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Evaluation Urinary Dipstick Parameters In Predicting Urinary Tract Infection (UTI) Among Adult Females In A Primary Care Setting In Benin City, Edo State

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Abstract: ***This study on the evaluation of urinary dipstick parameters in predicting urinary tract infection (UTI) among adult females in a primary care setting was done using 300 randomly selected women between the ages of 18 and 64 years attending the General Practice Clinic of the University of Benin Teaching Hospital, Benin City, Nigeria. The aim was to assess the usefulness of urine dipstick parameters in predicting UTI among those respondents. The study employed the use of a pretested interviewer administered questionnaire. Dipstick urinalysis, urine microscopy was carried out. From the study, the prevalence of asymptomatic positive dipstick finding was found to be 21%, and none of the asymptomatic respondents were culture positive. Nitrituria, pyuria, and haematuria were strong predictors of UTI. This was especially so when more than one of the dipstick parameters were considered together. Conclusion: Physicians should rely more on urinary dipstick parameters in the management of UTI without routinely ordering for a urine microscopy and culture. Routinely ordering a urine M/C/S is unnecessary and a waste of resources.***

Keywords: Urinary Tract Infection, Urinary Dipstick, Sensitivity, Specificity, predictive value.

Abbreviations: UTI (Urinary Tract infection), GPC (General Practice Clinic), PPV (Positive Predictive Value), NPV (Negative Predictive Value).

I. INTRODUCTION

Urinary tract disorders are quite common in primary care (Little P, 2006; Mullee M, 2010; Othman S, 2003; Little P, 2009; O'Brien K, 2007). It accounts for 7 million office visits per year, and it is the second most common infectious complaint in outpatient primary care overall, and the most common outpatient complaint caused by bacteria (Foxman B, 2002). In the United Kingdom, UTI accounts for a significant number of clinic visits among women, and it is estimated that 60% of women would experience a UTI during their life time (Mercola J, 2001)

Urinary tract infection (UTI) is conventionally defined as significant bacteriuria (10^5 CFU/ml of urine) in the presence of symptoms (Othman S, 2003; Waei M, 2008). Urine culture remains the gold standard in the laboratory diagnosis of UTI and has been used as the bases for comparison with other urinary findings (Othman S, 2003).

Some studies (Franco A, 2005; Fihn S, 2003; Macnair I, 2001), have shown that sexual activity is a compounding factor to the anatomical peculiarity of females. This explains why women in the reproductive age group are more predisposed to developing UTI (Kolawole S, 2009; Olaitan J, 2006).

In clinical practice, especially in this environment, urine culture is not cost effective and empirical antibiotic treatment is usually advocated. Hence, the need to evaluate both clinical and dipstick parameters that can be used for better diagnosis and improved in physician's confidence especially so in the absence of a urine culture result (Fenwick, 2000 E; House of Lords, 2007).

Urinary tract infection is a regular occurrence in primary care and urine culture has been the gold standard for diagnosing this condition. However, reliance on urine culture alone has some limitations, particularly in our environment. First, the test is too expensive for many people because of the high prevalence of poverty, particularly in rural communities. Secondly, culture results usually take 24-48hours (sometimes more), and so delay diagnosis and initiation of appropriate antibiotic treatment, and may prolong absenteeism from work by the patient. Thirdly, facilities for culture are not available in many primary care settings in this country, and in other instance, the skilled personnel are lacking. There is therefore the need to depend more on clinical evaluation and dipstick urinalysis which is more cost-effective.

This study sought to evaluate the urinary dipstick parameters in predicting UTI among symptomatic patients, with the goal of improving diagnostic accuracy of UTI without using urine culture. The urinary dipstick parameters employed in this study are the following: urinary nitrite, leucocyte-esterase, blood and protein.

