

Investigation of the Predictive Value of Microscopic Hematuria in the Assessment of Blunt Abdominal Trauma

Ashok Kumar Anand

I.C.M.O, Murli Bhedi Jha Community and Trauma Center, Araria Sangram, Jhanjharpur, Madhubani, Bihar, India

Received: 01-07-2026/Revised: 15-08-2026 / Accepted: 21-09-2026

Corresponding author: Dr. Ashok Kumar Anand

Conflict of interest: Nil

Abstract

Background: Trauma is the most common cause of death for people under 50 out of the three main reasons. The impact of microscopic hematuria on the diagnosis of abdominal injuries is unknown. Examining the predictive significance of microscopic hematuria in the assessment of abdominal organ damage after physical trauma was the aim of this investigation.

Methods: This cross-sectional study included all blunt trauma patients admitted between May 2025 and April 2026 to the Murli Bhedi Jha Community Health and Trauma Center in Araria Sangram, Jhanjharpur, Madhubani, Bihar. Those between the ages of 18 and 65 who had blunt abdominal injuries were included; those with a history of renal illness, macroscopic hematuria, or an unstable hemodynamic situation were excluded. Intravenous contrast material with a delayed nephrogram phase was the gold standard for performing a spiral CT scan of the abdomen and pelvis. The SPSS software was used to analyze the data. McNemar's test and the Chi-square test were applied. ($P < 0.05$) was considered significant.

Results: This study included one hundred blunt trauma patients. Microscopic hematuria was much more common in individuals with intra-abdominal organ damage than in other patients (71.4% versus 38.9%, $P < 0.001$). The sensitivity and specificity of microscopic hematuria in detecting intra-abdominal organ damage were 53.84% and 77.14%, respectively. The overall accuracy of the test was 62.0% (Kappa coefficient=0.22, $P < 0.001$).

Conclusion: Due to its poor accuracy in diagnosing injury to intra-abdominal organs, microscopic hematuria can be used as an auxiliary diagnostic tool but should not be used as the primary method.

Keywords: Abdominal Injuries, Blunt Trauma, Evaluation, Hematuria.

DOI: 10.25258/ijcpr.18.10.33

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Trauma results from the body exchanging more energy with the environment than it can manage. Trauma is the most common cause of death for those aged 1 to 44. Its Years of Potential Life Lost (YPLL) is more than that of heart disease and cancer. Even though infectious diseases and malnutrition have become more prevalent worldwide, accidents remain one of the biggest problems in underdeveloped countries today and have been among the top three causes of death in recent years.[1]

There are two sorts of traumas: blunt trauma, which results in more energy being applied to the body's surface along with diffuse and many injuries, and penetrating trauma, which is caused by the impact of sharp items like knives, bullets, and other sharp objects.[2] Abdominal blunt trauma is usually caused by motor vehicle collisions, recreational

accidents, or falls. The spleen, liver, retroperitoneum, small intestine, kidneys, bladder, colorectum, diaphragm, and pancreas are the most often affected organs in blunt abdominal trauma. The suspicion of such damages is crucial, even if the majority of traumas result in modest injuries that only seldom call for surgical intervention. [3] The necessity of surgical intervention in cases of serious injuries and the efficiency of the intervention in terms of patient prognosis are the reasons for its significance. \

Pain, soreness, gastrointestinal bleeding, hypovolemia, and symptoms of peritonitis are the most typical warning signs in patients with nonpenetrating abdominal trauma. Of addition, there are situations where there may be no symptoms because of the buildup of blood in the pelvic cavity.[4-6] Lap belt markings, wheel-

shaped contusions, ecchymosis associated with the flanks (Grey Turner sign) or navel (Cullen's sign), abdominal distension, crypt or instability of the lower chest, and bruit auscultation can all be observed during the clinical examination. Making decisions on the treatment and prognosis of trauma patients and conducting diagnostic tests are quite beneficial. Additionally, carrying out pointless diagnostic and therapeutic procedures might result in delays in successful interventions as well as financial and fatal losses (such as additional radiation during a CT scan). These days, radiography (chest, abdomen, and pelvis), ultrasonography, and CT scans are three frequently utilized techniques to assess the injuries sustained after blunt trauma.[6–9] Abdominal organ injuries account for 10% of all trauma-related deaths.[10,11] Research indicates that a delay in accurately diagnosing injuries is one of the primary causes of the rise in the death rate from blunt trauma.[12] Additionally, the primary cause of avoidable deaths from abdominal trauma is inaccurate assessment of the severity of abdominal injuries.[13] The prompt diagnosis of individuals who require emergency surgical surgery is the most crucial aspect of managing patients with blunt abdominal injuries. Clinical evaluations are unreliable for identifying potential injuries in blunt abdominal trauma, according to a prior study.[14]

