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Original Research Article

A Clinical Study to Evaluate the Applicability of 24 Point Blunt Abdominal Trauma Scoring System in the Management of Blunt Trauma Abdomen

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Abstract:

Background: Blunt abdominal trauma is a common presentation in emergency departments, necessitating accurate and timely assessment to guide appropriate management. The assessment of intra-abdominal injuries can now be aided by the use of the Blunt Abdominal Trauma Scoring System (BATSS). The purpose of this study is to evaluate BATSS's clinical usefulness and ability to predict similar injuries.

Methods: A single-center study was conducted on a sample of 285 patients presenting with blunt abdominal trauma. Patients were evaluated using the BATSS, with a cutoff score of 12 to categorize them into high or low-risk groups. The presence of intra-abdominal injuries was confirmed through computed tomography (CT) scans or laparotomy.

Results: The study showed that BATSS has a high 89.7% sensitivity and 95.5% specificity for identifying intra-abdominal injuries. The most common organs damaged by blunt abdominal trauma were the spleen, liver, and jejunum; these injuries were primarily caused by road accidents. When the patients were first seen, a considerable percentage of them had symptoms like soreness, tachycardia, and stomach pain.

Conclusion: The BATSS showed promising accuracy in identifying patients at high risk for intra-abdominal injuries, with a substantial number of cases requiring operative interventions. Further multicentric validation studies are warranted to confirm the efficacy of BATSS in clinical decision-making and its potential integration into trauma protocols for improved patient outcomes.

Keywords: BATSS, Blunt abdominal trauma, Intra-abdominal injuries, Sensitivity, specificity.

Introduction

The abdomen is the third most frequently injured part of the body, behind the extremities and the head. Abdominal trauma is typically classified into two general categories: 1) Abdominal trauma with penetration. 2) Abdominal trauma with blunt force. The most common type of injury is blunt trauma to the abdomen, which can occur in a variety of settings such as car accidents, combat injuries, battering, falls from heights, sports accidents, martial arts, athletics, and mountain climbing. Car accidents are the leading cause of physical injuries to the abdomen. Deceleration, crushing, or external compression processes can all cause blunt abdominal damage [1,2].

A thorough assessment is necessary in cases of blunt abdominal injuries to improve the prognosis for the patient. Vigorous therapy and the rational application of diagnostic methods are needed to address the immediate life-threatening issues brought on by forceful trauma to the abdomen. The two most common side effects of abdominal injuries are infection and bleeding. Hemorrhage is usually the cause of early mortality after abdominal injuries. Large volumes of blood can become trapped inside the belly cavity before any clinical signs occur, and it can be surprisingly non-irritating. The liver and spleen are two solid organs that are frequently harmed by forceful trauma [3].

Sepsis is the most common cause of death that appears more than 48 hours after an accident. After trauma, hollow viscus injury—which often occurs with penetrating trauma and causes the stomach contents to spill—is the most prevalent cause of intra-abdominal infection. Identifying the organs that will be harmed is easier because knife incisions usually only cause injuries to the tract [4]. Blunt abdominal trauma can also result in ruptures of the pelvic hollow viscera, retroperitoneum, and intraabdominal viscera. Blast is a potent physical damage agent in military practice, especially to gas-filled viscera [5,6].

The traditional method to treating blunt trauma abdomen has shifted from urgent examinations to a more conservative and selective approach due to improved rigorous patient monitoring made available by minimally invasive technology. With the advent of cutting-edge treatment approaches such bleeding artery embolization, drainage guided by ultrasonography or CT, and improvements in critical care management, the possibility of nonsurgical management has increased [7]. The availability of close supervision is an additional important feature. Frequent physical and radiological examinations are performed to closely monitor the patient.

Rates of morbidity and death continue despite notable advances in trauma management, diagnostics, infrastructure, and procedure creation. This could be due to a variety of factors, including a longer period between the trauma and hospitalization, inadequate staffing or equipment, a delayed diagnosis, a lack of infrastructure for post-operative intensive and supportive care, and associated traumatic injuries to the chest, pelvis, brain, or spine. By comparing clinical outcomes and investigations, this study intentionally aims to evaluate the validity of the 24-point blunt abdominal trauma scoring system to diagnose intra-abdominal injuries and establish the optimal course of therapy for blunt injury abdomen. Using this grading system on the people of Northeast India is the study's goal. A precise intra-abdominal injury (IAI) grading system that is based on clinical manifestation and examination could save time, cut down on needless CT scans, and save medical expenses.

