ORIGINAL ARTICLE

https://doi.org/10.3126/njms.v11i1.9151

Spectrum of Computed Tomography Findings in Blunt Abdominal and Pelvic Trauma and Their Association with Gender

Acharya S[1], Jayshwal R[2], Subedi SS [3], Paudel B[4], Poudel S [5], Yadav A[6], Sharma P[7]

[1].Lecturer, [2,4,5] Resident, [6] Intern, [7] Professor, Department of Radiology, Manipal College of Medical Sciences, Pokhara, Nepal.

[3].Assistant Professor, Department of General Surgery, Pokhara University Teaching Hospital, Pokhara, Nepal.

Received: November 8, 2025 **Accepted: December 25, 2025** **Published: January 31, 2026**

Cite this paper: Acharya S[1], Jayshwal R[2], Subedi SS [3], Paudel B[4], Poudel S [5], Yadav A[6], Sharma P[7] Spectrum of computed tomography findings in blunt abdominal and pelvic trauma and their association with gender, *Nepal Journal of Medical Sciences.* 2026;11(1):21:81-90. https://doi.org/10.3126/njms.v11i1.91512

ABSTRACT

Introduction: Blunt abdominal and pelvic trauma is a significant cause of morbidity and mortality. Multidetector computed tomography (MDCT) is gold standard imaging modality for evaluating hemodynamically stable patients. This study aimed to evaluate the MDCT findings in blunt abdominal and pelvic trauma and their association with gender.

Methods: A hospital-based cross-sectional study was conducted in the Department of Radiodiagnosis, including 30 hemodynamically stable patients presenting with blunt abdominal trauma. All patients underwent multiphasic contrast-enhanced computed tomography of the abdomen and pelvis. Demographic characteristics, mechanism of injury, and MDCT findings were recorded and analyzed using descriptive statistics with the Statistical Package for the Social Sciences (SPSS) version 18. Fisher's exact test was applied to assess the association between grades of injury and gender.

Results: The mean age of patients was 47± 11.2 years with male predominance (66.7%). Male: Female ratio was 2:1. Road traffic accidents were the most common mechanism of injury (66.7%). The liver was the most frequently injured organ (40%), followed by the spleen (27%) and kidneys (13%). According to the American Association for the Surgery of Trauma (AAST) grading system, Grade III injuries were the most common for both liver and splenic injuries. No statistically significant association was found between the grade of injury and gender ($p = 0.623$). Hemoperitoneum was a common associated finding, particularly in splenic and hepatic injuries.

Conclusions: MDCT plays a crucial role in the accurate detection and grading of injuries in blunt abdominal trauma, thereby guiding appropriate clinical management

Keywords: *Abdominal Injuries; Hemoperitoneum; Morbidity; Multidector computed tomography*

Corresponding Author: Dr. Sabanam Acharya, Department of Radiology, Manipal College of Medical Sciences, Email: sabanamacharya@gmail.com

INTRODUCTION

Blunt abdominal and pelvic trauma is a major cause of morbidity and mortality worldwide and continues to pose a diagnostic challenge in emergency care. [1] In Nepal, Roshan et al. reported a prevalence of blunt abdominal trauma of 9.65% in 2023. [2] The absence of overt external injuries, combined with distracting injuries or altered mental status in polytrauma patients, may delay the diagnosis of potentially life-threatening intra-abdominal injuries. [3] Traditionally, evaluation relied on clinical examination, diagnostic peritoneal lavage (DPL), and focused assessment with sonography for trauma (FAST). Although FAST is useful as a rapid screening tool for detecting intraperitoneal free fluid, its limited sensitivity for specific organ injuries and retroperitoneal trauma restricts its role in definitive assessment. [4,5]

The introduction of multidetector computed tomography (MDCT) has transformed the evaluation of hemodynamically stable patients with blunt abdominal and pelvic trauma. Owing to its rapid image acquisition, wide availability, and high diagnostic accuracy, MDCT is now regarded as the gold standard imaging modality in trauma settings. [6] MDCT enables comprehensive visualization of solid organs, hollow viscera, vascular structures, and the pelvic skeleton, allowing accurate detection and grading of injuries. [7] Such precise characterization is essential for guiding management decisions and optimizing patient outcomes.