This means that one of the surgical challenges is always finding a quick and precise procedure to detect trauma-related abdominal injuries. Diagnostic Peritoneal Lavage (DPL) is one technique used to diagnose abdominal injuries.[10,15,16] Despite its great sensitivity (96%), DPL is an intrusive procedure that is linked to problems in 1% of patients due to injury to the major veins, intestines, and bladder.[11, 17]

Additionally, 29–39% of instances result in needless procedures due to its limited specificity [12, 18]. The use of computed tomography (CT) scans to detect abdominal injuries was recommended due to the invasiveness and low specificity of DPL. Sonography is now a viable substitute for DPL and CT scan techniques, according to numerous research.[11, 16, 19–21] Ultrasound is now the primary method of examination for patients with traumatic abdominal trauma in several European and Asian nations.[15] Nevertheless, the evidence suggests that using sonography as the sole diagnostic technique could result in an incorrect diagnosis.[14, 22] In the emergency room, a Urine Analysis (UA) is performed to detect hematuria in cases of abdominal trauma. With a sensitivity of 91–100%, this straightforward, fast, and inexpensive test can identify hematuria or blood in the urine.[23, 24] Severe hematuria is a sign of intraabdominal injury, according to the earlier study. Naturally, there is no

way to link microscopic hematuria to abdominal trauma.[25] There is currently disagreement over the significance of microscopic hematuria in the diagnosis of abdominal injuries and patient prognosis. According to a prior study, it is not advised to utilize urinalysis to assess patients with nonpenetrating abdominal trauma because of its low specificity and sensitivity when compared to the CT scan approach for microscopic hematuria.[26] Intra-abdominal injuries and injury severity may be predicted by microscopic hematuria.[24] The purpose of this study was to investigate the prognostic role of microscopic hematuria in the assessment of blunt abdominal injuries because there were insufficient studies and conflicting results.

Material and Methods

The purpose of this cross-sectional study was to examine the predictive value of microscopic hematuria in the assessment of blunt abdominal trauma in all blunt trauma patients admitted to the Murli Bhedi Jha Community Health and Trauma Center in Araria Sangram, Jhanjharpur, Madhubani, Bihar between May 2025 and April 2026.

Every patient between the ages of 18 and 65 who had acute abdominal trauma was included. A history of kidney disorders, unstable hemodynamic condition, and macroscopic hematuria were the exclusion criteria. Blunt trauma was defined in this study as being ejected from a vehicle during a collision, a motorbike crash, a fall of more than twenty feet, a vehicle-pedestrian collision, a motor vehicle crash with a speed change greater than twenty miles per hour (mph), or blunt direct trauma to the body. Demographic data, such as age, gender, and a history of prior conditions including diabetes, hypertension (HTN), dyslipidemia (DLP), cardiovascular illnesses, kidney disorders, etc., were collected and recorded after the participants provided written informed consent.

All data, including demographic information and paraclinical findings, were entered into the statistical software IBM SPSS Statistics for Windows, version 22 (IBM Corp., Armonk, N.Y., USA). Data were described using central tendency indices (quantitative data with mean and standard deviation, and qualitative data with frequency and percentage). After checking the normality of quantitative data using the Kolmogorov-Smirnov test, appropriate parametric tests were used. The chi-square test was used. Also, indicators of diagnostic value and efficiency of microscopic hematuria were evaluated using McNemar's test. The significance level in this study was considered $P\text{-value} < 0.05$.

