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Assessment of urinary dipstick in patients admitted to an emergency department for blunt abdominal trauma

F. Moustafa [a,*], C. Loze [a], B. Pereira [b], MA. Vaz [c], L. Caumon [d], C. Perrier [a], J. Schmidt [a,e]

[a] Service des urgences, Pôle SAMU-SMUR-Urgences, CHU Gabriel Montpied, Clermont-Ferrand, France
[b] Direction de la Recherche Clinique et de l'Innovation, Département de Biostatistiques, CHU Gabriel Montpied, Clermont-Ferrand, France
[c] Service de radiologie, CHU Gabriel Montpied, Clermont-Ferrand, France
[d] Service des urgences, CH Aurillac, Aurillac, France
[e] Université d'Auvergne, Clermont-I, UFR de médecine, Clermont-Ferrand, France

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ABSTRACT

Introduction: Clinicians still face significant challenge in predicting intra-abdominal injuries in patients admitted to an emergency department for blunt abdominal trauma. This study was thus designed to investigate the value of dipstick urinalysis in patients with blunt abdominal trauma.
Methods: We performed a retrospective, multicenter, cohort study involving patients admitted to the emergency department for abdominal traumas, examined by means of urinary dipstick and abdominal CT scan. The primary endpoint was the correlation between microscopic hematuria detected *via* dipstick urinalysis (defined by the presence of blood on the dipstick urinalysis but without gross hematuria) and abdominal injury, as evidenced on CT scan.
Results: Of the 100 included patients, 56 experienced microscopic hematuria, 17 gross hematuria, and 44 no hematuria. Patients with abdominal injury were more likely to present with hypovolemic shock (odds ratio [OR]: 8.4; 95% confidence interval [CI]: 2.7–26), abdominal wall hematoma (OR: 3.1; 95% CI: 1.2–7.9), abdominal defense (OR: 5.2; 95% CI: 1.8–14.5), or anemia (OR: 3.6; 95% CI: 1.2–10.3). Moreover, dipstick urinalysis was less likely to predict injury, with just 72.2% sensitivity (95% CI: 54.8–85.8), 53.1% specificity (95% CI: 40.2–65.7), and positive and negative predictive values of 46.4% (95% CI: 33.0–60.3) and 77.3% (95% CI: 62.2–88.5), respectively.
Conclusion: Dipstick urinalysis was neither adequately specific nor sensitive for predicting abdominal injury and should thus not be used as a key assessment component in patients suffering from blunt abdominal trauma, with physical exam and vital sign assessment the preferred choice.

1. Introduction

Abdominal injuries account for 15–20% of trauma-related lesions and constitute a leading cause of mortality in 10–30% of patients exhibiting such lesions [1]. They primarily constitute lesions caused by contusion in solid organs (spleen, liver, kidneys, or pancreas) or perforation of hollow organs (duodenum, small intestine, or colon).

Whilst clinical diagnosis can be straightforward, with indicators such as pain or abdominal defense, clinical abdominal examination cannot be used to diagnose all patients with intra-abdominal injuries [2,3]. Assessment of intra-abdominal post-traumatic injuries typically relies on contrast-injection abdominal computed tomography (CT) (92.4–100% sensitivity; 94.4–96.8% specificity), which remains the primary method of assessing hemodynamically-stable blunt-trauma patients with a positive predictive value (PPV) >98% [4].

A further examination, namely the urine dipstick, is frequently used in emergency services for abdominal trauma cases in order to diagnose hematuria. This simple, quick, and inexpensive examination for detecting the presence of blood in urine from red blood cells (RBC) exhibits a sensitivity of 91–100% [5,6]. One particular study has shown that the presence of gross hematuria suggests intra-abdominal injury, yet this cannot be said for microscopic hematuria associated with abdominal trauma [7]. The diagnostic and prognostic benefits of microscopic hematuria remain a subject of contention in the event of abdominal trauma. Several studies have, in fact, shown that simple microscopic hematuria may be associated with severe urogenital lesions, whilst others refrain from recommending examination *via* urine dipstick in

* Corresponding author at: Service des urgences, Hôpital Gabriel Montpied, 58 rue Montalembert, F-63003 Clermont-Ferrand Cedex 1, France.
E-mail addresses: fmoustafa@chu-clermontferrand.fr (F. Moustafa), charlotte.loze@gmail.com (C. Loze), bpereira@chu-clermontferrand.fr (B. Pereira), mavaz@chu-clermontferrand.fr (M.A. Vaz), l.caumon@ch-aurillac.fr (L. Caumon), cperrier@chu-clermontferrand.fr (C. Perrier), jschmidt@chu-clermontferrand.fr (J. Schmidt).

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abdominal trauma due to the lack of significance of microscopic hematuria [5,6,8].

In light of the paucity of articles regarding the diagnostic benefit of performing dipstick urinalysis in emergency cases following abdominal injury, we conducted this study with the aim of evaluating the diagnostic value of dipstick urinalysis in emergency medicine following abdominal trauma.

2. Patients and methods

We performed a retrospective, multicenter, cohort study at the University Hospital of Clermont-Ferrand (Trauma Center, Level one) and the Hospital of Aurillac (Trauma Center, level three) from January 2012 to August 2014. All included patients were over 18 years old, admitted to the emergency department for abdominal trauma, and underwent urinalysis dipstick and contrast-injection abdominal CT. We thereby excluded urine samples collected *via* catheterization or suprapubic catheters, in order to avoid iatrogenic traumatic hematuria cases, patients with kidney cancer, bladder cancer, or polycystic kidney disease, and patients affected by Berger's disease or those with suspected urinary tract infection through the presence of leukocytes or nitrites on urinalysis.

