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ORIGINAL ARTICLE

Utilizing Dipsticks to Measure Leukocyte Esterase in Urine to Detect UTIS

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ABSTRACT

Objective: The more expedient, less labor-intensive dipstick has come to be the tool of choice for diagnosing UTIs in the majority of primary care settings. The purpose of this study was to assess the usefulness of dipsticks in UTI diagnosis.

Study Design: Descriptive study

Place and Duration: Pathology Department Civil Hospital LUMHS. January 2021 to December 2021

Methods: Total 230 patients of both gender were presented in this study. The study included every urine sample that was received for urine culture by the Microbiology Department. The leukocyte esterase content of each specimen was measured using a urine dipstick. On Cysteine Lactose Electrolyte Deficient (CLED) agar, all of the urine samples were also used for culture. Every data was analysed using SPSS 24.0.

Results: There were majority 125 (54.3%) females and 105 (45.7%) females among all cases. There were 75 (32.6%) LE positive and 120 (52.2%) were LE negative. Culture positive cases was 87 (37.8%) and 143 (62.2%) were culture negative. We found sensitivity (78.2%), specificity (86%), PPV (55.7%) and NPV (90.4%). The overall effectiveness of the LE Test with dipsticks was observed (84.3%).

Conclusion: Under resource-constrained environments, the leukocyte esterase dipstick test is a quick and affordable screening method. Determining whether a urinary tract infection is present is very helpful. A negative test, however, gives a more accurate indication that a UTI is absent.

Keywords: Urine culture, Urinary Tract Infection, Leukocyte esterase dipsticks

INTRODUCTION

Within the general population, urinary tract infections (UTIs) are the most prevalent type of bacterial infections. The second most common cause of bacteremia in hospitalised patients is urinary tract infections.(Source:) Studies show that women are more likely than men to get UTIs. Men have approximately 20% of UTIs.In [2] The two most common pathogens that cause UTIs are Staphylococcus saprophyticus and Escherichia coli. The Klebsiella, Enterobacter, and Proteus species are less commonly found isolates.[3–4]

It can be difficult to diagnose a UTI because it is not always clear-cut. The most typical UTI symptom, dysuria affects one in four women annually. Additionally, in cases of pyelonephritis, chlamydial urethritis, and vaginitis, dysuria is the presenting complaint.* [5] A UTI patient may occasionally show no symptoms at all or unusual symptoms and indicators. Therefore, to diagnose UTI, laboratory tests are needed. To diagnose a UTI, a number of tests are available. The perfect test would be inexpensive, require less training and time, and have a high degree of accuracy to provide a trustworthy and timely diagnosis in patients who pose a high risk. Urine cultures are expensive and time-consuming, taking at least 48 hours to yield results, even though they are the gold standard for diagnosing UTIs. Urine analysis is now the first-choice investigation for clinicians due to the aforementioned limitations.

Accurate and timely patient treatment for urinary tract infections depends on a proper diagnosis. A series of diagnostic tests, such as urine dipstick, biochemical test, microscopy, Gramme staining, and quantitative urine culture, are essential to the laboratory diagnosis of UTI. Because of their well-known limitations, none of these diagnostic techniques is thought to be adequate for a single UTI diagnosis [6]. When using any of the aforementioned diagnostic techniques alone, combining two or more of them seems to be the best diagnostic practise in order to lower the degree of diagnosis errors [6]. As a result, culture must be a part of the set that is chosen because it is the gold standard for UTI diagnosis in laboratories. Quantitative urine culture, on the other hand, takes more time and effort to finish. For this reason, the use of one (typically dipstick) or very infrequently two of these protocols without quantitative urine culture is frequently relied upon for clinical laboratory diagnosis of UTI in most primary care settings [7,8]. Most of the time, a urine culture is only ordered when a patient has quite severe symptoms or a recurring infection.

