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Comparing Urine Analysis and Urine Dipstick Tests Used in the Diagnosis of Renal Injury in Children With Blunt Abdominal Trauma in Shiraz, Iran

Robab Sadegh[1], Somaye Mohebinejad[2], Razieh Sadat Mousavi-Roknabadi[1,3], Ali Ariafar[4], Afsaneh Dehbozorgi[1], Mehrdad Sharifi[1,3]

[1] Department of Emergency Medicine, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran
[2] Student Research Committee, Emergency Medicine Department, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran
[3] Emergency Medicine Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
[4] Urology Oncology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

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Abstract

Background: Blunt abdominal trauma (BAT) is the most common cause of abdominal injury and is responsible for renal injury in children. Urine dipstick is used in various clinical conditions, and its use in the diagnosis of microscopic hematuria is very common in adults, but its efficacy in children with BAT is unclear.

Objective: To determine the accuracy of urine dipstick test and compare it with microscopic urine analysis (UA) in predicting urinary system injury.

Methods: This prospective cross-sectional study was conducted on children with BAT who were referred to the Acute Care II of the Emergency Medicine Department of Shiraz Namazi Hospital in south of Iran (April–October 2018). The results of the urine dipstick test were compared with the results of UA, abdominal computed tomography (CT) scan as the gold standard, and the point-of-care ultrasound (POCUS). The diagnostic tests (sensitivity, specificity, positive and negative predictive values, positive and negative likelihood ratios, and accuracy) were calculated.

Results: A total of 380 patients were enrolled, with a mean ± standard deviation age of 6.3 ± 3.45 years. We obtained a sensitivity, specificity, and accuracy of 71.43% (95% CI, 41.90–91.61), 96.99% (95% CI, 94.69–98.49), and 96.05% (95% CI, 93.57–97.77), respectively, with a negative predictive value (NPV) of 98.89% (95% CI, 97.48–99.51) for the dipstick test in comparison with UA. In comparing the results of the dipstick and UA tests with CT scan, no difference was found in terms of sensitivity (P = 0.35), specificity (P = 0.65), accuracy (P = 0.72), and area under the curve (P = 0.97).

Conclusion: Due to no difference in diagnostic values between the urine dipstick and UA tests, dipstick can be considered as an alternative means of UA in the management algorithm of pediatric BAT. Also, with higher specificity and NPV of the dipstick test in comparison with the UA test, based on the negative results of dipstick, hematuria can be ruled out in children with BAT.

Keywords: Blunt Injuries, Urologic Diagnostic Technics, Computed tomography, Ultrasonography

Abbreviations / Acronyms:
AUC: area under the curve; **BAT:** Blunt abdominal trauma; **POCUS:** point-of-care ultrasound; **PLR:** positive likelihood ratio; **PPV:** Positive predictive value; **NLR:** negative likelihood ratio; **NPV:** negative predictive value; **ROC:** Receiver operating characteristics

Corresponding author:
Razieh Sadat Mousavi-Roknabadi. Emergency Medicine Department, School of Medicine, Shiraz University of Medical Sciences, Namazi Hospital, Postal Code: 71937-11351, Shiraz, Iran.
Tel: +98.9131563018, E-mail: mousavi_razieh@sums.ac.ir
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1. Introduction

Blunt abdominal trauma (BAT) is the most common cause of abdominal injury in children and is responsible for more than 90% of renal injury in children (1, 2). Renal injury occurs in 10%–20% of BAT cases and is more common than spleen, liver, and pancreatic injury (3). Penetrating trauma accounts for a small proportion of children's renal injury (2). Children are at greater risk of renal injury than adults due to structural and congenital predisposing factors and larger size of the kidney and lower renal fat content. Also, children's kidneys may retain the fetal lobules, and the parenchyma is more likely to break after trauma (4).

