SJIF Impact Factor: 6.711

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

ISSN: 2457-0400
Volume: 9.
Issue: 5
Page N. 36-42
Year: 2025

Original Article www.wjahr.com

INCIDENCE AND MANAGEMENT OF PENETRATING VERSUS BLUNT ABDOMINAL TRAUMA IN THE CAUSALITY OF AL IMAM AL-HUSSEIN MEDICAL CITY

Fahem Ali Hasan*, Hussein Nizar Ali and Shaimaa Sabri Abdul Amir

Karbala Health Directorate, Karbala, Iraq.

Article Received date: 17 March 2025 **Article Revised date:** 06 April 2025 **Article Accepted date:** 27 April 2025

***Corresponding Author: Fahem Ali Hasan**
Karbala Health Directorate, Karbala, Iraq.

ABSTRACT

Background: The abdominal trauma is a commonly presented to emergency wards all over the world especially during wars and disasters. The abdominal trauma is classified into either penetrating or blunt trauma. **Aim of study:** To assess the incidence and management of penetrating versus blunt abdominal trauma in the causality of Al-Imam Al- Hussein medical city. **Patients and methods:** A prospective Cohort study carried out in the Trauma center of Al-Imam Al-Hussein Medical city in Karbala City-Iraq during duration of one year from 1st of January, till 31st of December, 2023 on sample of 150 patients with abdominal trauma. Follow up of patients was done by the researcher for duration of one to two weeks in surgical ward. **Results:** The majority of injured patients were alive, while only two injured patients were died. The penetrating trauma was shown among 34.7% of injured patients and blunt trauma represented 65.3% of injured patients. Blunt abdominal trauma is related to associate injuries of patients, low hemoglobin level and severe external bleeding, while penetrating abdominal trauma is related to younger age, low heart rate, immediate revised trauma score, shorter interval between arrival and resuscitation and operative management. **Conclusions:** The penetrating and blunt abdominal traumas are variable in incidence, presentation, severity, management and outcomes**.**

KEYWORDS: Abdominal trauma, Penetrating, Blunt.

INTRODUCTION

Trauma remains the leading cause of death during the first four decades of life and continues to be a major public health concern globally, irrespective of socioeconomic status.[1] Abdominal trauma ranks as the third most commonly injured region, with surgical intervention required in approximately 25% of civilian cases.[2] Abdominal trauma is categorized into blunt and penetrating injuries. Penetrating injuries are generally more easily diagnosed due to visible wounds, whereas blunt trauma often presents with subtle signs, leading to delayed diagnosis.[1] Rural regions report a higher prevalence of blunt trauma, while penetrating trauma is more frequent in urban settings[2], commonly caused by stab or gunshot wounds.[3] Penetrating abdominal injury (PAI) occurs when a foreign object pierces the skin and enters the body, potentially damaging internal organs and causing shock or infection. Common causes include bone fragments, gunshots, and knife wounds.[4] The extent of injury depends on the involved organs, the object's characteristics, and energy transmission. The mortality rate varies widely (0–100%), largely influenced by the organs involved, time to intervention, and injury severity. Historically managed conservatively, PAI treatment shifted to laparotomy in the early 1900s.[5] Globally, PAIs are rising due to violence and conflict, comprising a significant proportion of urban trauma cases.[6] In Iraq, shrapnel and gunshot wounds are the most common causes, with small bowel injuries being the most prevalent and higher mortality linked to vascular injury and delayed care.[7] Diagnosis and management involve following ATLS protocols, including airway protection, fluid resuscitation, and hemodynamic stabilization.[8] Chest radiographs and ultrasonography (FAST or eFAST) aid in detecting injuries like pneumothorax.[9] Damage control surgery is essential in critical cases to halt the "lethal triad" of hypothermia, acidosis, and coagulopathy.[10] Outcomes are heavily dependent on injury severity and time to therapy, with vascular injuries associated with the highest mortality.[11] Complications include sepsis and short bowel syndrome. Blunt abdominal trauma (BAT) is also common, often resulting from road traffic accidents, falls, or assaults, with spleen and liver being the most