Despite its established role, limited local data are available regarding the spectrum and severity of CT-detected injuries in blunt abdominal and pelvic trauma. The objective of this study was to evaluate the spectrum of MDCT findings in patients with blunt abdominal and pelvic trauma, identify the commonly involved organs, grade injuries according to the American Association for the Surgery of Trauma (AAST) injury grading system, and assess their association with gender

METHODS

This cross-sectional study was conducted in the Department of Radiodiagnosis and Imaging Manipal College of Medical Sciences, from August 2024 to September 2025. Ethical clearance was

obtained from the Institutional Review Committee of MCOMS, Pokhara (IRC/MCOMS/639/GA) prior to the commencement of the study.

The study included patients presenting with blunt abdominal trauma who were either hemodynamically stable on admission or stabilized after initial resuscitation. Based on prevalence of disease sample size was calculated using non-probability, convenience sampling

The sample size was calculated using the formula,

Sample size: $Z^2 \times [p \times (1-p)] / e2$ Z: 1.96 (critical value of the normal distribution for 95% confidence interval) p: 9.65% e: 10% The minimum sample size required is calculated as per the equation with 9.65% prevalence; 95% Confidence interval (Z=1.96, assumed p=0.0965 q=0.9035) is 30. So, the minimum sample size of 30 was calculated.

Patients who were hemodynamically unstable, had signs of peritonitis, or were allergic to contrast agents were excluded. Demographic data and relevant clinical information were recorded at the time of admission.

All patients underwent contrast-enhanced computed tomography (CT) of the abdomen and pelvis using a 128-slice Philips Ingenuity multidetector CT scanner. A non-ionic, low-osmolar iodinated contrast agent (Iohexol) was administered intravenously with concentration of 300–350 mg/ml. The dose was calculated based on the patient's body weight, typically 1.0–1.5 ml/kg. Contrast was injected using a power injector, followed by a saline flush to optimize vascular enhancement. CT imaging was performed in three phases: arterial phase (25-30 seconds), portovenous phase (60-70 seconds), and delayed excretory phase (10-15 minutes) for urinary tract evaluation. KVP used was 100-140 KVP and MAs used was 200-300. Images were acquired with thin-collimation, pitch of 1 and reconstructed using 3-5 mm slice thickness and then reconstructed in axial, coronal, and sagittal planes for a comprehensive evaluation of abdominal and pelvic organs.

For the contrast-enhanced CT (CECT) of the abdomen and pelvis.

The spectrum of abdominal injuries was analyzed by using multiple observers and presented as

frequencies and percentages. The organ involved and grade of each organ injury were assessed. Accessary findings like presence of hemoperitoneum were noted. Fisher's exact test was applied to determine the association between patients' gender and the grade of injury. Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 18.

RESULTS

Fifty trauma patients underwent CT scan of abdomen and pelvis during the study period. Out of which 20 patients had normal CT scan without injury to abdominal organs. Those patients were excluded from the study. Most of the patients were in the age group 41-50 years with mean age of 47± 11.2 years. Most of the cases were male, with male: female ratio of 2:1**.** The most common mode of trauma in our study was road traffic accidents followed by fall injury, blunt trauma and physical assault as shown in table 1.