Blunt renal injuries in children are usually minor and require no intervention, and also the risk of subsequent complications is low (5). A small proportion of children have severe and potentially dangerous renal injury that requires immediate evaluation and treatment (2, 6). The challenge lies in the early diagnosis and choice of appropriate intervention in grade IV and V kidney injuries, because the clinical symptoms are not clear and further interventions are needed (7, 8). To assess the need for imaging, the number of red blood cells and the type of injury (>50 red blood cells [RBCs] per high-powered field in blunt trauma, and >5 RBCs in penetrating trauma) should be carefully considered (9, 10). It should be noted, however, that the presence or absence, as well as the severity of hematuria, cannot determine the degree of renal injury. Recent studies have reported severe hematuria in partial renal injury and no hematuria in cases with severe renal injury (IV and V) (10, 11).

The renal blunt trauma management algorithm for achieving maximum kidney protection is discussed in the McAninch and Buckley study. In the pediatric BAT management algorithm, urine analysis (UA) is first performed in children with BAT, and based on the results, it is decided whether the patient needs further treatment (1). Urine microscopic analysis is the gold standard for the diagnosis of microscopic hematuria, and hematuria is usually identified by the UA and reported as RBCs/high-powered field. Another common screening test for the diagnosis of hematuria is the urinary dipstick test. The test is sensitive to urine hemoglobin, but it may have many false-positive results. In contrast, false negatives are unusual, and, as a result, a negative dipstick test rejects hematuria. Compared to microscopic UA, dipstick test is a simple, fast, and inexpensive method for detecting blood in urine. Kennedy et al. found that using the urine dipstick test would result in a savings of $63,000 annually (12). Currently, urine dipstick is used all over the world in various clinical conditions, and its use in the diagnosis of microscopic hematuria is very common in adults. This test has a sensitivity of 91%–100%, but its sensitivity in children with BAT is unclear (13).

Considering the advantage of quick application of the urine dipstick test in the emergency department (ED), and, at the same time, limited studies being conducted on the use of this test in children with BAT, this study aimed to determine the accuracy of this test and compare it with microscopic UA in predicting urinary system injury. The hypothesis of this study was whether the use of urine dipstick test can be as effective as UA in the diagnosis of hematuria and the urinary system injury in children with BAT, also whether it could be used as an alternative for UA in the BAT management algorithm.

2. Material and Methods

2.1. Study design and setting

The current prospective cross-sectional study (April–October 2018) was conducted in the Acute Care II of the Emergency Medicine Department (ED) at Namazi Hospital, a university-affiliated hospital in southern Iran. This ED records about 65,000 admissions annually.

2.2. Study population and study protocol

The study was performed on children (<18 years old) who were referred to the ED with BAT. Microscopic UA, as well as POCUS and spiral abdominal CT scan with intravenous (IV) contrast, was done on them. In the ED's setting, radiographic evaluation is routinely performed for all traumatic children with hematuria, regardless of the amount of hematuria. Those patients whose urine samples were collected by catheterization or suprapubic catheters and those who were suspected to have urinary tract infection (leukocyte esterase positive in urine test) were excluded from the study. The urine dipstick test was done on all participants' urine samples by an emergency medicine resident [SM]. The demographic variables (such as age, gender), type of trauma, as well as the results of microscopic UA, urine dipstick test, and radiological findings (abdominal CT scan and point-of-care ultrasound [POCUS]) were recorded in a data gathering form [SM]. All POCUS tests were done by third-year emergency medicine residents, supervised by emergency medicine attending physicians, who were Iranian board-certified in emergency medicine, and a faculty member, who was an expert in performing POCUS [RS], using a portable ultrasonography machine (Fujifilm SonoSite, Inc., USA) with a high-frequency curve probe (5–8 MHz). POCUS is one of the topics of study in the emergency medicine curriculum, and is taught to emergency medicine residents in Iran, during their residency periods. All CT scans were performed and reported by the hospital's radiology department. It should be noted that abdominal CT scan is considered the gold standard for diagnosing renal injuries following BAT. A urine dipstick score of 0, 1, and 2 was considered as a negative dipstick result in this study. Also, for microscopic UA, RBC > 50 is considered as a positive result, and RBC ⩽ 50 as negative.

2.3. Sample size and sampling method

A sample size of 326 patients was calculated to obtain a 95% CI (SD = 5%) with an estimation of 22% prevalence of hematuria (α = 5%, d = 0.046) (14). The convenience sampling method was used for easy collection of samples from the participants.