affected organs.[12] Diagnostic evaluation includes physical examination, FAST, CT, and sometimes diagnostic peritoneal lavage.[13] Management, guided by hemodynamic status, follows ATLS protocols, with stable patients undergoing imaging and observation, while unstable ones may need urgent surgery.[14] Although outcomes have improved due to advanced imaging and supportive care, complications such as sepsis remain a concern.[15] The aim of study is to assess the incidence and management of penetrating versus blunt abdominal trauma in the causality of Al-Imam Al-Hussein medical city.

METHOD

A prospective cohort study was conducted at the Trauma Center of Al-Imam Al-Hussein Medical City in Karbala, Iraq, over a one-year period from January 1 to December 31, 2023. The study targeted all patients who presented with abdominal trauma during this timeframe. Study Population: All patients with abdominal trauma who presented to the trauma center formed the study population.

Inclusion Criteria

Adult patients aged 18 years or older.
Patients presenting with abdominal trauma.

Exclusion Criteria

Children and adolescents under 18 years.
Patients with trauma unrelated to the abdomen.
Re-admitted patients with abdominal trauma due to complications.

Patients lost to follow-up.
Sampling: A convenient sample of 150 eligible abdominal trauma patients was selected according to the inclusion and exclusion criteria.

Data Collection: Data were collected through direct patient interviews using a structured questionnaire designed by the study supervisor. The collected data included:

1. Demographics (age, gender).
2. Clinical information (associated injuries, chronic illnesses).
3. Vital signs upon arrival (heart rate, systolic BP, GCS, respiratory rate, SpO2, RBS, temperature, external bleeding).
4. General findings (hospitalization duration, time from incident to resuscitation, abnormal pelviabdominal ultrasound).
5. Management details (type of intervention, intraoperative findings).
6. Patient outcomes (alive or deceased).

Each patient was examined by both the surgeon and the researcher, who focused on rapid resuscitation and achieving hemodynamic stability. Diagnostic tools included abdominal X-ray, FAST, and abdominal CT scans. Final management decisions were made by the Senior Emergency Physician. Follow-up was conducted in the surgical ward for 1–2 weeks' post-admission.

Ethical Considerations: Approval was obtained from the Arab Board of Health Specializations and the trauma center administration.

Statistical Analysis: Data were analyzed using SPSS version 22. Descriptive statistics were expressed as mean ± standard deviation and percentages. Chi-square or Fisher's exact test was used for categorical variables, and the independent sample t-test was used to compare means. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

This study included 150 injured patients presented with mean age of 30.8±9.1 years and range of (18-60 years); 50.7% of patients were in age group of less than 30 years, 30% of them were in age group 30-39 years, 13.3% of them were in age group 40-49 years and 6% of them were in age of 50 years and more. Male injured patients were more than females (69.3% vs. 30.7%). More than half of injured patients had associated injuries, while only 9.3% of them had associated chronic illnesses. The mean heart rate of wounded patients was 114.3 b/m, and 65.3% had heart rates beyond 100. The Glasgow coma scale mean was 12.7, with 52% having GCS of 12-15, 46% 8-12, and 2% 4-8. Mean systolic blood pressure and respiratory rate of wounded individuals were 93.6 mmHg and 17.2 breath/m. The mean updated trauma score of wounded patients was 11, with 40% delayed, 38.7% urgent, and 21.3% emergency. The mean hemoglobin level of wounded patients at arrival was 10.5 g/dl, and 33.3% had less than 10 g/dl. External bleeding was nonexistent in half of wounded individuals, mild in 38%, serious in 9.3%, and severe in 2.7%. (Table 1).

