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# A negative urinalysis is associated with a low likelihood of intra-abdominal injury after blunt abdominal trauma

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**Abstract**

**BACKGROUND:** The utility of urinalysis (UA) to diagnose intra-abdominal (IA) or genitourinary (GU) injury after blunt trauma remains controversial. The purpose of this study was to determine the significance of UA in the blunt trauma patient.

**METHODS:** A retrospective review of patients admitted for blunt abdominal trauma from 2011 to 2013.

**RESULTS:** A total of 1,795 patients sustained blunt abdominal trauma: mean age of 44 ± 21 years; mean Injury Severity Score of 13 ± 10. Overall 810 patients had a negative UA (45%). Two patients (2/810 and .2%) had a GU injury and neither required intervention. Thirty-two patients (32/810 and 4.0%) had an IA injury, and 2 (2/810 and .02%) required intervention. The sensitivity for predicting GU injury requiring intervention was 1, and IA injury requiring intervention was .96. Negative predictive values were 1 and .99.

**CONCLUSIONS:** A negative UA correlates with a low risk for GU and IA injury after blunt abdominal trauma. A negative UA should be evaluated prospectively as part of a clinical prediction score to rule out injury and avoid unnecessary radiation exposure from computed tomography imaging.


The presence of hematuria in a trauma patient has been suggested as an indicator for genitourinary (GU) and intra-abdominal (IA) injury. Although it is commonly accepted that gross hematuria is a marker for both GU and IA injuries, the significance of microscopic hematuria remains questionable.[1–3] In children, a urinalysis (UA) with microscopic hematuria greater than 5 red blood cells per high-powered field (RBCs/hpf) correlates with the presence of an IA injury.[4,5] In the adult population, however, there is a discrepancy between hematuria and IA injury. A clinical prediction rule developed in 2009 validated microscopic hematuria greater than 25 RBCs/hpf as predictive of blunt torso trauma in adults.[6] In contrast, 2 studies demonstrated that even macroscopic hematuria was not accurate for predicting injury when used in adult patients who had concomitant computed tomography (CT) scans.[7,8] A more recent

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publication recommends omission of the UA from routine trauma assessment.[9]

Suggestions that routine UA can be omitted after blunt abdominal injury may stem from the increased use of computed tomography in the evaluation of the trauma patient. Whole-body CT scanning has been advocated to reduce morbidity and mortality in blunt trauma patients; however, the increasing cost and radiation exposure remains a significant concern.[10–12] Identification of patients with a low risk of IA injury may help limit the number of CT scans that are obtained in trauma patients and obtaining a UA may aid in the identification of such a patient cohort.

The purpose of this study was to define the utility of the UA after blunt abdominal trauma in a large patient population. We hypothesize that the UA would identify a subset of patients who are low risk for GU and IA injury; this patient cohort could potentially be safely observed after blunt abdominal trauma without additional imaging.

## Methods

The Denver Health Medical Center Trauma Registry was queried for all blunt trauma patients between January 2011 and December 2013. Denver Health Medical Center is a state-certified and American College of Surgeons-verified level I regional trauma center and an integral teaching facility of the University of Colorado School of Medicine. Patients with a UA within 12 hours of arrival to the emergency department were included in the study population. Patients with gross hematuria, an initial trauma workup at an outside facility, or no available UA results were excluded. Patient demographics, mechanism of injury, Injury Severity Score, identified injuries, and the need for intervention were recorded. The presence of any red blood cell or hemoglobin in the specimen was considered a positive UA.

The sensitivity, specificity, positive predictive value and negative predictive value (PPV and NPV, respectively) and likelihood ratio of the UA were calculated for all GU and IA injuries and those GU and IA injuries that required intervention (surgical or an interventional radiology [IR] procedure). A $P < .05$ was considered statistically significant. The University of Colorado Multi-Institutional Review Board approved this study.

## Results

There were 3,932 patients evaluated for blunt trauma during the study period and 1,795 (46%) met inclusion criteria. The majority (1,140 patients and 64%) were men with a mean age of 44 ± 21 years of age and mean Injury Severity Score of 13 ± 10. The most common mechanisms of injury were motor vehicle collisions in 628 patients (35%), followed by falls (487 patients and 27%), auto vs pedestrian collisions (214 patients and 12%), and assaults (171 patients and 10%). Two hundred and six patients (12%) had IA injuries including liver (92 patients and 45%), spleen (79 patients and 38%), and kidney (45 patients and 22%). Fifty-three patients (24%) with IA injuries required intervention for their injuries: 50 patients went to surgery and 3 patients were treated with IR procedures. Of these IA injury patients, 10 patients had GU injuries requiring intervention (9 patients went to surgery and 1 was treated by IR).

A negative UA was documented in 810 patients (45%). Of these patients, two (.2%) had GU injuries and neither patient required intervention. There were 32 patients (4%) who had an IA injury and 2 patients (.2%) required intervention (Table 1).

A positive UA was documented in nine hundred and eighty five patients (55%). Of these patients, 174 (18%) had an IA injury and 51 patients (29%) required intervention. There were 51 patients (5%) who had GU injuries and 10 patients (22%) required intervention.

The sensitivity, specificity, positive predictive value, NPV, and likelihood ratios of the UA after blunt abdominal trauma are reported in Table 2. The UA has a high sensitivity and NPV for IA (.85 and .96, respectively) and GU (.98 and .99, respectively) injuries. The UA is even more sensitive and has a better NPV when it is used to identify only those patients who require intervention for their IA (.96 and .99, respectively) or GU (1.0 and 1.0, respectively) injuries.

Patients with defined injuries were compared to the quantification of RBCs in the UA; this analysis was done to evaluate for a possible threshold RBC value for injury screening. Table 3 demonstrates the number of patients who had quantified microscopic hematuria and those who had injuries. For example, of the patients who had 1 to 4 RBCs/hpf, 7 had GU injuries and 41 had IA injuries. Having the threshold for a positive UA as 5 to 9 RBCs/hpf would have missed these injuries, which also included 9 patients with IA injuries that required intervention (Table 3). Figs. 1 and 2 demonstrate the total number and percentage of injuries as well as injuries requiring intervention that were detected with each RBC/hpf cutoff. For example, with a threshold value of 50 to 99 RBCs/hpf, 85% of GU injuries were identified and 100% of injuries that required intervention were identified.

The association between catheterization and false positive samples or severity of injury is also unknown in this

**Table 1** Injury patterns by urinalysis result

| Type of injury | Positive UA (985 patients) | Negative UA (810 patients) | *P* values |
|---|---|---|---|
| GU injuries | 51 | 2 | .0001 |
| GU injuries requiring intervention | 10 | 0 | .007 |
| IA injuries | 174 | 32 | .0001 |
| IA injuries requiring intervention | 48 | 2 | .0001 |

GU = genitourinary; IA = intra-abdominal; UA = urinalysis.