2.4. Statistical analysis

All statistical analyses were performed by IBM© SPSS© Statistics version 26 (IBM© Corp., Armonk, NY, USA), using a Chi-squared test for independence, Fisher's exact tests for proportions, and one-way ANOVA for the means. Kappa was used to assess the agreement between tests. Results are presented as mean ± standard deviation (SD) for continuous variables and are summarized in number (percentage) for categorical ones. To examine the two-sided hypothesis, a P-value less than 0.05 and CI of 95% were considered to be statistically significant. To determine different characteristics of the diagnostic tests, such as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), positive likelihood ratio (PLR), negative likelihood ratio (NLR), and accuracy, the MedCalc Statistical Software version 13.3.3 (MedCalc Software Bvba, Ostend, Belgium; http://www.medcalc.org; 2014) was used. Receiver operating characteristics (ROC) curve was drawn to obtain the area under the curve (AUC).

2.5. Ethical consideration

The current study was supported by the Shiraz University of Medical Sciences and was approved by the Vice-Chancellor of Research and Technology as well as the local ethics committee of the Shiraz University of Medical Sciences (IR.sums.med.rec.1397.322). This study was conducted in accordance with the Declaration of Helsinki. To consider ethical issues, the collected data were not revealed to anyone except for the researchers. In the ED's setting, radiographic evaluation (POCUS or spiral abdominal CT scan with intravenous) is routinely performed for all traumatic children with hematuria, regardless of the amount of hematuria. Urine dipstick test was done on urine samples, which were then taken for the UA test, which is routinely performed in these patients. So, a written informed consent was not separately needed for performing these modalities in the patients.

3. Results

In total, 380 patients were enrolled, of which 212 (55.8%) were male. The mean ± SD of age was 6.3 ± 3.45 years (range: 1–17 years). Most of the patients had moderate BAT (85.3%) (Table 1). As shown in Table 2, there was a correlation between the results of the dipstick test and number of RBCs in the UA test (P < 0.0001), and the agreement between them was relatively strong (Kappa = 0.667). Also, an association between the results of the dipstick test and those of POCUS was found (P < 0.0001), but the observed agreement between them was very poor, clinically (Kappa = 0.005). This association was statistically significant between the results of the dipstick test and the CT scan (P < 0.0001), with a very poor agreement (Kappa = 0.08). Moreover, there was a correlation between the number of RBCs in UA and the results of POCUS (P < 0.0001, Kappa = 0.001) as well as the results of the CT scan (P < 0.0001, Kappa = 0.078) (Table 3).

The results of the dipstick and UA tests in diagnosis of renal injury in children with BAT are shown in Table 4. As shown in Table 5, the sensitivity and specificity of the dipstick test were 2.59% (95% CI, 1.19–4.87) and 63.64% (95% CI, 45.12–79.60), respectively, in comparison with CT scan, with an accuracy of 7.89% (95% CI, 5.39–11.08). For UA, the sensitivity and specificity were obtained as 0.86% (95% CI, 0.18–2.51) and 66.67% (95% CI, 48.17–82.04), with an accuracy of 6.58% (95% CI, 4.3–9.56). AUC was found to be 0.331 (95% CI, 0.217–0.445, P = 0.001) for the dipstick test and 0.338 (95% CI, 0.222–0.453, P = 0.002) for UA. Comparing these two diagnostic tests, no difference in sensitivity (P = 0.35), specificity (P = 0.65), accuracy (P = 0.72) as well as AUC (P = 0.97) could be found. Also, we obtained a sensitivity, specificity, and accuracy of 71.43% (95% CI, 41.90–91.61), 96.99% (95% CI, 94.69–98.49), and 96.05% (95% CI, 93.57–97.77), respectively, with AUC of 0.842 (95% CI, 0.801–0.877, P < 0.0001) for the dipstick test in comparison with UA (Table 6). PPV and NPV were calculated as 47.62% (95% CI, 31.76–63.98) and 98.89% (95% CI, 97.48–99.51). Also, these values were calculated for the dipstick test in comparison with POCUS: sensitivity of 2.45% (95% CI, 1.06–4.76), specificity of 75.47% (95% CI, 61.72–86.24), and accuracy of 12.63% (95% CI, 9.46–16.40).