Materials and Methods

This observational cross-sectional study was conducted at the Department of General Surgery, AGMC & GBP Hospital. The sample size was determined based on sensitivity. The formula used for calculating the sample size in this scenario is:

n = Z1-α/2^2 Sn(1-Sn) / L^2 P

Where:

n = sample size

Z1-α/2 = standard normal deviate corresponding to the specified size of the critical region (α), which is 1.96 for a 95% confidence level

Sn = anticipated sensitivity (91.4%)

Sp = anticipated specificity (77.7%)

L = absolute precision desired on either side (half width of the confidence interval), set at 10%

P = prevalence of blunt trauma abdomen in India (10.57%)

Given that the validity test of BATSS score obtained showed a sensitivity of 91.4%, specificity of 77.7%, and a prevalence of blunt trauma abdomen in India at 10.57%, with an absolute precision desired on either side set at 10%, and a Z1-α/2 value of 1.96, the calculated sample size comes out to be 285.

Inclusion Criteria: The study included patients with blunt abdominal injuries who consented to participate, underwent clinical examination, and were assessed based on specific parameters outlined in the scoring system.

Exclusion Criteria: Patients with abdominal injuries associated with other life-threatening injuries, pregnant lady with blunt trauma abdomen, patients on anticoagulation therapy and patients who may refuse to participate were excluded from the study.

Methodology

Data Collection- The research protocol, including the investigative and operational techniques, benefits, drawbacks, expected outcomes, and potential complications, was fully explained to all patients or their legal guardians. The research only covered instances in which consent was received. There was no financial burden placed on the patients, no need for additional research, and no substantial dangers associated with the study.

Assessment of Parameters: Patients who consented to participate and had blunt abdominal injuries underwent clinical examination following history-taking. They were then subjected to various investigations and assessed based on the following parameters: abdominal pain (scored 2), abdominal tenderness (scored 3), chest wall sign (scored 1), pelvic fracture (scored 5), Focused Assessment with Sonography for Trauma (FAST) results (scored 8), systolic blood pressure <100 mm Hg (scored 4), and pulse rate >100 beats/min (scored 1).

Assessment of Blunt Abdominal Injury: During the evaluation of patients with blunt abdominal injuries, the priority was the resuscitation of the patient. Following this, consent was obtained from the patient or their attendees to participate in the study. A detailed history was then taken, and a thorough physical examination was conducted. The physical exam included an assessment of vital signs such as blood pressure and heart rate, as well as an evaluation for abdominal pain, guarding, tenderness, and abdominal wall signs like erythema, ecchymosis, and abrasions. Additionally, tenderness over the lower chest ribs and chest wall signs were noted, along with any signs suggestive of pelvic fractures.

Patients were divided into three groups based on their risk levels: low risk, moderate risk, and high risk for intra-abdominal infection (IAI). The cut points for classification were set at scores of 8 and 12. Patients with a score <8 was categorized as low risk for IAI, while those with a score equal to or greater than 12 were highly suspected of having IAI. Patients with scores falling between 8 and 11 were classified as moderate-risk individuals who required further observations and tests to determine the correct diagnosis.

Statistical Analysis- Statistical analysis was conducted using SPSS-25 software. The data was analyzed and expressed in terms of frequency and percentage. The Chi-square test was utilized to determine the association between categorical variables in the dataset. A p-value less than 0.05 is typically considered statistically significant.

Ethical Approval- The study was conducted with prior approval from the Ethical Committee of AGMC & GBPH, Agartala.