II. MATERIALS AND METHOD

STUDY AREA

This study was carried out at the General Practice Clinic (G.P.C.) of the University of Benin Teaching Hospital, Benin City Nigeria. It is a busy outpatient clinic with a daily attendance of about 350 patients. It served the people living in the immediate five local government areas of Egor, Ikpoba-Okha, Oredo, Ovia North-East, and Ovia South-West of Edo state. In addition, it served as a referral center for hospitals and clinics within Edo State and adjoining Delta, Kogi, Ondo, and parts of Anambra state. Benin-City is a cosmopolitan city with the Benins constituting the major ethnic group, others being Ishan, Owan, Urhobo, Yoruba, Ijaw e.t.c. The inhabitants are largely civil servants undergraduate students, traders, farmers, and artisans.

STUDY DESIGN, STUDY POPULATION AND SAMPLE SIZE

This is a hospital based cross sectional analytical study. Women 18-64 years that granted consent for the study were recruited. Those who were in their menstrual period, had a known renal disease, were Pregnant or those who had a catheter in-situ were excluded. This study lasted for a period of one month (from 25th November to 23rd December, 2010). The sample size was calculated using the formulae $n= z^2pq/d^2$. Three hundred (300) respondents who met the inclusion criteria were recruited using a systematic random sampling method. Weekly, an average of 225 new female patients (who fell within the inclusion criterion) was being seen at the clinic. Hence, a study population (N) of approximately 900 (monthly) was obtained. For a sample size (n) of 300, the sampling fraction (k) was 3, i.e. 'k'= 900/300. Therefore, every 3rd new female patient who fell within the inclusion criterion was selected. The first respondent was selected from the first three by simple ballot.

METHOD OF SPECIMEN COLLECTION

The respondents were instructed to clean between the labia minora with soapy water and rinse well. A clean catch method of mid-stream urine collection was employed during this study. Samples were collected for dipstick urinalysis and Microscopy, Culture and Sensitivity. A significant bacteria count was taken as any count equal to or in excess of 10,000 colony forming unit (cfu)/millilitre (Barclay L, 2010; Smith P, 2003; Khouri T, 2000).

DATA COLLECTION/ANALYSIS

A simple pre-tested structured interviewer administered questionnaire was used to obtain information on Bio-data (age and marital status); presenting complaints which also included other relevant historical findings; relevant past medical history (including a history of UTT); significant positive examination findings; dipstick urinalysis result (only dipstick readings ≥1+ were taken as positive.); urine microscopy (samples with >5 white blood cells/hpf were regarded as significant pyuria while significant microscopic haematuria was taken as >1 red blood cell/hpf.); urine culture [a significant bacteria count was taken as any count equal to or in excess of 10,000 colony forming unit (cfu)/millilitre (Barclay L, 2010; Smith P, 2003; Khouri T, 2000).]; and bacterial sensitivity result; and the diagnosis.

Data was entered directly into the SPSS-19.0 (statistical package for social sciences). After checking for errors, the data were stratified into the various age brackets and analysed The respondents were grouped into four (table 1), namely: True Positives (a): Those who had UTl (positive culture) and were also positive for the dipstick parameter being analysed; True Negatives (d): Those who were culture negative and at the same time negative for the dipstick parameter being analysed; False Positives (b): Those who were culture negative but were positive for the dipstick parameter being analysed; False Negatives (c); Those who were culture positive but were negative for the dipstick parameter being analysed. A two by two (2x2) cross-tabulation was used to determine the sensitivity [a/(a+c) x 100], specificity [d/(d+b) x 100], positive predictive value [a/(a+b) x 100], and the negative predictive value [d/(d+c) x 100] of the dipstick parameters, singly and in combinations.

a (True positives)	b (False positives)
c (False negatives)	d (True negatives)

Table 1: A two by two table

The Results were displayed in tables and figures, and expressed percentages as non-parametric data. Pearson Chi-square was employed to test association between the categorical variables. The test was significant at p value <0.05.

III. ETHICAL CONSIDERATION

Ethical clearance from the University of Benin Teaching Hospital Ethical Committee was obtained and all the respondents who participated in the study agreed to do so in writing.

IV. RESULTS

The modal age range for symptomatic respondents was 36-41years while it was 24-29 years for the asymptomatic respondents.