Table 1: Demographic, Clinical, and Vital Characteristics of Abdominal Trauma Patients (n = 150)

Variable	Category	No.	%
Age (Mean ± SD = 30.8 ± 9.1 yrs)	< 30 years	76	50.7%
	30–39 years	45	30.0%
	40–49 years	20	13.3%
	≥ 50 years	9	6.0%
Gender	Male	104	69.3%
	Female	46	30.7%
Associated Injuries	Yes	77	51.3%

	No	73	48.7%
Type of Associated Injuries	Head Trauma	35	
	Chest Trauma	27	
	Pelvic Trauma	15	
Chronic Illness	Yes	14	9.3%
	No	136	90.7%
Heart Rate (Mean ± SD = 114.3 ± 22.7 b/m)	> 100 b/m	98	65.3%
	60–100 b/m	52	34.7%
Glasgow Coma Scale (Mean ± SD = 12.7 ± 1.4)	4–8	3	2.0%
	8–12	69	46.0%
	12–15	78	52.0%
Systolic BP (Mean ± SD = 93.6 ± 11.6 mmHg)			
Respiratory Rate (Mean ± SD = 17.2 ± 5 breath/m)	< 17	88	58.6%
	> 17	62	41.3%
Revised Trauma Score (Mean ± SD = 11 ± 1.2)	Immediate	32	21.3%
	Urgent	58	38.7%
	Delayed	60	40.0%
Hemoglobin (Mean ± SD = 10.5 ± 1.8 g/dl)	< 10 g/dl	50	33.3%
	10–12 g/dl	100	66.7%
External Bleeding	None	75	50.0%
	Mild	57	38.0%
	Moderate	14	9.3%
	Severe	4	2.7%
Mean Arterial Pressure	> 60 mmHg	66	44.0%
	< 60 mmHg	84	56.0%

The mean hospitalization duration among injured patients was 5.1 days, with 29.3% staying for one week or more. The average time between the accident and resuscitation was 1.5 hours; 15.3% received resuscitation within one hour, while 8% had delays exceeding two hours. Abnormal pelviabdominal ultrasound findings were observed in 90% of cases. Regarding management, 51.3% of patients were treated conservatively, while 48.7% underwent operative intervention. Intraoperative findings revealed that the most commonly affected organs were the small bowel (38.4%), spleen (23.3%), liver (16.4%), and stomach (12.3%). Most patients survived, with only two reported deaths. Blunt abdominal trauma was more prevalent (65.3%) compared to penetrating trauma (34.7%). As in table 2.

Table 2: Hospitalization, Management, and Outcomes of Abdominal Trauma Patients (n = 150)

Variable	Category	No.	%
Duration of Hospitalization (Mean ± SD = 5.1 ± 3 days)	< 1 week	106	70.7%
	≥ 1 week	44	29.3%
Interval between Accident and Resuscitation (Mean ± SD = 1.5 ± 0.7 hrs)	< 1 hour	23	15.3%
	1–2 hours	115	76.7%
	> 2 hours	12	8.0%
Abnormal Pelviabdominal Ultrasound	Yes	135	90.0%
	No	15	10.0%
Management	Conservative	77	51.3%
	Operative	73	48.7%
Intraoperative Findings (Affected Organs)	Small Bowel	28	38.4%
	Spleen	17	23.3%
	Liver	12	16.4%
	Stomach	9	12.3%
	Pancreas	3	4.1%
	Duodenal	2	2.7%
	Liver & Spleen	1	1.4%
	Bladder	1	1.4%
Outcome	Alive	148	98.7%
	Dead	2	1.3%
Type of Abdominal Trauma	Penetrating	52	34.7%
	Blunt	98	65.3%

No significant differences were observed between patients with penetrating trauma and patients with blunt trauma regarding age groups (p=0.16) and gender (p=0.06), however, mean age of patients with penetrating trauma was significantly younger than mean age of patients with blunt trauma (p=0.008). as in table 3.

Table 3: Distribution of demographic characteristics according to trauma type.