Results

In this study, there were a total of 285 cases, among them most patients were in the 31 to 45 years age group 138/48.4%) followed by the 16 to 30 years age group (72/25.2%), 46 to 60 years (44/15.4%), >60 years (23/8.1%), 0-15 years (8/2.8%). 78.6% of patients were male and only 21.4% were female. The majority of the mode of injury was road traffic accidents accounting for 70.5% followed by fall from height with a frequency of 15.1%, Assault at 9.5%, and others at 4.9%.

In the clinical presentation, all patients complained stomach pain (100%). During the evaluation, 60.7% of patients had tachycardia (pulse >100/min) and 14.7% had hypotension (systolic blood pressure <100 mmHg). 86.7% of patients experienced stomach soreness, 55.1% of patients had chest wall symptoms, 1.1% of patients had a pelvic fracture, and 30.5% of patients tested positive for FAST. Furthermore, the table reveals that 42 individuals had a SBP <100 mmHg, constituting 14.7% of the sample. However, 173 individuals had a pulse rate exceeding 100 bpm, which accounts for 60.7% of the sample. This indicates that a significant majority of the surveyed individuals had a high pulse rate, which could be indicative of various conditions such as stress, anxiety, physical activity, or underlying medical issues (Table 1).

Table 1: Clinical presentation and vitals in patients with abdominal pain (N=285).

Signs/symptoms/vitals	Frequency (%)
Abdominal pain	285 (100.0)
Abdominal tenderness	247 (86.7)
Chest wall sign	157 (55.1)
Fast sign	87 (30.5)
Pelvic fracture	3 (1.1)
BP <100 mmHg	42 (14.7)
Pulse rate >100 bpm	173 (60.7)

Patients were classified into three risk groups based on their BATS Score: low (score <8), moderate (scoring 8-11), and high (score >11). The number of patients (N) in the low-risk, moderate-risk, and high-risk categories were 185 (64.9%), 13 (4.6%), and 87 (30.5%), respectively (Fig. 1).

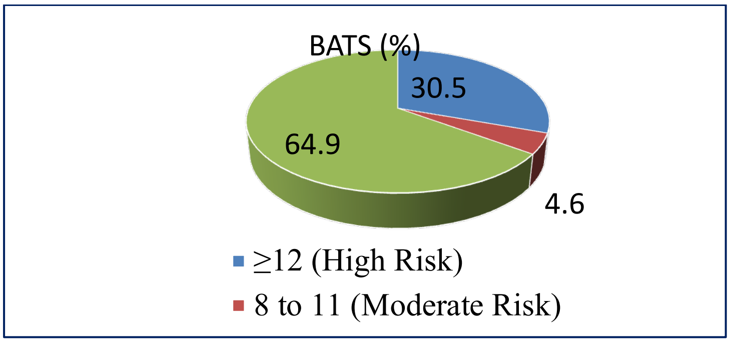

Fig. 1: Blunt abdominal trauma score (BATS) (N=285).

The intra-abdominal damage was found in 87 (30.5%) patients but absent in 198 (69.5%) cases. Among the 87 instances of intra-abdominal damage, the spleen was the most usually implicated organ (44.8%), followed by the liver (27.5%), jejunum (12.6%), kidney (6%), colon (2%), urinary bladder (2.3%), ileum (1.4%), omentum (1.4%), and 1.4% cases in which both the spleen and liver were involved (Table 2).

Table 2: Internal organ involved due to injury (N=87).

Organ involved	Frequency (%)
Spleen	39 (44.8)
Liver	24 (27.5)
Jejunum	11 (12.6)
Kidney	6 (6.9)
Colon	2 (2.3)
Urinary Bladder	2 (2.3)
Ileum	1 (1.4)
Omentum	1 (1.4)
Spleen and liver	1 (1.4)

From Fig. 2, it's observable that patients with BATS of ≥ 12 have a significantly higher prevalence of intra-abdominal injuries (89.70%) compared to those injuries being absent (10.30%). In the BATS 8 to 11 category, there is still a considerable presence of injuries (23.10%), although the absence of injuries is higher (76.90%) compared to the highest BATS group. Lastly, in the BATS < 8 category, intra-abdominal injuries are quite rare (3.20%), with most patients (96.80%) showing no signs of intra-abdominal injury. The p-value of 0.01 suggests that the relationship between BATS score and intra-abdominal injury is statistically significant, indicating that higher BATS scores are strongly associated with the presence of intra-abdominal injuries.

