delay in diagnosis and management. [7–9]

Diagnostic modalities in the form of diagnostic peritoneal lavage (DPL), abdominal ultrasonography (US), computed tomography (CT) scanning and laparoscopy usually provide valuable assistance in making a prompt diagnosis; yet there is no substitute for proper clinical judgement.[10–13]

Materials and methods

The current study assesses the validity of the proposed clinical abdominal scoring system (CASS) in triage and prompt decision for the management of patients with blunt

1743-9191/$ - see front matter
doi:10.1016/j.ijsu.2006.09.005

abdominal trauma. It is based on 476 cases of isolated blunt abdominal trauma as determined by the patient or his accompanying persons, or in association with other injuries, who agreed to join the study and were treated by the author at Kasr-El Aini Hospital and in private practice over a period of 92 months (January 1998—August 2005). In polytrauma cases, abdominal injury was suspected in the following conditions:

1. Motor car accidents, a fall from height and multiple direct trauma.
2. Patients complaining of abdominal pain or discomfort.
3. The presence of shock at presentation.
4. Bruises affecting the abdominal wall.
5. Associated fracture pelvis.
6. Associated fracture lower ribs (intrathoracic abdominal compartment).

The protocol of management included a triage of patients based on the clinical abdominal scoring system (CASS) proposed as a result of a previous pilot study, which collected the constant data registered in patient's files in the casualty department, as shown in Table 1. In such a score, we included the five constant data always reported by the attending surgeons at the casualty department and they were not just chosen from different available scoring systems. It included five items: first, the time of arrival, in which a high score of 3 is given to cases presenting after 6 h, which is enough time for evolution of the consequences of internal haemorrhage if present. Second, the pulse rate, which was given a high score of 3 when it exceeded 110 beats/min denoting hypovolaemia. In fact we had a query at that time concerning the paediatric patients, accordingly we excluded patients below the age of 2 years. The same principle applied to the third item, which included the systolic blood pressure, in which a high score of 3 was given to cases presented with a systolic pressure lower than 90 mm Hg. The fourth item included the Glasgow coma scale, which was given a high score of 3 when below 9 in order to compensate for the altered response to the abdominal examination, which is the fifth item included in the score. The response of the patient in such a situation is variable, but in most cases tenderness is appreciated, when the patient moves, pushes the hand of the examiner or produces sounds or cries in response to touching his abdomen.

Table 1 Clinical abdominal scoring system (CASS)

Item	Score
Time of presentation after the trauma	
Less than 2 h	1
2—6 h	2
More than 6 h	3
Pulse rate	
Less than 90 beats/min	1
90—110 beats/min	2
More than 110 beats/min	3
Systolic blood pressure	
Above 120 mm Hg	1
90—120 mm Hg	2
Less than 90 mm Hg	3
Glasgow coma scale (GCS)	
13—15	1
9—12	2
Less than 9	3
Abdominal clinical findings	
Abdominal pain	1
Guarding	2
Abdominal rigidity and tenderness	3

- Total score range: 5—15.
- Patients with score of 12 or above are subjected to immediate laparotomy.
- Patients with score of 9—11 are subjected to auxiliary investigations such as DPL, CT scanning and US.
- Patients with score of 8 and below are subjected to clinical observation with no auxiliary investigations.

Following triage, resuscitation was done according to the standard priorities, followed by history taking and clinical examination with special emphasis on the type of trauma and mechanism of injury. Patients were grouped into three categories:

1. Priority (1) with a score of 12 or above, which included 160 cases subjected to immediate laparotomy following an initial phase of resuscitation.
2. Priority (2) with a score of 9—11, which included 200 patients subjected to auxiliary investigations in the form of abdomino-pelvic US, CT scan and/or diagnostic peritoneal lavage (DPL). Final management was decided according to the observed findings.
3. Priority (3) with a score of 8 or less, which included 116 cases kept under observation for an average of 24 h with no auxiliary investigations for the suspected abdominal injury. Re-evaluation of the score was determined 6 h after admission and before discharge to avoid missed injuries.

Abdominal exploration 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 haematomas. The result of the treatment was used as a gold standard for the evaluation of the proposed scoring system. Statistical analysis of the data was done using the SPSS computer software, V. 9.