One of the main signs of a UTI is bacteriuria or pyruria. Pyuria is identified using nitrite and bacteriuria with leucocyte esterase indicators on the dipstick, respectively. Testing for nitrite depends on your ability to change nitrate into nitrite. While other bacteria isolates including Staphylococcus saprophyticus, Pseudomonas spp., and Enterococcus cannot manufacture nitrite from nitrate, it is thought that members of the Enterobacteriaceae family are responsible for nitrite synthesis [9]. Another drawback of nitrite testing is that urine samples taken no later than 4 hours after patients have urinated are likely to produce incorrect findings because it takes bacteria more than 4 hours to complete the biochemical conversion of nitrate to nitrite [6]. The ability of leucocytes to create esterolytic proteins, which hydrolyze esters, is necessary for leucocyte esterase to function. Patients with acute leukaemia or those receiving antibiotic treatment may receive false-positive results from leucocyte esterase tests [10].

Some specialists believe that pyuria (>10 white blood cells per high power field, or WBC/HPF) on microscopic urine is a prerequisite for any classification of UTI, in order to reduce the needless treatment of individuals with silent bacteriuria [11]. However, the nonselective inclusion criteria of prior research and the absence of a gold standard for the diagnosis of a urinary tract infection make it unclear if the dipstick and microscopic urinalysis can effectively rule out a UTI. Overdiagnosis happens to people with asymptomatic bacteriuria who are admitted to the hospital for reasons unrelated to their urinary tract. If a microscopic urinalysis is not sensitive enough to require >10 WBC/HPF, underdiagnosis may result.

Urinalysis sensitivity should be evaluated in a special and ideal situation: bacterial urinary tract infections. Contamination or asymptomatic bacteriuria are less common when the same organism is infected in both the blood and the urine, reducing the possibility of misclassification [12].

The effectiveness of urine dipsticks in identifying UTIs was evaluated in this study by contrasting their results with urine cultures. This might be useful in situations with limited resources, such as when urine culture equipment and qualified workers are hard to come by.

MATERIALS AND METHODS

This descriptive study was conducted at Pathology Department Civil Hospital LUMHS and comprised of 230 patients. Patients' cultures were included in the study without regard to their age or gender. The study excluded all patients with indwelling catheters, vaginal discharge with symptoms, and those who had taken an antibiotic within 48 hours of submitting their specimens.

Within an hour of their arrival, all samples were processed completely to prevent the growth of any contaminating bacteria. Leukocyte esterase was measured on all specimens using CYBOWTM10M stripes and a urine dipstick analysis. The test pad area that was impregnated with indoxyl ester showed a positive colour change in just 60 seconds, going from white to purple. A culture was performed on each and every urine sample. Before streaking the exact amount of urine (0.2µl) onto Cysteine Lactose Electrolyte Deficient (CLED) agar using an aseptic technique, sterile paper strips were dipped into a urine container. This allowed the aseptic technique to count the bacteria in the original sample after it had been incubated. For a duration of 18 to 24 hours, the plates were incubated at 35°C. The number of Colony Forming Units (CFU) per millilitre of urine was computed by counting the individually isolated colonies. Species identification was achieved by testing the obtained colonies with Gramme stain and biochemical techniques. Genital contaminants were identified as urine cultures that contained two or more distinct species isolated from one another and had a colony count between 104 and 55. Urine samples were incubated for 48 hours before reporting negative growth. Based on the culture result in relation to the dipstick test, SPSS 24 was used to determine the descriptive statistical values, including sensitivity, specificity, positive and negative predictive values, and overall efficacy of the dipstick test in determining the UTI.