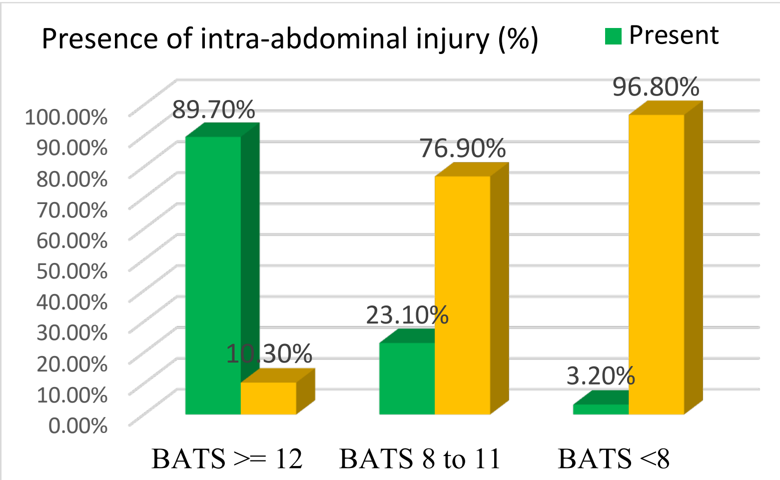

Figure 2: Relationship between BATS and intra-abdominal finding (CT/Laparotomy).

The Table 3 presents the association between gender and BATS score among 285 participants. For males, 75 participants (33.5%) had a BATS score of 12 or higher, 12 participants (5.4%) had a score between 8 and 11, and 137 participants (61.2%) had a score lower than 8. For females, 10 participants (19.7%) had a BATS score of 12 or higher, 1 participant (1.6%) had a score between 8 and 11, and 48 participants (78.7%) had a score lower than 8. The p value for this association is 0.036, which is statistically significant (commonly, a P value less than 0.05 is considered significant). This indicates that there is a notable difference in BATS scores between males and females.

Table 3: Association between gender and BATS score (N=285).

Gender		BATS score			p-value
		> 12	8 to 11	< 8	
Male	Count (N)	75	12	137	0.036
	% Sex	33.5	5.4	61.2	
Female	Count (N)	12	1	48	
	% Sex	19.7	1.6	78.7	

The sensitivity and specificity of the BATS in detecting intra-abdominal injuries are shown in Fig. 3. For BATS score <12, 78 patients were found to have intra-abdominal injuries, while 9 patients did not, giving a high sensitivity (89.7%). This implies that a score below 12 is quite effective in identifying those with injuries. Conversely, for scores equal to or >12, only 10.3% of the 10 patients had intra-abdominal injuries, and a significant 95.5% did not, reflecting a high specificity. The p-value of 0.001 indicates that the results are statistically significant.

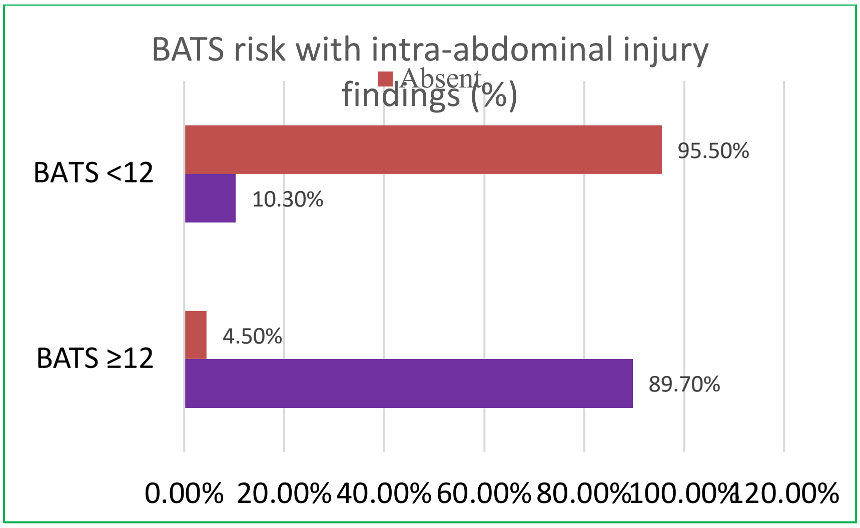

Figure 3: Sensitivity and specificity of BATS score against intra-abdominal injury (N=285).