Table 1. Patients' characteristics

Variables		Values
Age	Mean±SD	6.3±3.45
	Maximum	17
	Minimum	1
Gender (%)	Male	212 (55.8)
	Female	168 (44.2)
Type of trauma	Moderate	324 (85.3)
	Severe	56 (14.7)
Number of RBC in microscopic urine analysis (%)	0	283 (74.5)
	1-5	57 (15.0)
	5-50	26 (6.8)
	>50	14 (3.7)
Number of RBC in urine dipstick test (%)	0	298 (78.4)
	1	39 (10.3)
	2	22 (5.8)
	3	21 (5.8)
Ultrasound's findings (%)	Positive	327 (86.1)
	Negative	53 (13.9)
Computed tomography (CT) scan's findings (%)	Positive	347 (91.3)
	Negative	33 (8.7)

SD=standard deviation, RBC=red blood cell count

Table 2. Relationship between urine dipstick and other diagnostic tests (the number of RBC in urine analysis, point-of-care ultrasound (POCUS) and CT scan's findings)

Dipstick test	Total	Number of RBC in urine analysis					POCUS's findings			CT scan's findings		
		0	1-5	5-50	>50	p-value	Positive	Negative	p-value	Positive	Negative	p-value
0	298 (78.42)	281 (94.3)	15 (5.0)	2 (0.7)	0 (0)	<0.0001*	16 (5.4)	282 (94.6)	<0.0001*	5 (1.7)	293 (98.3)	<0.0001*
1	39 (10.26)	2 (5.1)	30 (76.9)	7 (17.9)	0 (0)		14 (35.9)	25 (64.1)		8 (20.5)	31 (79.5)	
2	22 (5.79)	0 (0)	9 (40.9)	9 (40.9)	4 (18.2)		10 (45.5)	12 (54.5)		8 (36.4)	14 (63.6)	
3	21 (5.53)	0 (0)	3 (14.3)	8 (38.1)	10 (47.6)		13 (61.9)	8 (38.1)		12 (57.1)	9 (42.9)	
Total	380	283 (74.5)	57 (15.0)	26 (6.8)	14 (3.7)		53 (13.9)	327 (86.1)		33 (8.7)	347 (91.3)	

*Statistically significant, CT=computed tomography, RBC=red blood cell count

Table 3. Relationship between the number of RBC in dipstick test and computed tomography (CT) scan's findings

Number of RBC in microscopic urine analysis	Total	Ultrasound's findings		p-value	CT scan's findings		p-value
		Positive	Negative		Positive	Negative	
0	283	16 (5.7)	267 (94.3)	<0.0001*	4 (1.4)	279 (98.6)	<0.001*
1-5	57	17 (29.8)	40 (70.2)		8 (14.0)	46 (86.0)	
5-50	26	13 (50.0)	13 (50.0)		10 (38.5)	16 (61.5)	
>50	14	7 (50.0)	7 (50.0)		11 (78.6)	3 (21.4)	
Total	380	53 (13.9)	327 (86.1)		33 (8.7)	347 (91.3)	

*Statistically significant, CT=commuted tomography, RBC=red blood cell count

Table 4. Comparison of diagnostic values of urine dipstick and microscopic urine analysis tests for diagnosing renal injury in comparing with CT scan's findings

Tests	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Positive Likelihood Ratio	Negative Likelihood Ratio	Accuracy	Area under the curve	p-value
Urine dipstick test	2.59% (1.19-4.87%)	63.64% (45.12-79.60)	42.86% (25.45-62.23)	5.85% (4.58-7.45)	0.07 (0.03-0.16)	1.53 (1.18-1.98)	7.89% (5.39-11.08)	0.331 (0.217-0.445)	0.001 *
Microscopic urine analysis	0.86% (0.18-2.51)	66.67% (48.17-82.04)	21.43% (7.41-48.16)	6.01% (4.78-7.53)	0.03 (0.01-0.09)	1.49 (1.17-1.89)	6.58% (4.3-9.56)	0.338 (0.222-0.453)	0.002*
p-value	0.35	0.65	0.001*	0.96	0.90	0.98	0.72	0.97	-