As this study was observational, non-interventional, and retrospective, there was no need to request approval from the ethics committee, nor informed consent from patients.

By means of patients' medical records, we collected demographic variables as well as clinical and laboratory data, such as age, gender, background, indication of anticoagulant therapy, injury mechanism (accidents involving light vehicles, two-wheelers, falls or board sports, sustained as a pedestrian, or trauma caused by an object), abdominal pain, abdominal defense or abdominal wall hematoma, signs of hemodynamic shock (defined as systolic blood pressure ≤ 90 mmHg), and anemia (Hb < 10 g/dL). Abdominal CT data was collected from archived radiological reports. Therapeutic management (fluid resuscitation, transfusion, surgery, embolization, hospitalization, etc.) and patient outcome data was also obtained. Microscopic hematuria was defined *via* the presence of over 5–10 red cells per field or the appearance of at least one cross on the urine dipstick (Clinitek Status® Analyser, Siemens) [9]. Gross hematuria was defined *via* visible blood in patient urine. The gold standard for determining abdominal injury was the result obtained *via* contrast-injection abdominal CT.

2.1. Statistical analysis

Data was expressed as numbers and percentages for categorical variables, as means and standard deviations or medians and interquartile ranges in terms of the statistical distribution (normality analyzed using the Shapiro-Wilk test) for quantitative variables. Comparison of quantitative variables was performed by means of Student's *t*-test or Mann-Whitney test. Comparison of qualitative parameters was carried out *via* the Chi-squared test or, if necessary, Fisher's exact test. Diagnostic results were expressed in terms of sensitivity and specificity, as well as positive and negative predictive values (PPV and NPV) and areas under the curve, in conjunction with their 95% confidence interval (CI). All analyses were conducted through bilateral formulation for an error significance level of 5% using the Stata software (Version 13, StataCorp, College Station, US).

3. Results

From January 2012 to August 2014, abdominal CTs and urine dipstick analysis were performed for 123 patients suffering from abdominal trauma (Fig. 1).

Overall, 100 patients were included in our study, comprising 33 women and 67 men, with a mean age of 46.3 ± 21.8 years old (Table 1). In total, 36 had experienced abdominal injury, 19 (52.7%) involving cases of kidney or urinary tract damage, four (11.1%) splenic lesions, seven (19.4%) liver lesions, seven (19.4%) pelvic fractures, 24 (66.7%) intra-abdominal hematomas, and two (5.5%) lesions of the renal pedicle. Two out of every three traumas were accounted for by car accidents or falls.

The clinical examination revealed 69 patients affected by abdominal pain. For patients exhibiting abdominal injury compared to those without, abdominal defense was over 3-fold higher (odds ratio [OR]: 5.2; 95% CI: 1.8–14.5), abdominal wall hematoma over 2-fold higher (OR: 3.1; 95% CI: 1.2–7.9), and hemodynamic shock over 5-fold higher (OR: 8.4; 95% CI: 2.7–26). Moreover, one in every three patients with abdominal injury presented with anemia on the initial blood test (OR: 3.6; 95% CI: 1.2–10.3).

For the 56 patients with microscopic hematuria, the presence of three crosses on the dipstick was 3-fold higher for patients with abdominal injury than those without (OR: 4.8; 95% CI: 1.9–11.9). The incidence of gross hematuria was 6-fold higher in patients with abdominal injury than those without (OR: 8.5; 95% CI: 2.5–28.7).

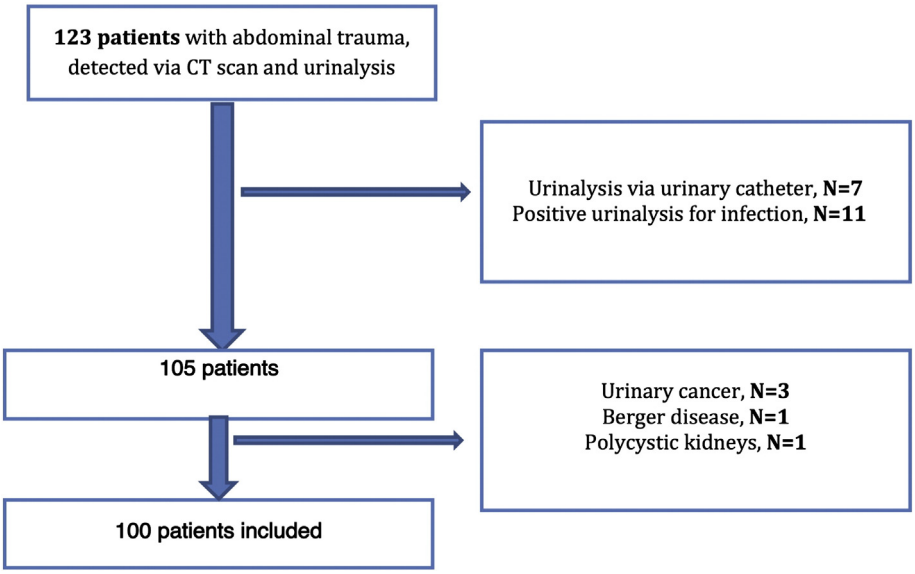

Fig. 1. Flowchart.

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