Variable	Abdominal trauma				P
	Penetrating		Blunt		
	No.	%	No.	%	
Age					0.16*^{NS}
<30 years	32	61.5	44	44.9	
30-39 years	14	26.9	31	31.6	
40-49 years	5	9.6	15	15.3	
≥50 years	1	1.9	8	8.2	
Mean ± SD (years)	28.1±7.9		32.2 ± 9.3		**0.008**^{**S}
Gender					0.06*^{NS}
Male	41	78.8	63	64.3	
Female	11	21.2	35	35.7	

** Chi square test, **Independent sample t-test, NS=Not significant, S=Significant.*

A significant association was observed between associated injuries of patients and blunt trauma (p=0.008). No significant differences were observed between patients with penetrating trauma and patients with blunt trauma regarding associated chronic illnesses (p=0.27). (*Table 4*).

Table (4): Distribution of clinical characteristics according to trauma type.

Variable	Abdominal trauma				P
	Penetrating		Blunt		
	No.	%	No.	%	
Associated injuries					**0.008**^{*S}
Yes	19	36.5	58	59.2	
No	33	63.5	40	40.8	
Associated chronic illness					
Yes	3	5.8	11	11.2	0.27**NS
No	49	94.2	87	88.8	

** Chi-square test, **Fishers exact test, NS=Not significant, S=Significant.*

Although no significant differences regarding heart rate groups, the mean heart rate of injured patients was lower among patients with penetrating trauma (p=0.007). There was a significant association between immediate revised trauma score of patients and penetrating trauma (p=0.002). A highly significant association was observed between low hemoglobin levels of patients and blunt trauma (p=0.008). Injured patients with moderate to severe external bleeding were significantly associated with blunt trauma (p=0.02). (***Table 5***).

Table (5): Distribution of vital signs according to trauma type.

Variable	Abdominal trauma				P
	Penetrating		Blunt		
	No.	%	No.	%	
Heart rate					0.07*^{NS}
>100 b/m	29	55.8	69	70.4	
60-100 b/m	23	44.2	29	29.6	
Mean±SD (b/m)	107.5±20.3		117.9±23.2		**0.007**^{**S}
Revised trauma score					**0.002**^{*S}
Delayed	27	51.9	33	33.7	
Urgent	10	19.2	48	49.0	
Immediate	15	28.8	17	17.3	
Hemoglobin level					**0.008**^{*S}
<10 g/dl	10	19.2	40	40.8	
10-12 g/dl	42	80.8	58	59.2	
External bleeding					**0.02**^{***S}
None	28	53.8	47	48.0	

Mild	15	28.8	42	42.9	
Moderate	9	17.3	5	5.1	
Severe	0	-	4	4.1	

** Chi square test, ** Independent sample t-test, *** Fishers exact test, S=Significant, NS=Not significant.*

No significant differences were observed between patients with penetrating trauma and patients with blunt trauma regarding duration of hospitalization (p=0.15) and abnormal pelviabdominal ultrasound (p=0.9). There was a significant association between shorter interval between accident and resuscitation of patients and penetrating trauma (p=0.004). (***Table 6***).

Table (6): Distribution of general findings according to trauma type.

Variable	**Abdominal trauma**			**P**
	Penetrating		**Blunt**	
	No.	**%**	**No.**	**%**
Duration of hospitalization				0.15*^{NS}
<1 week	33	63.5	73	74.5
≥1 week	19	36.5	25	25.5
Interval between accident and resuscitation				**0.004***^{S}
<1 hour	13	25.0	10	10.2
1-2 hours	39	75.0	76	77.6
>2 hours	0	-	12	12.2
Abnormal pelviabdominal US				0.9*^{NS}
Yes	47	90.4	88	89.8
No	5	9.6	10	10.2

** Chi square test, S=Significant, NS=Not significant.*

There was a significant association between operative management of patients and penetrating trauma (p=0.003). No significant differences were observed between patients with penetrating trauma and patients with blunt trauma regarding intraoperative findings (p=0.16) and outcome (p=0.64). (***Table 7***).