* Statistically significant

Table 5. The results of urine dipstick and microscopic urine analysis tests for diagnosing renal injury in children with blunt abdominal trauma

Diagnostic tests		CT scan's findings		Total
		Positive	Negative	
Urine dipstick test	Positive (3)	9	12	21
	Negative (0-2)	338	21	359
	Total	347	33	380
Microscopic urine analysis	Positive (>50)	3	11	14
	Negative (≤50)	344	22	366
	Total	347	33	380

CT=computed tomography

Table 6. Diagnostic values of urine dipstick test for diagnosing renal injury in comparing with urine analysis test, point-of-care ultrasound (POCUS) and abdominal computed tomography scan

Diagnostic values	Microscopic UA	POCUS	Abdominal CT scan
Sensitivity	71.43% (41.90-91.61)	2.45% (1.06-4.76)	2.59% (1.19-4.87%)
Specificity	96.99% (94.69-98.49)	75.47% (61.72-86.24)	63.64% (45.12-79.60)
Positive predictive value	47.62% (31.76-63.98)	38.10% (21.13-58.57)	42.86% (25.45-62.23)
Negative predictive value	98.89% (97.48-99.51)	11.14% (9.70-12.77)	5.85% (4.58-7.45)
Positive likelihood ratio	23.77 (12.17-46.43)	0.10 (0.04-0.23)	0.07 (0.03-0.16)
Negative likelihood ratio	0.29 (0.13-0.67)	1.29 (1.11-1.51)	1.53 (1.18-1.98)
Accuracy	96.05% (93.57-97.77)	12.63% (9.46-16.40)	7.89% (5.39-11.08)
Area under curve	0.842 (0.801-0.877)	0.390 (0.298-0.481)	0.331 (0.217-0.445)
p-value	<0.0001*	0.01*	0.001*

* Statistically significant, CT=computed tomography scan, UA=urine analysis

Figure 1 shows the ROC curves of the dipstick test in diagnosis of renal injury in children with BAT in comparison with microscopic UA, POCUS, as well as abdominal CT scan. The AUC of the urine dipstick test in diagnosis of renal injury in children with BAT was more than that for the microscopic UA by 0.5 (0.842 with 95% CI, 0.801–0.877, $P < 0.0001$). However, it was less than that of POCUS by 0.5 (0.390 with 95% CI, 0.298–0.481, $P = 0.01$) and abdominal CT scan (0.331 with 95% CI, 0.217–0.445, $P = 0.001$).