The ROC curve is a plot of the true positive rate (sensitivity) against the false positive rate (1 - specificity) across different threshold values. A curve closer to the top-left corner of the plot indicates a better-performing model because it signifies higher sensitivity and specificity. The AUC, is a single metric that summarizes the overall performance of the model. An AUC value of 1 represents a perfect model, whereas an AUC value of 0.5 suggests a model that performs no better than random chance. In present study, the AUC was 92.6%, indicating that the model has excellent discrimination power and can effectively distinguish between the positive and negative classes (Fig. 4).

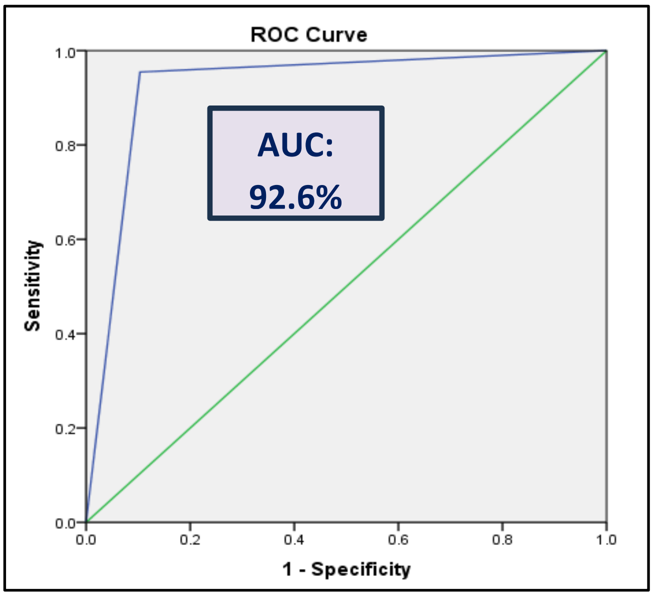

Figure 4: Area under the curve of BATS (92.6%).

Discussion

The study was conducted to evaluate the applicability of 24-point blunt abdominal trauma scoring system in the management of blunt trauma abdomen. In this study, there were a total of 285 cases, with the majority of patients in the 31-45 years age range (138/48.4%), followed by the 16-30 years age group at 25.2%, 46-60 years at 15.4%, >60 years at 8.1%, and 0-15 years at 2.8%. When comparing these findings with other studies, it was observed that the commonest age group varied across different research works. For instance**,** Nabachandra *et al.* reported the commonest age group as 21-30 years (20.80%), Singh *et al.* found it to be 21-30 years (21.2%), Shojaee *et al.* identified it as 20-29 years (38.18%), and Veera *et al.* reported it as 21-30 years (46.4% and

30%) [8-11].

The majority of the mode of injury in our study was road traffic accident accounting for 70.5% followed by fall from height with a frequency of 15.1%. The mode of injury distribution has also been analyzed in different studies. Nabachandra *et al*. reported that vehicular accidents accounted for 86.40% of blunt thoracoabdominal trauma cases, with assault by blunt weapons following at 8%. Singh *et al*. found that crushing by heavy motor vehicles was the primary cause, followed by direct impact by blunt objects and falls from height. Ajitha *et al.* identified road traffic accidents as the most common mode of injury at 66%, with falls and assaults following at 22% and 12%, respectively. Similarly, Shah *et al*. observed that road traffic accidents were predominant at 70%, physical assaults at 15%, and falls from height at 7% [8,9,12,13].