Table 1: Mode of injury (n =30)

Mode of injury	Frequency	Percentage
Road Traffic Accident (RTA)	20	66.7%
Fall Injury	6	20.0%
Blunt Trauma with Object	2	6.7%
Physical Assault	2	6.7%

Liver was the most commonly injured organ accounting for 40% of the cases (Table 2). The most common grade of liver injury was grade III (Table 3). The spleen was the second most commonly injured organ after the liver (Table 2). According to the American Association for the Surgery of Trauma (AAST) grading system, Grade III injuries were the most common for both liver and splenic injuries (Table 3 and 4). The kidneys were injured in four patients (13%). Grade III and grade IV renal injury were seen in 50% and 25% of cases respectively. There was one case (3.3%) with grade II renal injury. Pancreatic injuries were observed in two cases (7%). Both cases were grade II injuries. Three (10 %) patients had bowel injury, whereas one patient had mesenteric injury. The mesenteric

hematomas were associated with hemoperitoneum without solid organ injuries in all four (100%) cases. This study does not show any association between grade of injury with gender (p value of 0.623).

Hemoperitoneum was a common associated finding, particularly in splenic and hepatic injuries. Liver injury showed hemoperitoneum in 90.9% of cases. Similarly, 100% of the splenic injury were associated with hemoperitoneum, a hallmark of splenic trauma. Kidney injuries showed hemoperitoneum in 75%. Fifty percent of pancreatic injuries were associated with haemoperitoneum.

Table 2: Frequency of organ involved in different injuries (n =30)

Organ Involved	No. of cases	Percentage
Liver	12	40
Spleen	8	27
Kidney	4	13
Pancreas	2	7
Hollow viscus	3	10
Mesentery	1	3

Table 3: Grading of hepatic Injury (n =12)

Injury Grade	No. of cases	Percentage
Grade I	Nil	0
Grade II	5	42
Grade III	6	50
Grade IV	1	8
Grade V	Nil	0

Table 4: Grading of Splenic injury. (n =8)

Injury Grade	No. of cases	Percentage
Grade I	Nil	0
Grade II	1	12.5
Grade III	4	50
Grade IV	1	12.5
Grade V	2	25

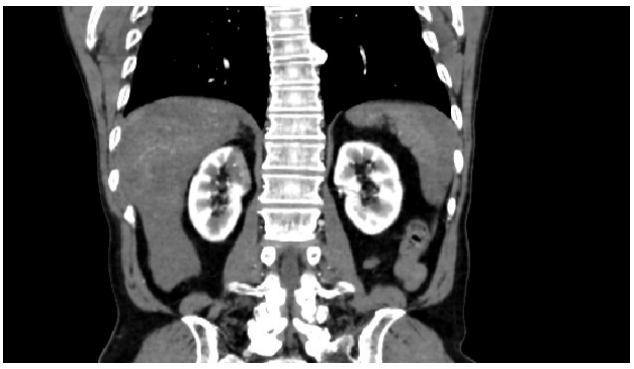

Figure 1 CT coronal view scan corticomedullary phase; Few non-enhancing linear hypodensities suggestive of lacerations at upper pole of right kidney- s/o AAST grade III renal injury.

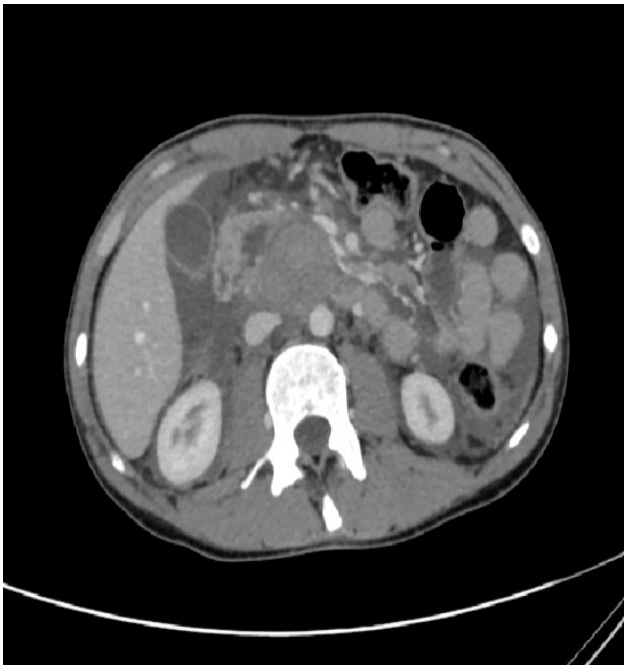

Figure 2: Axial CT scan porto-venous phase: Iso to hypodense collection in head of pancreas suggestive of pancreatic hematoma - AAST Grade II.