Results

The studied 476 patients included 364 males and 112 females (a ratio of 3.3:1), their age ranged from 2 to 60 years with the highest distribution (41.2%) in the first decade of life (Fig. 1). No sex difference was observed between different groups using the χ^2 test ($p = 0.761$). Trauma resulted from a motor vehicle accident in 324 cases (68%), direct trauma to the abdomen in 80 cases (16.8%) and fall from height in 72 cases (15.2%). Three hundred cases (63%) presented with an isolated abdominal trauma and the remaining 176 cases (37%) were polytrauma

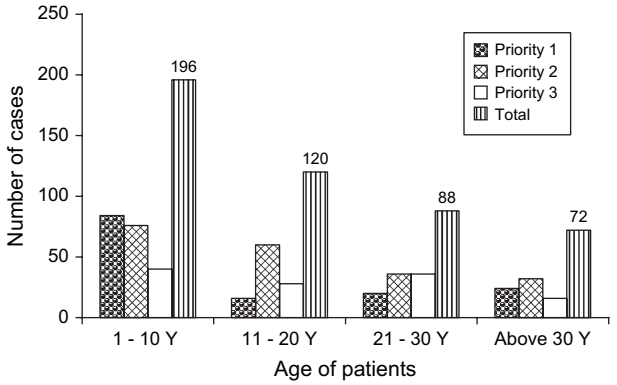

Figure 1 Age distribution of patients involved in the study.

victims. A combination of extra-abdominal injuries was observed in 72/176 (41%) cases. In 24 cases the injury was fatal so that the mortality rate was 5% (Table 2).

Priority I group included 160 cases subjected to an immediate laparotomy following resuscitation. Positive laparotomy finding was observed in 144 cases (90%). The remaining 16 (10%) cases with negative laparotomy had zone II and III retroperitoneal haematomas, which mandated no intervention. This group had 16 mortalities due to severe liver injury in 4 cases and severe multiple injuries in 12 cases.

Table 2 Demographic data

Total no of cases	476
Sex	
Male (M)	364
Female (F)	112
M to F ratio	3.3:1
Age	
Range	2—60 years
Mean	17.7 ± 12.9
Type of trauma	
Direct trauma	80 (16.8%)
Motor car accident	364 (68%)
Fall from height	72 (15.2%)
Isolated abdominal trauma	300 (63%)
Polytrauma	176 (37%)
Type of associated injury[a]	
Head	104 (59%)
Skeletal	80 (45.5%)
Chest	52 (29.5%)
Soft tissue	44 (25%)
Laparotomy findings	
Positive	212/256 (82.8%)
Negative	44/256 (17.2%)
Mortality	24/476 (5%)

[a] Multiple injuries in the same patient were observed in 72 cases.

Priority II group included 200 cases subjected to auxiliary investigations according to availability in the form of abdomino-pelvic US in 92 cases, CT scan in 36 cases and DPL in 104 cases. In 32 cases combinations of these modalities of investigations were performed. Negative findings were observed in 68 cases (34%) and were treated by a conservative non-operative approach. Eight cases of them died due to an associated severe head trauma. The remaining 132 cases (66%) showed positive findings and were divided into two groups based on the results of auxiliary investigations (US, CT scan and/or DPL), the first one included 36 (27%) cases treated by a conservative non-operative approach, while the remaining 96 (73%) cases were subjected to exploratory laparotomy. Sixty-eight cases (71%) showed positive findings in the form of rupture spleen in 40 (59%) cases (28 cases were subjected to splenectomy, 4 partial splenectomy and in 8 cases bleeding was controlled by simple sutures), Intestinal injury in 16 (23.5%) cases (diagnosed by DPL) and liver tears in 12 (18%) cases. The remaining 28 (29%) cases showed negative laparotomy findings with no abnormality detected in 4 cases and zone II and III retroperitoneal haematomas in 24 cases that mandated no intervention. All 28 cases were confirmed positive by DPL alone.

Priority III group included 116 cases treated by conservative non-operative approach with no auxiliary investigations performed. Injury was caused mainly by motor car accident in 65.5% and direct trauma in 31% of cases. There was no mortality observed in this group.