The present study divided patients based on the BATS Score into low-risk (64.9%), moderate-risk (4.6%), and high-risk (30.5%) groups. In the high-risk group, 89.70% had intra-abdominal injuries, while only 23.10% in the moderate-risk group and 3.20% in the low-risk group had such injuries. The sensitivity of BATS was found to be 89.7% with a specificity of 95.5%, and a p-value of 0.001 was obtained in this study. The ROC curve sensitivity of BATS was calculated to be 92.6%. The sensitivity and specificity of the BATSS varied across different studies. Shojaee *et al*. reported a sensitivity and specificity of 100% for BATSS. Ajitha *et al*. found a sensitivity of 88.89% and a specificity of 90.91%. Fahmi *et al*. documented a sensitivity of 100% and a specificity of 97.5% for BATSS. Additionally, based on the ROC curve analysis, Shojaee *et al.* reported a sensitivity of 99.3% for BATSS [10,12,14].

In the clinical presentation of patients with abdominal trauma, all individuals presented with abdominal pain. Tachycardia (pulse rate >100/min) was observed in 60.7% of patients, while hypotension (systolic blood pressure <100 mmHg) was noted in 14.7% of cases. Abdominal tenderness was present in 86.7% of patients, and chest wall signs were found in 55.1% of cases. Pelvic fractures were identified in only 1.1% of patients, and a positive FAST exam was reported in 30.5% of individuals. In a study conducted by Mehta *et al*., it was reported that the majority of patients (66) experienced abdominal pain, with 70% reporting abdominal tenderness and guarding [15]. Additionally, 34% of patients were found to be in hypovolemic shock. Ghimire *et al.'s* study highlighted that the most common extra-abdominal injury observed was rib fractures, accounting for 20% of cases. Among these rib fractures, hemothorax was reported in 17.14% of instances. Pelvic fractures were less common, occurring in only 5% and 4.29% of cases [16].

In our study the most frequently injured organ among the 87 cases of intra-abdominal injury was the spleen (44.8%), which was followed by the liver (27.5%), the jejunum (12.6%), the kidney 6%, the colon 2%, the urine bladder 2.3%, the ileum 1.4%, the omentum 1.4%, and the combined liver and spleen 1.4%. The study by Singh *et al*. [9] reported liver involvement in 67.27% of cases, spleen in 30.91%, small intestine and kidney in 18.18% each, stomach in 9.09%, urinary bladder in 5.45%, gallbladder in 7.27%, and pancreas in 5.45%. Hemidi *et al*. [17] identified the spleen as the most commonly injured organ, while Beltagy *et al.'s* research showed gut involvement in 19% of cases, spleen hematoma in 32%, liver tear in 13%, kidney hematoma in only 1%, and shattered spleen in another 1% [18]. Veera *et al.'s* findings indicated that the most common organs involved were the spleen at 26.67%, small bowel at 23.33%, liver at 16.67%, kidney at 3.33%, and bladder at 1.67% [11].

Conclusion

The present study concluded that the BATS demonstrated a high sensitivity of 89.7% and specificity of 95.5%, with an AUC of 92.6%. Blunt abdominal injuries were notably common among middle-aged and young adult individuals, with 48.4% occurring in the 31-45 age group and 25.2% in the 16-30 age group, predominantly affecting males (78.6%). Road traffic accidents were identified as the leading cause of blunt abdominal injuries, accounting for 70.4% of cases. The most prevalent symptoms upon presentation were abdominal pain (100%), tenderness (86.7%), and chest wall signs (55.1%). A significant portion of patients exhibited hypotension (14.7%) and tachycardia (60.7%) upon arrival at the hospital. Following BATS evaluation, 30.5% of individuals were classified as high risk for intra-abdominal injuries (BATS ≥12), while the majority, comprising 64.9% of cases, were deemed low risk for such injuries (BATS <8). The primary organs affected by blunt trauma included the spleen (44.8%), liver (27.5%), and jejunum (12.6%), with nearly half of the cases necessitating operative interventions, primarily splenectomy and small bowel repair. Future research could include conducting multicentric validation studies to enhance generalizability, exploring the integration of BATS into trauma protocols for real-time decision support, and investigating the development of predictive biomarkers to augment diagnostic accuracy in blunt abdominal trauma cases.

Limitations

The present study, conducted in a single center only, may not fully represent the population of whole North-East India in terms of patients with blunt trauma injuries. However, the achieved sample size was sufficient. Therefore, further research through multicentric trials involving a larger number of patients is needed to validate the efficacy of BATS in clinical decision-making.