RESULTS

There were majority 125 (54.3%) females and 105 (45.7%) females among all cases.(figure 1)

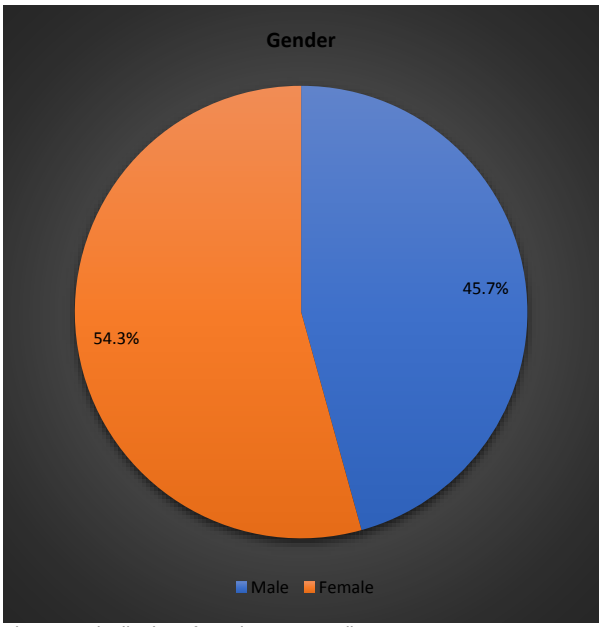

Figure-1: Distribution of genders across all cases

There were 75 (32.6%) LE positive and 120 (52.2%) were LE negative.(figure 2)

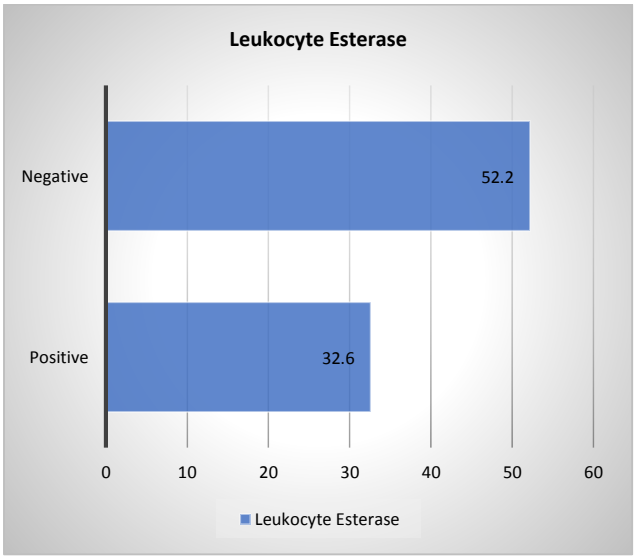

Figure-2: Results of Leukocyte esterase test

Culture positive cases was 87 (37.8%) and 143 (62.2%) were culture negative.(table 2)

Table-2: Culture outcomes of urine samples

Variables	Culture Positive	Culture Negative
LE Positive		
Yes	75 (32.6%)	120 (52.1%)
No	12 (5.2%)	23 (10%)
Total	87 (37.8%)	143 (62.2%)

We found sensitivity (78.2%), specificity (86%), PPV (55.7%) and NPV (90.4%). The overall effectiveness of the LE Test with dipsticks was observed (84.3%).(figure 3)