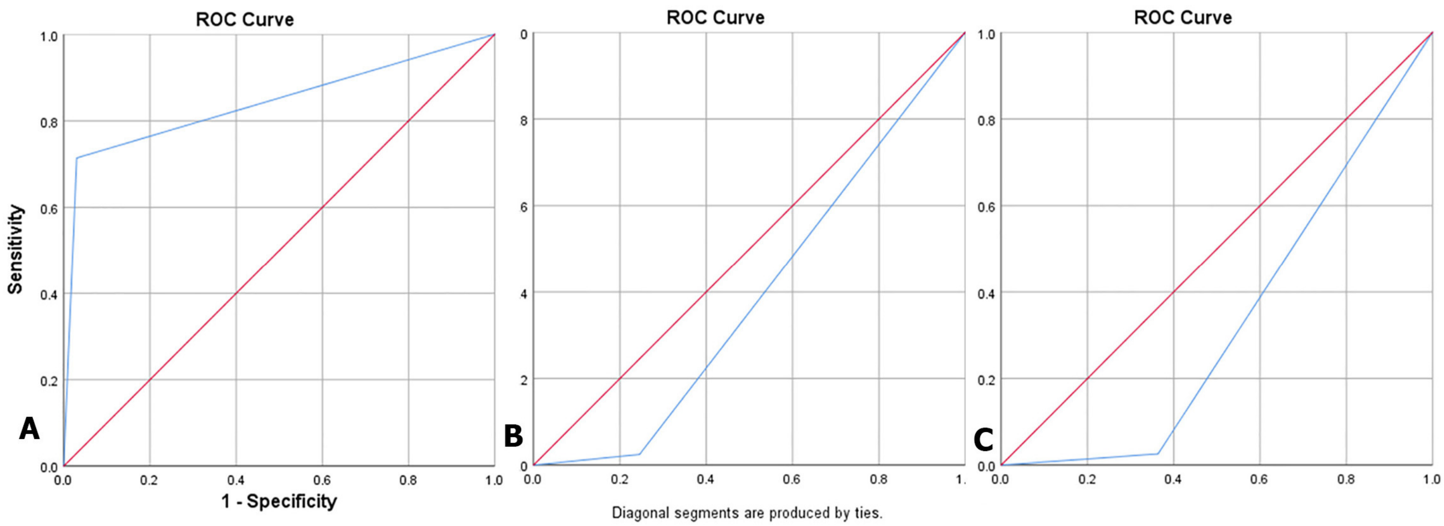

Figure 1. Receiver operating characteristics (ROC) curve of urine dipstick test for diagnosing renal injury in children with abdominal blunt trauma. **A)** In comparison with microscopic urine analysis: AUC is 0.842 (95%CI, 0.801-0.877, P<0.0001); **B)** In comparison with point-of-care ultrasound: AUC is 0.390 (95%CI, 0.298-0.481, P=0.01); **C)** In comparison with abdominal computed tomography scan: AUC is 0.331 (95%CI, 0.217-0.445, P=0.001).

4. Discussion

This study was performed to determine the diagnostic accuracy of the urine dipstick test and compare it with microscopic UA in detecting urinary tract injuries in children with BAT who were referred to ED. The results showed that the sensitivity, specificity, and accuracy of the dipstick test were low in comparison with CT scan. These results were not statistically different in comparison with UA. Also, the AUCs were similar. Moreover, the agreement between these two tests was relatively strong. It was found that the sensitivity, specificity, and accuracy of the urine dipstick test were high in comparison with microscopic UA. With high specificity and NPV for the dipstick test in comparison with UA, based on the negative results of dipstick, hematuria can be ruled out in children with BAT.

Over the past several decades, various methods have been investigated for the diagnosis of microscopic hematuria, and their accuracies have always been compared. Many studies have investigated the ability of the urine dipstick test in detecting renal injury and evaluating its severity, but to our knowledge, no study in line with the current study has been performed in children, which distinguishes the present study from previous ones.

We found that the dipstick test had high specificity and NPV in detecting urinary tract injuries in children with BAT in comparison with UA. In line with our study, Kennedy et al. (12) compared the dipstick and microscopic UA tests to evaluate their efficacy in predicting the severity of urinary system injury. They found that dipstick is a safe, accurate, and valid test for determining the presence or absence of hematuria in patients with abdominal trauma. Also, Daum et al. (15) examined the agreement between the UA and dipstick tests in patients with BAT. In 178 patients, the sensitivity and specificity of the dipstick test were found to be 100% and 58.6%, respectively. They reported PPV and NPV of 60.8% and 100%, respectively. Similar to the results obtained in the present study, they suggested that other tests, including microscopic UA, would not be needed if the dipstick test result was negative.

The results of this study showed that the sensitivity, specificity, and accuracy of the urine dipstick test were high in comparison with microscopic UA. In line with our study, Chandhoke and McAninch (16) compared the prediction rates of microscopic hematuria based on the dipstick and microscopic UA tests in 339 patients with BAT, whose injury severity was identified through radiographic studies. In contrast with our findings, the results of their study indicated that the correlation between these two methods was low (Pearson coefficient: 0.41). But, similar to the current study, they found that the dipstick test had more than 97.5% sensitivity and specificity in the diagnosis of microscopic hematuria. They concluded that although the UA test determines microscopic hematuria more accurately, it can also be detected using dipstick. Moreover, Anigilaje et al. (17) compared the efficacy of the urine dipstick and microscopic UA tests in patients with thalassemia. They reported that both tests had a Pearson correlation of 0.623. Matulewicz et al. (18) compared these two methods in the detection of microhematuria for the diagnosis of bladder cancer. Also, they investigated the sensitivity and specificity of the dipstick test compared with UA. In line with our findings, they stated that there was a strong correlation between the results of the two tests. Also, similar to the results of the present study, no significant difference was found in the accuracy of the two methods. They suggested that the dipstick test can be used to rule out microhematuria due to its high specificity.