Results

There were 74 (74%) male and 26 (26%) female among the 100 blunt trauma patients that were included in this study. The patients' average age was 35.14 ± 8.99 years, ranging from 18 to 65. Moreover, a co-morbidity was present in 11 (11%) patients. Table 1 shows that motor vehicle accidents accounted for 69 (69%) of the trauma mechanisms, falls for 20 (20%), and miscellaneous instances (conflict, sporting events, etc.) for 11 (11%). 1 patient (1%) passed away, while 9 patients (9%) had shock. Out of 100 patients who were studied, 21 (21%) had damage to internal organs, including 11 (52.4%) had spleen damage, 7 (34.5%) had liver injuries and 3 (13.1%) had damage to other organs. Also, microscopic hematuria was present in 45 (45%) patients. The

frequency of microscopic hematuria was significantly higher in patients with intra-abdominal organ damage (71.4% vs. 38.9%, $P < 0.001$). Classification of patients based on age, gender, and hospitalization duration (less than and more than 7 days), shock, and mechanism of trauma (including accidents and falls) showed that the frequency of microscopic hematuria was significantly higher in patients with intra-abdominal organ damage ($P < 0.05$). Also, the sensitivity and specificity of microscopic hematuria in detecting inter-abdominal organ damage were 53.84% and 77.14%, respectively. Also, its positive and negative predictive values were 81.39% and 47.37%, respectively. The overall accuracy of the test was 62% (kappa equal was 0.22, $P < 0.001$).

Table 1: Comparison of the frequency of microscopic hematuria in intra-abdominal organ damage in different subgroups

Variables	Subgroups	Microscopic of hematuria	Organ damage		Total	P-value*
			No	Yes		
Age	<40	Yes	26 (40.4%)	12 (68.1%)	38 (46.3%)	<0.001
		No	38 (59.6%)	5 (31.9%)	43 (53.7%)	
	>40	Yes	5 (32.8%)	3 (86.7%)	8 (43.4%)	<0.001
		No	10 (67.2%)	1 (13.3%)	11 (56.6%)	
Sex	Male	Yes	23 (38.9%)	39 (67.2%)	62 (44.4%)	<0.001
		No	37 (61.1%)	4 (32.8%)	41 (55.6%)	
	Female	Yes	7 (39.0%)	5 (80.8%)	12 (49.5%)	<0.001
		No	12 (61.0%)	1 (19.2%)	13 (50.5%)	
Mechanism of trauma	Accident	Yes	21 (39.4%)	3 (71.4%)	24 (46.7%)	<0.001
		No	33 (60.6%)	5 (28.6%)	38 (53.3%)	
	Falling	Yes	6 (38.8%)	2 (75.0%)	8 (44.3%)	0.028
		No	10 (61.2%)	1 (25.0%)	11 (55.7%)	
	Others	Yes	3 (36.1%)	6 (66.7%)	9 (42.2%)	0.137
		No	6 (63.9%)	4 (33.3%)	10 (57.8%)	
Shock	Yes	Yes	3 (47.6%)	2 (60.0%)	5 (52.8%)	0.463
		No	3 (52.4%)	1 (40.0%)	4 (47.2%)	
	No	Yes	28 (38.3%)	13 (73.9%)	41 (45.1%)	<0.001
		No	45 (61.7%)	5 (26.1%)	50 (54.9%)	
Hospitalization length	<7 days	Yes	24 (40.9%)	8 (78.6%)	32 (46.6%)	<0.001
		No	35 (59.1%)	2 (21.4%)	37 (53.4%)	
	>7 days	Yes	7 (33.3%)	7 (64.3%)	14 (43.9%)	<0.001
		No	13 (66.7%)	3 (35.7%)	16 (56.1%)	
Total		Yes	31 (38.9%)	15 (71.4%)	46 (45.8%)	<0.001
		No	48 (61.1%)	6 (28.6%)	54 (54.2%)	

*Chi-square test were used.

Discussion

The current study was conducted to determine the predictive utility of microscopic hematuria in the diagnosis of intra-abdominal organ damage in blunt trauma. Auto accidents were the primary cause of trauma for most of the patients.

The average age of the patients in this study varied from 30 to 40, with men making up the majority. The results demonstrated a substantial association between microscopic hematuria and intra-abdominal organ damage in abdominal blunt

trauma cases. Furthermore, the results showed that the evaluation of microscopic hematuria lacked a favorable sensitivity and negative predictive value (NPV) but had a high specificity and positive predictive value (PPV) for predicting intra-abdominal organ damage. As a result, using microscopic hematuria to evaluate intra-abdominal organ damage is inappropriate and ineffective as a screening method. However, injury to the intra-abdominal organs is more consistently suggested when microscopic hematuria are present. The microscopic hematuria examination was

determined to have no appropriate diagnostic value in a multicenter retrospective analysis. The sensitivity and NPV were higher than the specificity and PPV, in contrast to the current study. The microscopic hematuria measurement techniques may be one of the causes of this discrepancy. Urinalysis was employed as a microscopic hematuria examination method in the current investigation, while the dipstick test was employed in the previously stated study.[26] Microscopic hematuria and injury severity are significantly correlated, although there is no correlation with histological damage, according to an animal study. Additionally, the study demonstrated a connection between the macroscopic results of laparotomy and microscopic hematuria. Therefore, microscopic hematuria can have a suitable diagnostic power to assess intra-abdominal damage, which is not consistent with the present study, and the reason for this could be the difference in the gold standard for examining intra-abdominal organ damage with macroscopic laparotomy and CT scan, respectively.[24]