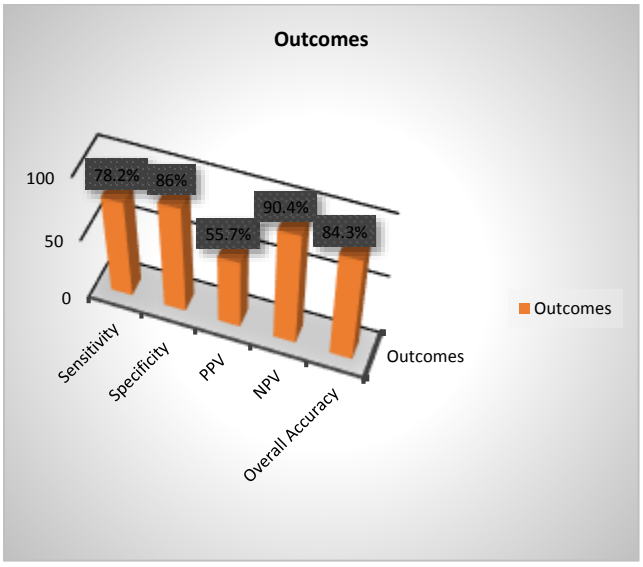

Figure-3: Over all efficacy and sensitivity of dipstick method

DISCUSSION

The use of dipstick tests saves patients money and time, and they may also enable treatment to start earlier. Despite being the gold standard for diagnosing UTIs, culture has certain drawbacks.

Reliability is ensured by a well-equipped laboratory, skilled personnel, and urine cultures taken at least 48 hours in advance. On the other hand, dipstick tests are quick, simple, and can be conducted in a small laboratory by laboratory technicians.

Urine cultures are helpful in the diagnosis of UTIs, as is a history of dysuria, raised frequency, urine colour change, suprapubic pain, etc. The effectiveness of screening tests is being studied, though, in an effort to lower the expense and time associated with UTI diagnosis.

The tests for pyuria and bacteriuria are readily accessible dipstick screening assays. Urine glucose >2 mg/dL and urine protein excretions >500 mg/dL, as well as high dosages of cephalexin/gentamicin or boric acid used as a preservative, can all cause a decrease in the intensity of the reaction colour on a dipstick experiment.[13] However, in such cases, a negative dipstick cannot conclusively rule out an infection in the event of a strongly suggestive history of UTI.

The results of previous study showed that the combined efficacy of nitrite and leucocyte esterase activity appeared to be more reliable than the individual results from nitrite as well as leucocyte esterase. According to this report [14], the most effective way to differentiate between positive as well as negative outcomes for quantitative urine culture was to look for "nitrite-positive or leucocyte-positive" results. Dipstick's capacity to forecast negative results might be essential in lowering the possibility of starting antibiotic treatment prematurely [15,16]. In light of the growing global reports of antibiotic resistance, this is crucial. Overall, the nett positive variance (NPV) for both the single and combined dipstick markers was relatively high (88.4%–93.6%), indicating that dipstick can be a useful indicator of unfavourable outcomes. The NPV of leucocyte esterase alone was 91.2% (95% CI = 87.4–94.2) and that of nitrite alone was 88.4% (95% CI = 84.9–91.3).

In contrast to ABU, this study found that urine dipstick sensitivity for nitrite and leukocyte esterase increased slightly in symptomatic UTIs. The percentage of significant pyuria is also shown to be slightly higher in symptomatic UTI than in ABU, according to a study by Assefa et al. [17]. When a test yields a positive result, leukocyte esterase and nitrite's sensitivity increases; however, when both tests yield positive results, their sensitivity decreases. When the results of the leukocyte esterase and nitrite tests were combined, a study conducted in Nigeria by Eigbefoh et al.[18] also revealed a decrease in the sensitivity of the urine dipstick.

We found sensitivity (78.2%), specificity (86%), PPV (55.7%) and NPV (90.4%). The overall effectiveness of the LE Test with dipsticks was observed (84.3%). In 2015, Mambatta A et al. proposed the use of urine dipsticks as an initial screening test for urine in outpatient settings [19]. In remote areas with limited access to technical laboratory staff and services, the LE dipstick urinalysis method for diagnosing urinary tract infections (UTIs) is a valuable diagnostic tool for medical professionals. The presence of negative leukocyte esterase in midstream urine samples can determine if culture is necessary or not. A combined leukocyte esterase and nitrite urine dipstick test has been shown to have high levels of specificity and sensitivity, according to another Thai study.Twenty [20]

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CONCLUSION

Under resource-constrained environments, the leukocyte esterase dipstick test is a quick and affordable screening method. Determining whether a urinary tract infection is present is very helpful. A negative test, however, gives a more accurate indication that a UTI is absent.

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