DISCUSSION

In our cohort of 30 patients with blunt trauma abdomen, the most common age group was 41-50 years with mean age of 47± 11.2 years and male: female ratio of 2:1. This gender predominance is consistent with the 2014 study by Mehta N et al., which, in a larger cohort of 72 patients, found that 79% were male, though their most frequent age group was 21-30 years (40%).[8] This gender predominance may be due to more male travelers. Trauma disproportionately impacts young individuals of productive age, resulting in a significant economic burden for both their families and the wider community.[9]

RTAs are a well-known contributor to high-impact abdominal trauma, especially in low- and middle-income countries like Nepal where traffic safety measures may be suboptimal as reflected in our study where 66% of cases were due to road traffic accident, a finding consistent with the study by Mehta n et al., followed by fall injuries, blunt trauma and physical assault.[8]Similarly, a study by Davis J et al. also identified automobile accidents as the most prevalent mechanism of injury, accounting for a higher proportion (70%) of cases.[10] In their cohort, a direct blow to the abdomen (17%) was the second most common cause, while fall injuries were the least frequent, constituting approximately 6%. Conversely, a separate study by Morton J et al. reported a different distribution, with automobile accidents (33%) still being the leading cause, but followed by fall injuries (17%) and blows to the abdomen (13%).[11]

CT imaging revealed a wide spectrum of organ involvement. The liver was the most frequently injured organ, consistent with its large size and

anterior position in the upper abdomen. This was followed by the spleen and kidneys, which were also commonly affected, especially in high-velocity trauma such as RTAs. Pancreatic injuries were less common. Some patients had isolated organ injuries, whereas others presented with multiple organ involvement, indicating the severity and variability of trauma patterns. The findings underscore the utility of CT in delineating both major and subtle injuries in trauma cases.

When organ involvement was analyzed against the mode of injury, distinct patterns emerged. Liver injuries were predominantly associated with RTAs, underscoring the high-energy nature of vehicular trauma. Spleen and kidney injuries were also frequently observed in RTA cases, suggesting multi-organ damage due to deceleration forces. Fall-related trauma showed a more variable pattern, with involvement of both solid and hollow viscera. Blunt trauma with object and physical assault were more often associated with injuries to the bowel, mesentery, and pelvic bones, including iliac crest fractures. These findings support the hypothesis that different trauma mechanisms result in different anatomical injury patterns, with solid organs more likely involved in high-velocity injuries like RTAs, and skeletal or bowel injuries in more focal, directed trauma.

Injury severity was graded according to the American Association for the Surgery of Trauma (AAST) criteria. Among the injuries reported, Grade III injuries were the most frequent, particularly in the liver and spleen. Notably, Grade IV kidney injuries were seen in several RTA and fall victims, indicating significant parenchymal disruption. Grade I and II injuries were more common in cases of fall or physical assault, where the kinetic energy transferred was lower. The study also documented organ-specific grades such as “Liver Grade III” and “Pancreas Grade I,” which reflect more accurate assessments of injury severity and help in guiding management decisions. These findings highlight that high-grade injuries are not uncommon, even in blunt trauma, emphasizing the need for high-resolution imaging and prompt clinical intervention.