DISTRIBUTION OF URINARY DIPSTICK FINDINGS AMONG THE ASYMPTOMATIC RESPONDENTS

In table 2 below, haematuria was not present in any of the asymptomatic respondents. That finding was quite significant. Forty-four (32.4%) of the asymptomatic respondents had proteinuria, eighteen (13.2%) had leucocytes, while eight (5.9%) had nitrites. Haematuria was not found among the asymptomatic respondents.

URINARY DIPSTICK	SYMPTOMATIC		ASYMPTOMATIC		
FINDINGS	COUNT	PERCENT	COUNT	PERCENT	TOTAL
PROTEIN	44	32.4	92	67.6	136
NITRITE	8	5.9	128	94.1	136
LEUCOCYTE ESTERASE	18	13.2	118	86.8	136
BLOOD	0	0	136	100	136

Table 2: Distribution of urinary dipstick findings among the asymptomatic respondents

THE DISTRIBUTION OF POSITIVE URINARY DIPSTICK FINDINGS AMONG SYMPTOMATIC RESPONDENTS

Figure 1 below shows the distribution of the individual dipstick findings among symptomatic respondents. Sixty-four (39%) of the respondents had proteinuria, thirty-seven (22.6%) had urinary nitrites, forty-two (25.6%) had positive leucocyte esterace, while fourteen (8.5%) had dipstick haematuria. The most common urinary dipstick finding was proteinuria (22.6%) while haematuria (8.5%) was the least common finding among the symptomatic respondents.

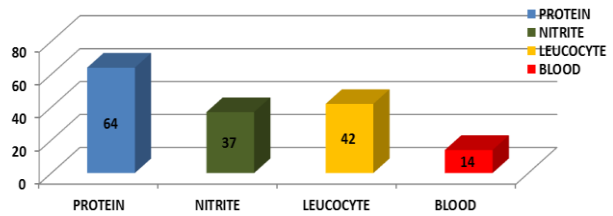

Figure 1: The distribution of positive urinary dipstick findings among symptomatic respondents

THE DISTRIBUTION OF POSITIVE CULTURE RESULTS AMONG SYMPTOMATIC AND ASYMPTOMATIC RESPONDENTS

Table 3 below shows that 43 (26.3%) of the symptomatic respondents were culture positive while 14.3% of the entire respondents were culture positive. None of the asymptomatic respondents was culture positive.

	SYMTOMATIC	ASYMPTOMATIC	TOTAL
CULTURE POSITIVE	43 (26.3%)	0	43 (14.3%)
CULTURE NEGATIVE	121 (73.3%)	136 (100%)	257 (85.7%)
TOTAL	164	136	300

Table 3: The distribution of positive culture results among symptomatic and asymptomatic respondents

RELATIONSHIP BETWEEN URINARY DIPSTICK FINDINGS AND UTI

Table 4-7 below are 2x2 tables showing the relationship between urinary dipstick findings and the presence or absence of UTI (as confirmed by the culture result.)

PROTEIN	UTI		TOTAL
	PRESENT (%)	ABSENT (%)	
POSITIVE	37(34)	71(66)	108
NEGATIVE	6(3)	186(97)	192
TOTAL	43	257	300

Chi-Square=54.57, at df=1, P <0.05

Table 4: relationship between dipstick proteinuria finding and UTI

NITRITE	UTI		TOTAL
	PRESENT(%)	ABSENT(%)	
POSITIVE	24(53)	71 (66)	45
NEGATIVE	19(7)	236(93)	255
TOTAL	43	257	300

Chi-Square=65.58, at df=1, P <0.05

Table 5: Relationship between dipstick nitrituria finding and uti

LEUCOCYTE ESTERASE	UTI		TOTAL
	PRESENT (%)	ABSENT (%)	
POSITIVE	33(55)	27(45)	60
NEGATIVE	10(4)	230(96)	240
TOTAL	43	257	300

Chi-Square=101.01, at df=1, P <0.05.