Similar to the present study, Moustafa et al. (19) evaluated the efficacy of the urine dipstick test compared with abdominal CT scan in adult patients admitted to ED due to BAT. Results of this retrospective, multicenter cohort study showed that of the 100 patients studied, this test had a sensitivity of 72.2% and specificity of 53.1%. In line with our findings, due to low sensitivity and specificity of the dipstick test in comparison with CT scan, they stated that the dipstick test was unable to predict and determine abdominal injury in these patients. Furthermore, similar to the results of the present study, Sabzghabaei et al. (14), Capraro et al. (20), and Seyedhosseini-Davarani et al. (21) showed that CT scan's performance in diagnosis of patients with BAT is better compared with UA. However, Trop et al. (22) stated that microscopic UA has moderate power in predicting urologic injuries in children with BAT compared to abdominal and pelvic CT scans. In their study, Zamani et al. (23) compared the results of focused assessment with sonography for trauma (FAST) and UA test with CT scan in children with BAT in the ED. They concluded that the combination of these two tests would increase the diagnostic accuracy of abdominal injuries.

5. Study limitations

One of the limitations of the present study is that it was conducted in a single center with limited patients. Also, this study was performed only on children with BAT. Hence, its results cannot be generalized to children with penetrating trauma and adult patients, who make up the majority of trauma patients. It is suggested that future studies should include a larger, multicenter population of patients of different age to be able to extrapolate the results to all trauma patients.

6. Conclusions

The results of this study showed that the urine dipstick and microscopic UA tests have no higher sensitivity and specificity in comparison with abdominal CT scan, and they cannot be considered as a diagnostic tool in determining renal injury and its severity in children with BAT. Due to no significant difference in diagnostic values between the urine dipstick and microscopic UA tests, dipstick can be considered as an alternative for UA in the pediatric BAT treatment algorithm. Also, with high specificity and NPV for the dipstick test in comparison with UA, it may be concluded that based on the negative results of dipstick, hematuria can be ruled out in children with BAT. Hence, future studies with a larger, multicenter population of patients of different age groups are highly recommended.

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Conflict of Interest:

There is no conflict of interest to be declared.

Authors' contributions:

All authors read and approved the final manuscript. Conception or design of the work (RS, AA, AD, MS); Acquisition of data (RS, SM, AA); Analysis or interpretation of data (RSM, SM); Drafting the manuscript (RS, SM, RSM, AA); Revising the manuscript: All authors; Accountable for all aspects of the work: All authors.

References:

1) Rance CH, Singh SJ, Kimble R. Blunt abdominal trauma in children. J Paediatr Child Health. 2000 Feb;36(1):2-6. doi: 10.1046/j.1440-1754.2000.00449.x. PMid: 10723682
2) Buckley JC, McAninch JW. Pediatric renal injuries: management guidelines from a 25-year experience. J Urol. 2004;172(2):687-90; discussion 690. doi: 10.1097/01.ju.0000129316.42953.76, PMid: 15247762
3) Smith EM, Elder JS, Spirnak JP. Major blunt renal trauma in the pediatric population: is a nonoperative approach indicated? J Urol. 1993;149(3):546-8. doi: 10.1016/S0022-5347(17)36143-8

