



A Study of Dipstick and Microscopic Analysis of Formed Elements in Urine

Author

Dr Preeta Naik

Assistant Professor, Department of Pathology, Nimra institute of medical sciences,
Vijayawada, Andhra Pradesh, India

Corresponding Author

Preeta Naik

Phone: +91-9448105579, Email: preetanaik@gmail.com

Abstract

Background: *Urinalysis is one of the major diagnostic screening tests in the clinical laboratory. Microscopic urine sediment analysis has been the gold standard for decades. Introduction of new technologies and automation has improved the accuracy and productivity of the process. This study was conducted to study the formed elements in urine by dipstick method and microscopy.*

Methods: *Dipstick urinalysis and sediment microscopy were carried out on 1000 consecutive urine samples of patients presenting to our hospital. Dipstick urinalysis was done using DIRUI A10 strips. The results obtained were analyzed and sensitivity and specificity were determined.*

Results: *Age of patients ranged from 1 month to 80 years. Male patients were in higher number than females in all age groups. Dipstick showed 86.53% sensitivity and specificity was 98.24% for RBCs. The sensitivity for leukocytes was 94.18% and specificity was 99.25%.*

Conclusions: *Combining sediment microscopy and dipstick examination of urine helps to assure accurate results urinalysis.*

Keywords: *Urine, dipstick urinalysis, urine sediment microscopy.*

Introduction

Urinalysis is one of the common laboratory tests ordered by clinicians. It has a number of applications, including screening for diagnosis of asymptomatic disease to monitoring and following the course of a disease. Microscopic urine sediment analysis has been the gold standard for

decades.^{1,2,3} Urine sediment microscopy provides information about a wide variety of genitourinary diseases. Various disease states and prognosis can be diagnosed on number of cells and casts found in a sediment analysis.⁴ This study was conducted to study the formed elements in urine by dipstick method and microscopy.

Materials and Methods

This prospective study was conducted in the Department of Pathology. Consecutive 1000 urine samples of patients from a period of October to December 2016 were included in this study. All the samples were examined within 30 minutes of receipt. Dipstick urinalysis was done using DIRUI A10 strips. For microscopic examination urine specimens were prepared by centrifuging 10ml of urine at 1,000rpm for 5 minutes. The supernatant was decanted and approximately 0.05 ml of sediment was placed on slide, coverslip placed and examined. The unstained urinary sediment was then examined at low(X10) and at high (X40) power for the presence of formed elements, including white blood cells (WBCs), red blood cells (RBCs) bacteria, crystals, fungi, casts, renal tubular cells, epithelial cells. The number of elements was approximated by counting a minimum of 10 high-power fields (hpf). Urine specimens were classified as microscopically normal based on the following criteria. RBCs: less than 2cells /hpf, WBCs: less than 2-5 /hpf, squamous epithelial cells :less than 15-20 cells/hpf, casts :0-5 hyaline casts/low power field, crystals: occasionally, bacteria: none and yeast: none.

Results

One thousand consecutive urine samples were studied from a period of October to December 2016. Results obtained from dipstick analysis and urine microscopy was compared. In this study, age of patients ranged from 1 month to 80 years. Male patients were in a higher number than females in all age groups.(table 1) Majority of the patients were from 51-60 years age group.

Out of the 1000 samples, 63% of the urine specimens had completely normal microscopic findings. Dipstick analysis showed 75% urine

samples to be normal. Males had higher rate of normal microscopic results (67.3%) than females (32.7%). Females had the higher prevalence of abnormal findings on urine microscopy (n- 221, 59%) than males (n-149,41%). Manual microscopy was positive for RBCs in 343 of 1000 samples whereas only 298 samples were positive on dipstick analysis. By manual microscopy, 361 of 1000 samples were positive for WBCs, only 340 samples were positive on dipstick analysis. For squamous epithelial cells, 44 of 1000 samples were positive by microscopy. Fifty cases showed bacteria on microscopy, dipstick detected only 20 cases. Pathological casts were seen in 19 samples, these cases showed protein positivity on dipstick in 10 cases. Hyaline and granular casts were the most common casts seen. Crystals were seen in 34 samples, oxalate and urate crystals were seen in majority of cases. Only 3 cases showed triple phosphate crystals. Majority of these cases did not show any abnormality on dipstick, 4 cases were positive for RBCs. Dipstick showed 86.53% sensitivity for detecting 2 or more RBCs per hpf and specificity was 98.24%. The sensitivity of leukocyte esterase was 94.18% and specificity was 99.25%. The sensitivity of nitrite was only 40% and specificity was 99.44%.