Table (7): Distribution of management and outcome according to trauma type.

Variable	**Abdominal trauma**			**P**
	Penetrating		**Blunt**	
	No.	**%**	**No.**	**%**
Management				**0.003***^{S}
Conservative	18	34.6	59	60.2
Operative	34	65.4	39	39.8
Intraoperative findings (Affected organs)				0.16**^{NS}
Small bowel	19	55.9	9	23.1
Spleen	6	17.6	11	28.2
Liver	5	14.7	7	17.9
Stomach	3	8.8	6	15.4
Pancreas	1	2.9	2	5.1
Duodenal	0	-	2	5.1
Liver & spleen	0	-	1	2.6
Bladder	0	-	1	2.6
Outcome				0.64**^{NS}
Alive	51	98.1	97	99.0
Dead	1	1.9	1	1.0

** Chi square test, **Fishers exact test, S=Significant, NS=Not significant.*

DISCUSSION

Abdominal injuries account for approximately one-quarter of all trauma cases presenting to emergency departments worldwide and are associated with high mortality, contributing to about 20% of trauma-related deaths globally.[16] In contrast, the current study conducted in the Trauma Center of Al-Imam Al-Hussein Medical City reported a relatively low mortality rate of 1.3% among abdominal trauma patients. This figure is considerably lower than rates reported in similar studies, including 8.3% by Arumugam et al. in Qatar[17] and 19.4% by Gönültaş et al. in Turkey.[1] The relatively low mortality in this study could be attributed to improvements in emergency healthcare infrastructure in Iraq over the past decade, as well as differences in sample size and methodology. Regarding trauma type,

this study revealed that blunt abdominal trauma (BAT) accounted for 65.3% of cases, while penetrating abdominal trauma (PAT) accounted for 34.7%. These findings are comparable to those from Ntundu et al. in Tanzania, who reported 72.8% blunt and 27.2% penetrating injuries.[3] However, results differ from those of Agrboko et al. in Nigeria, where penetrating injuries predominated at 59.8%.[18] Such discrepancies are likely due to sociopolitical differences, including war, violence, and road traffic accidents, as well as methodological variations across studies. The current study also showed that patients with penetrating injuries were significantly younger than those with blunt trauma (p=0.008), consistent with the findings of Ahmadinejad et al. in Iran, who highlighted differences in injury types and outcomes based on age.[19] Blunt trauma was significantly associated with coexisting injuries (p=0.008), supporting the findings of Naeem et al. in Pakistan, where blunt injuries were more often linked with associated injuries such as liver and spleen trauma.[20] In terms of physiological responses, the mean heart rate was significantly lower in patients with penetrating trauma (p=0.007), aligning with Nadikuditi et al.'s study in India.[21] Moreover, this study found a significant association between penetrating injuries and a higher immediate revised trauma score (p=0.002), in agreement with Gad et al. in Egypt, who linked penetrating trauma with greater injury severity and mortality.[22] Hemoglobin levels were significantly lower in patients with blunt trauma (p=0.008), a finding supported by Kawai et al.'s retrospective study in Japan, which emphasized hemoglobin as a critical marker in assessing blunt abdominal injuries.[23] Similarly, moderate to severe external bleeding was significantly more common in blunt trauma cases (p=0.02), consistent with Ghimire et al.'s study in Nepal.[24] A shorter interval between the incident and resuscitation was significantly associated with penetrating injuries (p=0.004). This concurs with the systematic review by Seo et al. in South Korea and a study by Moriwaki et al. in Japan, both of which emphasized the importance of rapid intervention in penetrating trauma cases for survival.[25,26] Operative management was more frequently associated with penetrating trauma (p=0.003), supporting Abdullah et al.'s hospital-based study in Iraq, which reported surgical intervention as the primary management for penetrating abdominal injuries.[27] Although the difference in mortality between trauma types was not statistically significant, penetrating injuries had a slightly higher mortality rate, reflecting findings by Larsen et al. in Norway.[28]