4) Brown SL, Haas C, Dinchman KH, Elder JS, Spirnak JP. Radiologic evaluation of pediatric blunt renal trauma in patients with microscopic hematuria. World J Surg. 2001;25(12):1557-60. doi: 10.1007/s00268-001-0149-6, PMid: 11775191
5) Dangle PP, Fuller TW, Gaines B, Cannon GM, Schneck FX, Stephany HA, et al. Evolving Mechanisms of Injury and Management of Pediatric Blunt Renal Trauma--20 Years of Experience. Urology. 2016;90:159-63. doi: 10.1016/j.urology.2016.01.017, PMid: 26825488
6) Medica J, Caldamone A. Pediatric renal trauma: special considerations. Semin Urol. 1995;13(1):73-6.
7) Armstrong LB, Mooney DP. Pediatric renal injury: which injury grades warrant close follow-up. Pediatr Surg Int. 2018;34(11):1183-7. doi: 10.1007/s00383-018-4355-9, PMid: 30264373
8) Lee JN, Lim JK, Woo MJ, Kwon SY, Kim BS, Kim HT, et al. Predictive factors for conservative treatment failure in grade IV pediatric blunt renal trauma. J Pediatr Urol. 2016;12(2):93.e1-7. doi: 10.1016/j.jpurol.2015.06.014, PMid: 26292911
9) Morey AF, Bruce JE, McAninch JW. Efficacy of radiographic imaging in pediatric blunt renal trauma. J Urol. 1996;156(6):2014-8. doi: 10.1016/S0022-5347(01)65422-3
10) Perez-Brayfield MR, Gatti JM, Smith EA, Broecker B, Massad C, Scherz H, et al. Blunt traumatic hematuria in children. Is a simplified algorithm justified? J Urol. 2002;167(6):2543-6; discussion 2546-7. doi: 10.1016/S0022-5347(05)65033-1
11) Nguyen MM, Das S. Pediatric renal trauma. Urology. 2002;59(5):762-6; discussion 6-7. doi: 10.1016/S0090-4295(02)01548-0
12) Kennedy TJ, McConnell JD, Thal ER. Urine dipstick vs. microscopic urinalysis in the evaluation of abdominal trauma. J Trauma. 1988;28(5):615-7. doi: 10.1097/00005373-198805000-00009, PMid: 3367403
13) Mazouz B, Almagor M. False-positive microhematuria in dipsticks urinalysis caused by the presence of semen in urine. Clin Biochem. 2003;36(3):229-31. doi: 10.1016/S0009-9120(02)00473-3
14) Sabzghabaei A, Shojaee M, Safari S, Hatamabadi HR, Shirvani R. The Accuracy of Urinalysis in Predicting Intra-Abdominal Injury Following Blunt Traumas. Emerg (Tehran). 2016;4(1):11-5.
15) Daum GS, Krolikowski FJ, Reuter KL, Colby JM, Silva WM. Dipstick evaluation of hematuria in abdominal trauma. Am J Clin Pathol. 1988;89(4):538-42. doi: 10.1093/ajcp/89.4.538, PMid: 3354507
16) Chandhoke PS, McAninch JW. Detection and significance of microscopic hematuria in patients with blunt renal trauma. J Urol. 1988;140(1):16-8. doi: 10.1016/S0022-5347(17)41472-8
17) Anigilaje EA, Adedoyin OT. Correlation between dipstick urinalysis and urine sediment microscopy in detecting haematuria among children with sickle cell anaemia in steady state in Ilorin, Nigeria. Pan Afr Med J. 2013;15:135. doi: 10.11604/pamj.2013.15.135.1854, PMid: 24319525, PMCid: PMC3852513
18) Matulewicz RS, DeLancey JO, Pavey E, Schaeffer EM, Popescu O, Meeks JJ. Dipstick Urinalysis as a Test for Microhematuria and Occult Bladder Cancer. Bladder Cancer. 2017;3(1):45-49. doi: 10.3233/BLC-160068, PMid: 28149934, PMCid: PMC5271483
19) Moustafa F, Loze C, Pereira B, Vaz MA, 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. doi: 10.1016/j.ajem.2016.12.047, PMid: 28040382
20) Capraro AJ, Mooney D, Waltzman ML. The use of routine laboratory studies as screening tools in pediatric abdominal trauma. Pediatr Emerg Care. 2006;22(7):480-4. doi: 10.1097/01.pec.0000227381.61390.d7, PMid: 16871106
21) 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. International Journal of Pediatrics. 2017;5(11):6103-10.
22) Thorp AW, Young TP, Brown L. Test characteristics of urinalysis to predict urologic injury in children. West J Emerg Med. 2011;12(2):168-72. doi: 10.15171/jept.2018.05
23) Zamani M, Heydari F, Esmailian M. FAST and abnormal urinalysis: the effective screening tools in pediatric abdominal trauma. Journal of Emergency Practice and Trauma. 2019; 5(1):14-18.