In priority I and III cases (total of 276 cases) the management decision was only dependent on the proposed clinical score with a 100% sensitivity, 88% specificity, 90% positive predictive value, a 100% negative predictive value and an overall accuracy of 94%.

In priority II cases (200 cases) the management decision was dependent on the auxiliary investigation (US, CT scan and/or DPL) findings in a selected score group of 9—11. This showed a sensitivity and specificity of 100% each for the US and CT scans. While for DPL the sensitivity was 100% and specificity was 50%. This signifies that DPL alone cannot be relied upon for identification of patients without abdominal injury and at least an US should be used as well in order to avoid unnecessary laparotomy for a cost effective treatment of patients.

Discussion

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 the population. Traffic accidents in Egypt are increasing, as the number of vehicles increased from 323,224 in 1975 to 2,017,943 in 1990 and to 3,466,000 in 2004. This is associated with an increase in the number of accidents from 17,242 in 1975 to 24,000 in 2004.[14,15]

Natural disasters and terrorist attacks in different parts of the world represent a real threat.[16,17] These result in mass casualty, which overwhelms the health service in the region concerned. Also the war against terrorism in different parts of the world exposes a large number of civilians to different forms of injuries. This threat regains the priority of the clinical judgement in screening and planning the

management of patients, as there will not be enough time or equipment to use the more sophisticated modalities of investigations.

Since only about one-fifth of the patients with blunt abdominal trauma would require operative intervention,[18] proper patient selection for either operative or non-operative management is a crucial factor for getting a satisfactory outcome as well as minimizing the cost and morbidity that would result from the overuse of the auxiliary investigations or unnecessary surgery. In the current study 256/476 (54%) patients were subjected to laparotomy, 44/256 (17%) of them showed a negative exploration.

The clinical decision for operative intervention was reported to be of a limited accuracy ranging from 16% to 45%.[19] Several studies concluded that physical examination alone is an inadequate and unreliable method for the evaluation of patients with blunt abdominal trauma.[2,6,19] These studies were mostly based on opinion and not evidence based, in addition, some of them did not describe the abdominal examination findings or mention the mental status of the patients.[3,4]

The presence of extra-abdominal injuries was thought to distract the attention from a potentially severe intra-abdominal injury.[5] This was proven incorrect by Gonzalez et al.,[21] who reported missed injuries in only 1.2% of cases, who required no blood transfusion or operative intervention, and concluded that physical examination may be a reliable method for the identification of surgically significant abdominal injury in the awake and alert blunt trauma patient with extra-abdominal injuries.[20]

Several studies reported the use of clinical and laboratory parameters for detection or exclusion of intra-abdominal injury in patients subjected to blunt abdominal trauma.[1,21,22,23] The use of physical examination in conjunction with urine analysis showed a sensitivity of 100% with a positive predictive value of only 13%.[24] Recently, Cotton et al. reported that physical examination combined with hepatic serum transaminases may be a useful and an easily applied clinical screening for predicting the presence or absence of an intra-abdominal injury. This resulted in reduction in the use of CT scan for injury detection.[25,26]

In this study the use of a simple clinical scoring system for triage and management of patients with blunt abdominal trauma showed an accuracy rate of 94% for the detection or exclusion of intra-abdominal injury with a sensitivity of 100%, a specificity of 88% and a positive predictive value of 90%. In addition this scoring system avoided the use of auxiliary investigations in 58% of cases. The proper selection of cases suitable for US and CT scan guided by the proposed clinical score, resulted in a 100% accuracy in detection and exclusion of intra-abdominal injuries with its impact on the cost effectiveness of the treatment.

At the extreme ends of the score, based on clinical data only we identified two groups of patients: the first group was subjected to an immediate laparotomy, and the other group was treated conservatively with no auxiliary investigation performed. This ensures the rapidity of the diagnosis and definitive treatment as well as remarkably reduces time, costs and the mortality that may result from improper and/or delayed diagnosis.

From this preliminary data it seems that the clinical abdominal scoring system is a reliable scoring system for triage and management of patients with blunt abdominal trauma. In addition, it is a valuable tool for selection of cases requiring an auxiliary investigation; this approach avoids overwhelming the radiology department with unnecessary examinations.

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