CONCLUSION

Penetrating and blunt abdominal injuries differ in incidence, severity, presentation, management, and outcomes. This study showed a lower mortality rate of abdominal trauma compared to international figures. Blunt trauma was more common and associated with co-injuries, low hemoglobin, and severe bleeding. Penetrating trauma occurred in younger patients and was linked to lower heart rate, urgent intervention, and surgical management.

REFERENCES

1. Gönültaş F, Kutlutürk K, Gok AFK, Barut B, Sahin TT, Yilmaz S. Analysis of risk factors of mortality in abdominal trauma. Ulus Travma Acil Cerrahi Derg, 2020; 26(1): 43-49.
2. National Clinical Guideline Centre (UK). Major Trauma: Assessment and Initial Management. London: National Institute for Health and Care Excellence (NICE); 2016 Feb. (NICE Guideline, No. 39.) Available from: https://www.ncbi.nlm.nih.gov/books/NBK344252/
3. Ntundu SH, Herman AM, Kishe A, Babu H, Jahanpour OF, Msuya D, et al. Patterns and outcomes of patients with abdominal trauma on operative management from northern Tanzania: a prospective single centre observational study. BMC Surg, 2019; 19(1): 69.
4. Abdulkadir A, Mohammed B, Sertse E, Mengesha MM, Gebremichael MA. Treatment outcomes of penetrating abdominal injury requiring laparotomy at Hiwot Fana Specialized University Hospital, Harar, Ethiopia. Front Surg, 2022; 9: 914778.
5. Musau P, Jani PG, Owillah FA. Pattern and outcome of abdominal injuries at Kenyatta National Hospital, Nairobi. East Afr Med J., 2016; 83(1): 37–48.
6. Chalya PL, Mabula JB. Abdominal trauma experience over a two-year period at a tertiary hospital in northwestern Tanzania: a prospective review of 396 cases. Tanzan J Health Res, 2017; 15(4): 234-238.
7. Hamdawi MA, Nile AK, Abed WM. Penetrating abdominal trauma: Evaluation in Baghdad during the pandemic Covid-19, Journal of Emergency Medicine, Trauma & Acute Care, 2022; 3: 11. Available from: http://doi.org/10.5339/jemtac.2022.ismc.11
8. van Maarseveen OEC, Ham WHW, van de Ven NLM, Saris TFF, Leenen LPH. Effects of the application of a checklist during trauma resuscitations on ATLS adherence, team performance, and patient-related outcomes: a systematic review. Eur J Trauma Emerg Surg, 2020; 46(1): 65-72.
9. Sankar D, Krishnan R, Veerabahu M, Vikraman BP, Nathan JA. Retrospective evaluation of airway management with blind awake intubation in temporomandibular joint ankylosis patients: A review of 48 cases. Ann Maxillofac Surg, 2016; 6(1): 54-57.
10. Germanos S, Gourgiotis S, Villias C, Bertucci M, Dimopoulos N, Salemis N. Damage control surgery in the abdomen: an approach for the management of severe injured patients. Int J Surg, 2018; 6(3): 246-252.
11. Nishimura T, Sakata H, Yamada T, Terashima M, Shirai K, Yamada I, et al. Different Patterns in Abdominal Stab Wound in the Self-Inflicted and