Microscopic hematuria has a high specificity and extremely poor sensitivity for assessing intra-abdominal organ damage, making it an inappropriate diagnostic tool, according to two related studies on children under 16 who had blunt trauma. This result aligned with our research.[27, 28] Hematuria has a very high sensitivity and negative predictive value, according to a study done to determine the predictive function of hematuria (gross and microscopic) in renal and genitourinary system damage after acute abdominal trauma. This leads to the conclusion that hematuria is an appropriate diagnostic test for assessing damage to the urinary-genital system and not other intra-abdominal organs.[27] Of course, considering that the difference between gross and microscopic hematuria was not considered in the mentioned study, it is not possible to make a decision about microscopic hematuria with certainty.

Microscopic hematuria was linked to an increased risk of kidney damage, multiple injuries, and intra-abdominal organ damage in another investigation including toddlers. Additionally, intraabdominal injury may be indicated by microscopic hematuria in conjunction with other clinical signs and symptoms. According to the aforementioned study, patients with blunt abdominal injuries who have microscopic hematuria should have a diagnostic CT scan.[29]

Conclusion

The current study shown that while the characteristics of microscopic hematuria and its high PPV make it a valuable additional test for verifying intra-abdominal organ damage, its sensitivity and NPV render it unreliable for organ

damage screening. In other words, a negative microscopic hematuria test does not rule out intra-abdominal injury, but a positive test greatly increases the risk of intra-abdominal damage.

References

1. Surgery for musculoskeletal injuries, Stinner DJ, Edwards D. 97(5), 2017, 1119-1131.
2. Children's trauma risks: An update for the busy physician, Soundappan SS, Holland AJ. 53(11):1096-1100, J. Paediatr Child Health, 2017.
3. Traumatic injury to the main vessels in the chest (Hardcastle TC, Naidoo S). Mediastinum, 2021, 5:26.
4. Lustenberger T, Lam L, Barmparas G, Eberle BM, Schnüriger B, Inaba K, et al. Do trauma-related serial white blood cell counts point to a hollow viscus injury? J. Trauma Acute Care Surg. 69(2):302-307 (2010).
5. The sensitivity of plain pelvic radiography in children with blunt torso injuries, Kwok MY, Yen K, Adelgais K, Garcia M, Quayle K, Atabaki S, et al. 65(1):63-71 (2015) Ann Emerg Med.
6. Goldstein AL, de Moya M. An update on patient selection for non-operative treatment of penetrating abdominal injuries. Curr Transplant Rep. 2019, 7:1–10.
7. Vasquez M, Cardarelli C, Glaser J, Murthi S, Stein D, Scalea T. The ABC's of pancreatic trauma: airway, breathing, and computerized tomography scan? Mil Med. 2017;182(1):66-71.
8. Moussavi N, Ghani H, Davoodabadi A, Atoof F, Moravveji A, Saidfar S, et al. Routine versus selective chest and abdominopelvic CT-scan in conscious blunt trauma patients: a randomized controlled study. Eur J Trauma Emerg Surg. 2018;44(1):9-14.
9. Keihani S, Anderson RE, Hotaling JM, Myers JB. Diagnosis and management of urinary extravasation after high-grade renal trauma. Nat Rev Urol. 2019;16(1):54-64.
10. Kordzadeh A, Melchionda V, Rhodes K, Fletcher E, Panayiotopoulos Y. Blunt abdominal trauma and mesenteric avulsion: a systematic review. Eur J Trauma Emerg Surg. 2016;42(3):311-315.
11. Jahromi AH, Johnson L, Youssef AM. Delayed small bowel perforation following blunt abdominal trauma: a case report and review of the literature. Asian J Surg. 2016;39(2):109-112.
12. Iaselli F, Mazzei MA, Firetto C, D'Elia D, Squitieri NC, Biondetti PR, et al. Bowel and mesenteric injuries from blunt abdominal trauma: a review. La radiologiamedica. 2015;120(1):21-32.