Table 6: Relationship between dipstick pyurua finding and UTI

BLOOD	UTI		TOTAL
	PRESENT (%)	ABSENT (%)	
POSITIVE	14(100)	0	14
NEGATIVE	29(10)	257(90)	286
TOTAL	43	257	300

Chi-Square=87.77, at df=1, P <0.05.

Table 7: Relationship between dipstick haematuria finding and UTI

PREDICTIVE VALUES FOR THE URINARY DIPSTICK FINDINGS

Table 8 below shows that proteinuria was the most sensitive (86%) but the parameter with the least PPV (34.3%). On the other hand, dipstick haematuria was the feast sensitive (33.3%) but one with the highest PPV (100%). All the dipstick parameters have high NPVs ranging from approximately 90 - 97%.

DIPSTICK	SENS.	SPEC.	PPV	NPV
PROTEIN (Pr)	**0.860**	**0.724**	**0.343**	**0.969**
NITRITE (Nit)	**0.558**	**0.918**	**0.533**	**0.925**
LEUCOCYTE (Leu)	**0.767**	**0.895**	**0.550**	**0.958**
BLOOD (Bid)	**0.333**	**1.000**	**1.000**	**0.902**

Table 8: Predictive values for the urinary dipstick findings

THE PREDICTIVE VALUES OF THE COMBINATION OF URINARY DIPSTICK PARAMETERS FOR UTI

The predictive values of the parameters analysed in combinations are well stated in table 9 below. As highlighted in the boxes below, the combination of proteinuria and nitrituria; nitrituria and dipstick pyuria, proteinuria, nitrituria and dipstick pyuria had the highest predictive values (all ranging between 90-100%).

DIPSTICK PARAMETERS	FREQ	SENS.	SPEC.	PPV	NPV
Pr + Nit	39	**0.909**	**0.988**	**0.909**	**0.988**
Pr + Leu	43	1.000	0.954	0.771	1.000
Pr + Bld	32	0.750	1.000	1.000	0.978
Nit + Leu	40	**0.938**	**0.991**	**0.938**	**0.995**
Nit + Bld	15	0.353	1.000	1.000	0.954
Leu + Bld	26	0.611	1.000	1.000	0.969
Pr + Nit + Leu	39	**0.900**	**1.000**	**1.000**	**0,996**
Pr + Nit + Bld	9	0.211	1.000	1.000	0.944
Pr + Leu+ Bld	30	0.692	1.000	1.000	0.979
Nit + Leu + Bid	14	0.333	1.000	1.000	0.966
All Four	2	0.047	1.000	1.000	0.862

Table 9: The predictive values of the combination of urinary dipstick parameters for uti

V. DISCUSSION

THE PREVALENCE OF ASYMPTOMATIC POSITIVE URINARY DIPSTICK FINDINGS

There were 136 asymptomatic respondents in this study representing 45.3% of the entire respondents. Of these, 63 had positive urinary dipstick finding representing 21% of all the respondents (table 2**).** Therefore, the prevalence of asymptomatic positive urinary dipstick was 21%. Table 2 showed that most asymptomatic respondents still had proteinuria and dipstick pyuria at 32.4% and 13.2% respectively. There was statistically significant relationship and correlation in the relationship between urinary dipstick findings and urinary clinical features except for proteinuria. Reviewed literatures that evaluated dipstick findings, did so among symptomatic respondents.

THE PREVALENCE OF UTI

The prevalence of UTI in this study was found to be 14.3% (Table 3). This figure was quite similar to the prevalence rate reported by Mgbechi et al (Mgbechi E, 2008) in a multicenter study, who obtained a prevalence rate of 12.4% among respondents using the Ebonyi State University Teaching Hospital, but 44% in the Federal medical center (The average from all the centers he was 25.1%). The prevalence obtained from this study is lower than the prevalence rate of 66.6% recorded by kolawole et al among adult females attending Dalhatu Araf Specialist Hospital, Lafia, Nasarawa State (Kolawole S, 2007). The difference may be accounted for by socio-cultural and regional differences, within which revolves factor such as hygiene, diet, sexuality and peer group influence. It should be noted that there may also be center to center variations as confirmed by Mgbechi in his study (Mgbechi E, 2008). Among symptomatic respondents was found to be 26.3% **(**Table 3). This finding was similar to that of Othman et al who found a prevalence of 25% among the symptomatic respondents. This may be as a result of similarity in both study designs.