Assaulted Patients: An Observational Analysis of Single Center Experience. Kobe J Med Sci, 2017; 63(1): E17-E21.
12. Zangana AM, Saber AA, Bilal FA. Blunt abdominal trauma after Baghdad invasion April 2003 a report on 1020 patients. Advances in Medical and Dental Sciences, 2008; 2(2): 28-33.
13. Tsai R, Raptis D, Raptis C, Mellnick VM. Traumatic abdominal aortic injury: clinical considerations for the diagnostic radiologist. Abdom Radiol (NY)., 2018; 43(5): 1084-1093.
14. Jakob DA, Benjamin ER, Cho J, Demetriades D. Combined head and abdominal blunt trauma in the hemodynamically unstable patient: What takes priority? J Trauma Acute Care Surg, 2021; 90: 170.
15. Waheed KB, Baig AA, Raza A, Ul Hassan MZ, Khattab MA, Raza U. Diagnostic accuracy of Focused Assessment with Sonography for Trauma for blunt abdominal trauma in the Eastern Region of Saudi Arabia. Saudi Med J., 2018; 39(6): 598-602.
16. Bouzat P, Valdenaire G, Gauss T, Charbit J, Arvieux C, Balandraud P, et al. Early management of severe abdominal trauma. Anaesth Crit Care Pain Med, 2020; 39(2): 269-277.
17. Arumugam S, Al-Hassani A, El-Menyar A, Abdelrahman H, Parchani A, Peralta R, et al. Frequency, causes and pattern of abdominal trauma: A 4- year descriptive analysis. J Emerg Trauma Shock, 2015; 8(4): 193-198.
18. Agbroko S, Osinowo A, Jeje E, Atoyebi O. Determinants of Outcome of Abdominal Trauma in an Urban Tertiary Center. Niger J Surg, 2019; 25(2): 167-171.
19. Ahmadinejad M, Mohammadzadeh S, Shirzadi A, Soltanian A, Ahmadinejad I, Pouryaghobi SM. Trauma factors among adult and geriatric blunt trauma patients. IJS Open, 2021; 28(4): 17-21.
20. Naeem BK, Perveen S, Naeem N, Ahmed T, Khan I, Khan I, et al. Visceral Injuries in Patients with Blunt and Penetrating Abdominal Trauma Presenting to a Tertiary Care Facility in Karachi, Pakistan. Cureus, 2018; 10(11): e3604.
21. Nadikuditi S, Uthraraj NS, Krishnamurthy V, Kumar K, Hiriyur Prakash M, Sriraam LM, et al. Penetrating Abdominal Trauma: Descriptive Analysis of a Case Series From an Indian Metropolitan City. Cureus, 2022; 14(12): e32429.
22. Gad MA, Saber A, Farrag S, Shams ME, Ellabban GM. Incidence, patterns, and factors predicting mortality of abdominal injuries in trauma patients. N Am J Med Sci, 2012; 4(3): 129-134.
23. Kawai Y, Fukushima H, Asai H, Takano K, Okuda A, Tada Y, et al. Significance of initial hemoglobin levels in severe trauma patients without prehospital fluid administration: a single-center study in Japan. Trauma Surg Acute Care Open, 2021; 6(1): e000831.
24. Ghimire R, Acharya BP, Pudasaini P, Limbu Y, Maharjan DK, Thapa PB. 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): 404-408.
25. Seo D, Heo I, Choi D, Jung K, Jung H. Efficacy of direct-to-operating room trauma resuscitation: a systematic review. World J Emerg Surg, 2024; 19(1): 3.
26. Moriwaki Y, Sugiyama M, Toyoda H, Kosuge T, Tahara Y, Suzuki N. Cardiopulmonary arrest on arrival due to penetrating trauma. Ann R Coll Surg Engl, 2010; 92(2): 142-6.
27. Abdullah FJ, Abed BA, Ibrahim NS. The presentation and the outcome of penetrating abdominal bullet injuries – Iraqi hospital based study. Diyala Journal of Medicine, 2022; 23(1): 10-21.
28. Wiik Larsen J, Søreide K, Søreide JA, Tjosevik K, Kvaløy JT, Thorsen K. Epidemiology of abdominal trauma: An age- and sex-adjusted incidence analysis with mortality patterns. Injury, 2022; 53(10): 3130- 3138.