However, it is important to note that certain significant injuries were not included in this table due to the absence of explicit grading in the dataset. These include injuries to the viscus, duodenum,

jejunum, and inferior vena cava (IVC), which were documented in the CT findings but were described using general terms such as “perforation” or “laceration” rather than standardized AAST grades. For example, one patient had viscus perforation following blunt trauma with an object, and another sustained duodenal and jejunal injuries evident on imaging but not explicitly graded. Similarly, IVC injuries and mesenteric involvement were recorded as critical accessory findings but were excluded from the grade-based table due to non-uniform reporting. While these cases are not reflected in the tabulated data, they represent clinically significant pathologies that underscore the value of CT in detecting life-threatening but often subtle injuries beyond the commonly graded solid organs.

In a study by Wing and associates evaluating clinical impact of CT for blunt abdominal trauma, it was concluded that the use of computed tomography (CT) had a tremendous impact on the evaluation and management of blunt abdominal trauma. It is non-invasive, easy to perform, and has been shown to be highly sensitive (100%), specific (96.8%), and accurate (97.6%). The use of CT has helped decrease the total number of laparotomies performed for abdominal trauma as well as the number of negative and non-therapeutic laparotomies [12].

The study has only limited sample size. Further study in a large sample size with longer duration is suggested.

CONCULSION

The findings of this study highlight the vital role of computed tomography in the evaluation of blunt abdominal and pelvic trauma. Liver was the most common organ injured during trauma followed by the spleen. Most of these injuries were of moderate to high grade (AAST Grade III–IV). Injuries were more common in male. However no significant association was noted between gender and the grade of injury.

CONFLICT OF INTEREST:

None

SOURCES OF FUNDING:

None

REFERENCES

1. Advanced Trauma Life Support (ATLS) Student Course Manual. 10th ed. American College of Surgeons Committee on Trauma; 2018.
2. 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 May 1;61(261):404-408.[DOI]
3. Soto JA, Anderson SW. Multidetector CT of Blunt Abdominal Trauma. Radiology. 2012 Oct;265(3):678-93. [DOI]
4. Richards JR, McGahan JP. Focused Assessment with Sonography in Trauma (FAST) in 2017: What Radiologists Can Learn. Radiology. 2017 Apr;283(1):30-48. [DOI]
5. Van der Vlies CH, Olthof DC, Gaakeer M, Ponsen KJ, van Delden OM, Goslings JC. Changing patterns in diagnostic strategies and the treatment of blunt injury to solid abdominal organs. Int J Emerg Med. 2011 Nov 4;4:47.[DOI]
6. Poletti PA, Wintermark M, Schnyder P, Becker CD. Traumatic injuries: role of imaging in the management of the polytrauma victim (conservative expectation). Eur Radiol. 2002 May;12(5):969-78. [DOI]
7. Brofman N, Atri M, Hanson JM, Grinblat L, Chughtai T, Brenneman F. Evaluation of bowel and mesenteric blunt trauma with multidetector CT. Radiographics. 2006 Jul-Aug;26(4):1119-31. [DOI]
8. Mehta N, Babu S, Venugopal K. An experience with blunt abdominal trauma: evaluation, management and outcome. ClinPract. 2014;4(2):599.[DOI]
9. Salimi J, Ghodsi M, Zavvarh MN, Khaji A. Hospital management of abdominal trauma in Tehran, Iran: A review of 228 patients.

Chin. J. Traumatol. 2009;12(5):259-62.[FULL TEXT]

10. Davis JJ, Cohn Jr IS, Nance FC. Diagnosis and management of blunt abdominal trauma. . Ann Surg. 1976;183(6):672. [DOI]

11. Morton JH, Hinshaw JR, Morton JJ. Blunt trauma to the abdomen. . Ann Surg. 1957;145(5):699.[DOI]

12. Wing VW, Federle MP, Morris JA, Jeffrey RB, Bluth R. The clinical impact of CT for blunt abdominal trauma. American Journal of Roentgenology (AJR), 1985 December; 145(6): 1191-94.[DOI]