THE PREDICTIVE VALUE OF DIPSTICK PARAMETERS

The ability of those urinary dipstick parameters to predict UTI, as illustrated in tables 8 and 9, is fundamental to this study.

PROTEINURIA

The most sensitive of the individual urinary dipstick parameters was proteinuria (sensitivity of 86.0%) - Table 7. It also had a specificity of 72.4% and the PPV was however low (30.0%). This implied that its presence poorly predicted UTI. A NPV of 96,9% indicated that its absence made UTI very unlikely. These may have informed the decision of some researchers (Othman S, 2003; Little P, 2006; Medina-Bombardo D, 2003; Santos J, 2007) not to analyse proteinuria as a UTl marker.

NITRITURIA

Nitrituria had a PPV of 53.3% and a NPV of 92.5% which indicated that its absence strongly predicts the absence of UTI (table 8). Nitrituria is thus a good predictor of UTI among adult females. Othman et al found the sensitivity, specificity, PPV, NPV of nitrite to be 56%, 81%, 50% and 84% respectively. This present study found approximately 56%, 92%, 53% and 93% for sensitivity, specificity, PPV and NPV respectively, a result similar to that by Othman et al. On the other hand, Santos et al found a sensitivity, specificity, PPV and NPV to be approximately 39%, 99%, 93% and 89%

respectively (Santos J, 2007). The reason for this may be regional variations

DIPSTICK PYURIA

Pyuria had a sensitivity and specificity of 76.7% and 89.5% (table 8); in comparison with 76% and 60% obtain by Othman et al and 65% and 94% obtained by Santos et al. The PPV of 55.3% and a NPV of 95.8% indicate that its presence does not strongly predict UTT but its absence strongly predicts the absence of UTI. Othman et al found a PPV of 39% and a NPV of 88%. The finding of Santos et al which was a PPV 65% and a NPV of 94% was similar to that in this study. The result of this study indicates that, among adult females, the presence of pyuria was not a good predictor of UTI but its absence made UTI unlikely.

DIPSTICK HAEMATURIA

Table 8 showed that dipstick haematuria was the least sensitive (sensitivity was 33.3%) but the most specific finding (specificity was 100%). This sensitivity was much lower than that obtained by Othman et al who got a sensitivity of 76% and a specificity of 61%. In this study, The PPV was 100% and the NPV was 90.2%. Therefore, one of the strongest predictors of UTI was the presence of blood on urinary dipstick.

As seen in table 9, the presence of two or more of the urinary dipstick parameters were better predictors of UTI than individual parameters. These agreed with the findings from other studies (Othman S, 2003; Santos J, 2007).

VI. CONCLUSION

The prevalence of UTI among the adult female attendees at the General Practice Clinic, UBTH was found to be 14.3%. This prevalence was accounted for majorly by those aged 24-48 years. The findings suggest that urinary dipstick, coupled with the presence of clinical urinary indices was sufficient to make a diagnosis of UTI and to manage accordingly. Requesting for a urine microscopy after carrying out urinary dipstick appeared to be unnecessary. Similarly, ordering for a urine culture after a positive dipstick finding was a waste of time and scarce resources.

VII. RECOMMENDATIONS

- ✓ Physicians should rely more on urinary dipstick (positive nitrite or positive leucocytes and blood) in the management of UTI with the use of an empirical antibiotic.
- ✓ In taking a decision to treat or not, clinical features should not be used in isolation but should provide a clinical filter for positive dipstick findings.
- ✓ Ordering urine culture for all patients in whom we suspect UTI is not only a waste of scarce resource but also an unnecessary work load to the already over stressed laboratories. This should be discouraged.
- ✓ More research should be done especially in the area of symptom scoring and development of clinical rules or guidelines for the management UTI in remote centres that are run by health workers.

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