References

1. Britt LD, Maxwell RA. Management of abdominal trauma. In: Zinner MJ, Ashley SW, eds. Maingot's Abdominal Operations. 12th ed. The McGraw-Hill Companies, Inc.; 2013; 247-59.
2. Singh S, Gupta V, Singh S. Pattern of injury of blunt trauma abdomen in rural population. Int Surg J., 2016; 497-500.
3. Weledji P, Tambe J. Perspectives on the Management of Abdominal Trauma. J Univer Surg., 2018; 6(2): 1-5.
4. Hassan R, Aziz AA. Computed tomography (CT) imaging of injuries from blunt abdominal trauma: a pictorial essay. The Malaysian J Med Sci., 2010; 17: 29.
5. Kendall J, Kestler AM, Whitaker KT, Adkisson MM, Haukoos JS. Blunt abdominal trauma patients are at very low risk for intra-abdominal injury after emergency department observation. Western J Emerg Med., 2011; 12 (4): 496-504.
6. Baradaran H, Salimi J, Nassaji-Zavareh M, Rabbani AK. Epidemiological study of patients with penetrating abdominal trauma in Tehran-Iran. Acta Medica Iranica. 2007; 45: 305-8.
7. Farrath S, Parreira JG, Perlingeiro JA, Solda SC, Assef JC. Predictors of abdominal injuries in blunt trauma. Revista do ColégioBrasileiro de Cirurgiões. 2012; 39: 295-301.
8. Nabachandra H, Meera Th. A Study of Pattern and Injury Severity Score in Blunt Thoraco-abdominal Trauma cases in Manipal. J Indian Acad Forensic Med., 2005; 5(2): 47-52.
9. Singh M, Kumar A, Verma AK, Kumar S, Singh AK. Abdominal Organ Involvement in Blunt Injuries. J Indian Acad Forensic Med., 2012; 34(1): 0971-73.
10. Shojaee M, Faridaalae G, Yousefifard M, Mehdi Y, ArhamiDolatabadi A, et al. New scoring system for intra-abdominal injury diagnosis after blunt trauma. Chin J Traumatol., 2014; 17 (1): 19-24.
11. Veera DG, Purushotham G, Rao KA, Kishan NR. Blunt Abdominal Trauma andIts Surgical Management-A Clinical Study in a Tertiary Care Unit. IOSR-JDMS., 2018; 17(3): 22-26.
12. Ajitha A, Ramya C, Kumar D. Diagnostic validity of blunt abdominal trauma scoring system (BATSS) on blunt abdominal trauma patients admitted in osmania general hospital. Int J Acad Med Pharm., 2023; 5(4); 2027-31.
13. Shah DK, Patel KM, Patel S, Padshala R, Doliya T. Efficacy of blunt abdominal trauma scoring system in management of blunt abdominal trauma. Int Surg J., 2022; 9: 1726-30.
14. Fahmi K, Omar RD, Ahmed AK. Diagnostic Evaluation of Blunt Abdominal Trauma Scoring System (BATSS).The Egypt J Hospital Med., 2022; 86; 871-6.
15. Mehta N, Babu S, Venugopal K. An experience with blunt abdominal trauma: evaluation, management and outcome. Clin Pract., 2011; 4 (2): 599.
16. Ghimire R, Acharya BP, Pudasaini P, Limbu Y, Maharjan DK, et al. Blunt Abdominal Trauma among Patients Admitted to the Department of Surgery at a Tertiary Care Centre: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc., 2023; 61(261): 404-8.
17. Hamidi I, Aldaoud M, Qtaish I. The role of computed tomography in blunt abdominal trauma. Sultan Qaboos Univ Med J., 2007; 7(1): 41–6.
18. Beltagy IRE, Mohammed AM, Ghalwash ET. Evaluation of Blunt Abdominal Trauma Severity Score (Batss) in Predicting the Necessity of Laparotomy for Admitted Cases with Blunt Abdominal Trauma. Azhar Med J., 2021; 50 (4): 2531-42.