13. McGrath A, Whiting D. Recognising and assessing blunt abdominal trauma. *Emergency Nurse*. 2015;22(10):18-24.
14. Nayak SR, Yeola MP, Nayak SR, Kamath K, Raghuwanshi PS. Role of focused assessment with sonography for trauma in the assessment of blunt abdominal trauma—a review. *J Evol Med Dent Sci*. 2021;10(1):45-51.
15. Stengel D, Rademacher G, Ekkernkamp A, Güthoff C, Mutze S. Emergency ultrasound-based algorithms for diagnosing blunt abdominal trauma. *Cochrane Database Syst Rev*. 2015(9).
16. Chereau N, Wagner M, Tresallet C, Lucidarme O, Raux M, Menegaux F. CT scan and Diagnostic Peritoneal Lavage: towards a better diagnosis in the area of nonoperative management of blunt abdominal trauma. *Injury*. 2016;47(9):2006-2011.
17. Lee MJ, Sperry JL, Rosengart MR. Evaluating for acute mesenteric ischemia in critically ill with reduced operative intervention and mortality. *J Trauma Acute Care Surg*. 2014;77(3):441-417.
18. Hashemzadeh S, Mameghani K, Fouladi RF, Ansari E. Diagnostic peritoneal lavage in hemodynamically stable patients with lower chest or anterior abdominal stab wounds. *Ulus TravmaAcilCerrahiDerg*. 2012;18(1):37-42.
19. Swaine JM, Breidahl W, Bader D, Oomens C, O'Loughlin E, Santamaria N, et al. Ultrasonography detects deep tissue injuries in the subcutaneous layers of the buttocks following spinal cord injury. *Top Spinal Cord Inj Rehabil*. 2018;24(4):371-378.
20. Scott A, Zahradnik TM, Squier K, Beck C, Brunham LR. Diagnostic accuracy of ultrasound and MRI for Achilles tendon xanthoma in people with familial hypercholesterolemia: A systematic review. *J Clin Lipidol*. 2019;13(1):40-48.
21. Montoya J, Stawicki S, Evans DC, Bahner D, Sparks S, Sharpe R, et al. From FAST to E-FAST: an overview of the evolution of ultrasound-based traumatic injury assessment. *Eur J Trauma Emerg Surg*. 2016;42(2):119-126.
22. Mohammadi A, Ghasemi-Rad M. Evaluation of gastrointestinal injury in blunt abdominal trauma" FAST is not reliable": the role of repeated ultrasonography. *World J Emerg Surg*. 2012;7(1):1-6.
23. Hematuria as a predictor of abdominal damage following blunt trauma (Knudson MM, McAninch JW, Gomez R, Lee P, Stubbs HA). *The American Journal of Surgery*. 164(5):482-486, 1992.
24. Microscopic hematuria as a marker of blunt abdominal trauma in rats: description of an experimental paradigm, Karamercan MA, Sevgili AM, Karamercan A, Atilla P, Balkanci ZD, Karamercan G, et al. *Journal of Acute Care Surgery and Trauma*. 71(3):687-693 (2011).
25. Hatamabadi HR, Sabzghabaei A, Shojaei M, Safari S, and Shirvani R. The accuracy of urinalysis in predicting intra-abdominal damage following blunt injuries. *urgent*. 4(1):11 (2016).
26. Moustafa F, Loze C, Pereira B, Vaz M, Caumon L, Perrier C, et al. Assessment of urinary dipstick in patients admitted to an ED for blunt abdominal trauma. *Am J Emerg Med*. 2017;35(4):628-631.
27. Seyedhosseini-Davarani S, Saeedi A, Rouhipour A, Sanei Taheri M, Baratloo A. The value of urinalysis in detection of abdominal organ injuries in children with hematuria following blunt abdominal trauma; a diagnostic study. *Int J Pediatr*. 2017;5(11):6103-6110.
28. Forouzanfar MM, Hashemi B, Heydari K, Majidi A, Mahmoodi S, Saeedi A. Concordance of Abdominal Computed Tomography with Urinalysis Findings in Pediatrics with Hematuria Resulted from Blunt Abdominal Trauma. *Iranian Journal of Emergency Medicine*. 2017;4(3):125-129.
29. Taylor GA, Eichelberger MR, Potter BM. Hematuria. A marker of abdominal injury in children after blunt trauma. *Annals of surgery*. 1988;208(6):688.