Table 1: Distribution of age groups and sex in the study group

Age in year	Males	Females	No of patients	Percentage
0-10	12	8	20	2%
11-20	24	16	40	4%
21-30	47	33	80	8%
31-40	90	30	120	12%
41-50	190	40	230	23%
51-60	300	60	360	36%
61-70	90	20	110	11%
71-80	34	6	40	4%
Total	840	160	1000	100%

Discussion

In this study samples obtained from male patients were more than female patients. Generally good agreement was obtained between dipstick hemoglobin test and RBCs on microscopy. Good agreement was obtained between the microscopy WBC count and the dipstick leukocyte esterase reaction. In a few cases, the microscopy detected more RBCs and WBCs than did dipstick testing. Study conducted by Tetrault et al¹ and Shaw et al⁵ showed similar results. In both the studies samples from male patients were more compared to female patients. Their studies also showed good correlation between urine microscopy and dipstick analysis. They recommended not to skip microscopy despite normal findings on dipstick analysis.^{1,5} Although dipstick urinalysis remains a valuable tool in the screening of haematuria, it does not confirm haematuria. It cannot differentiate clearly between myoglobin and haemoglobin. Moreover, haemoglobinuria can occur without haematuria. Urine sediment microscopy is useful in differentiating this. By detecting erythrocytes, it confirms a positive dipstick reaction as haematuria. Urine sediment microscopy helps in differentiating the origin of haematuria within the urinary tract system by the morphology of RBCs.^{6,7} It is difficult to detect pyuria by the leukocyte esterase reaction, as it usually gives positive results when WBC concentration exceeds 15 cells/hpf. This detection limit can be overcome by having a high index of suspicion for positive protein reaction that is minimally associated with 6 WBCs/ hpf. The nitrite reaction is influenced by multiple variable, like reductase enzyme in the organism, dietary nitrate and time duration of urine present in the bladder.⁸

Conclusion

Microscopic urine sediment analysis has been the gold standard for examining urine cells and particles. It can be subjective, imprecise, is labor-intensive and time-consuming. These problems have led to the widely used concept of using microscopic analysis when the results of chemical screening are abnormal. This can lead to substantial losses in diagnostic data like abnormal casts and crystal that are not detected by dipsticks. Combination of both methods can yield accurate results.

References

1. Tetrault GA. Automated reagent strip urinalysis: utility in reducing work load of urine microscopy and culture. *Lab Med.* 1994;25:162-167.
2. Langlois MR, Delanghe JR. Automated Flow Cytometry Compared with an automated Dipstick Reader for Urinalysis. *Clin Chem.* 1999;45:118-122.
3. Roggeman S, Zaman Z. Safely Reducing Manual Urine Microscopy Analyses by Combining Urine Flow Cytometer and Strip Results. *Am J Clin Pathol* 2001;116:872-878.
4. Morrison MC, Lum GDipstick Testing of Urine—Can It Replace Urine Microscopy? *Am J Clin Pathol* 1986; 85: 590-594
5. Shaw ST Jr, Poon SY, Wong ET. “Routine urinalysis”: is the dipstick enough? *JAMA.* 1985;253: 1596-1600.
6. Bataille A, Wetzstein M, Hertig A, Vimont S, Rondeau E, Galichon P. Evidence of dipstick superiority over urine microscopy analysis for detection of hematuria. *BMC Res Notes* 2016;9:435.
7. 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.

8. Memişoğulları R, Yüksel H, Yıldırım AH, Yavuz O. Performance characteristics of dipstick and microscopic urinalysis for diagnosis of urinary tract infection. Eur J Gen Med. 2010;7:174–8.