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How Reliable is the Diagnosis Urinary Tract Infection (UTI) Using Common Urinary Symptoms Alone? – A Study of 300 Adult Females in a Primary Care Setting in Benin City, Edo State, Nigeria

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Abstract:
This study on the reliability of clinical parameters in diagnosing 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 (GPC) of the University of Benin Teaching Hospital, Benin City, Nigeria. The aim was to assess the usefulness of common symptoms in predicting UTI among those respondents. The study employed the use of a pretested interviewer administered questionnaire that obtained information on biodata, clinical presentation and physical examination. The diagnosis of UTI was confirmed with urine microscopy and culture. From the study, it was observed that none of the asymptomatic respondents were culture positive. The prevalence of UTI was approximately 14% with most of the respondents aged between 18 and 47 years, and married. Among symptomatic respondents, the prevalence was 26.2%. Urinary frequency, nocturia and urgency were the most predictive symptoms of UTI especially when considered in combination. Physicians should rely more on this parameters in the management of Urinary tract infection. Routinely ordering for a urinary dipstick and/or urine culture in resource deprived health facilities may be unnecessary.

Keywords: *Urinary tract infection, urinary dipstick, sensitivity, specificity, predictive value*

1. Introduction

UTI 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.[1] Urinary tract infection (UTI) is conventionally defined as significant bacteriuria (10^5 CFU/ml of urine) in the presence of symptoms. 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.[2]

Additionally, some studies[3-5] 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.[6, 7]

The symptoms of UTI include urinary frequency, urgency, incontinence, dysuria, nocturia, supra-pubic pain, and haematuria.[8, 9] It has been shown that suspected urinary tract infection based on the above complaints remains one of the most common presentations in primary care, The management of UTI is challenging, not only because of the large number of infections that occur each year, but also because it is not always straightforward to distinguish mostly from other diseases that

have similar clinical presentation in females such as pelvic inflammatory disease. Additionally, it appears that too much reliance has been placed on laboratory tests to augment clinical impressions. Even when clinical diagnoses are unequivocal, physicians may still unnecessarily order a urine culture.[6] It therefore comes as no surprise that laboratory examination of urine specimen account for a large part of the avoidable workload in many hospitals based laboratories.[6, 10-13] It appears that too much reliance has been placed on laboratory tests to augment clinical impressions. Even when clinical diagnoses are unequivocal, physicians may still unnecessarily order a urine culture.[6] It therefore comes as no surprise that laboratory examination of urine specimen account for a large part of the avoidable workload in many hospitals based laboratories.[6, 10-13] In clinical practice, especially in this environment, urine culture is not cost effective and empirical antibiotic treatment is usually advocated. Worse still, in underdeveloped countries, access to simple laboratory procedures such dipstick urinalysis is difficult and the likelihood of developing complications is very high due to their peculiar low socioeconomic conditions with its attendant health implications. There is therefore the need to depend more on clinical evaluation which is most cost-effective.
This study sought to evaluate the common clinical parameters that could predict UTI among symptomatic individuals, with the goal of improving diagnostic accuracy and career's confidence in making empirical prescribing for suspected cases, in resource deprived settings without making use of the overstressed and underequipped laboratories.

2. Materials and Method

2.1. 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 etc. The inhabitants are largely civil servants undergraduate students, traders, farmers, and artisans.

2.2. Study Design, Study Population and Sample

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.

2.3. Method of Specimen Collection

A clean catch method of mid-stream urine collection was employed during this study. The respondents were instructed to clean between the labia minora with soapy water and rinse well. Then a small amount of urine was passed into the toilet bowl to clear the urethra of any contaminants and then the sterile container (in this case, a sterile universal bottle) was filled up at mid-stream and then sealed. The urine sample was then divided into two (2) sterile containers labelled 'A' and 'B'. Dipstick urinalysis was carried out on the container labelled 'A', while the second urine sample labelled 'B' was sent to the main laboratory for Microscopy, Culture and Sensitivity. Muitistix 10SG reagent strip was used to rapidly determine the specific urine parameters of interest, namely leucocyte-esterase, nitrite, protein, and blood. Only dipstick readings ≥1+ were taken as positive. The read time for protein, blood and nitrite was 60 seconds, while it was 2 minutes for leukocyte esterase[14]. A stopwatch was used, as much as possible by a trained assistant who was adequately trained on split timing set at 60 seconds per lap for each of the urine specimen analysed.

Microscopy, culture and sensitivity were carried out in the main laboratory using the urine sample in the sterile container labelled 'B'. A laboratory technician spinned the urine samples for 5 minutes at 2000 rpm (revolution per minute) using a centrifuge and the sediments put on glass slide and was then examined microscopically under x10 and x40 objectives by the laboratory scientist. The result was then categorized as the number of white blood cells (WBCs) and red blood cells (RBCs) per high power field (hpf). Samples with >5 white blood cells/hpf were regarded as significant pyuria. Significant microscopic haematuria was taken as >1 red blood cell/hpf.[15]

For culture, a calibrated sterile platinum wire loop was used for the plating. It had a 4.0mm diameter, which by virtue of its size delivered 0.01ml. A loop of the well-mixed urine samples was then inoculated into duplicate plates of blood and Mac-Conkey agar and then incubated at 37° for 24 hours. The plates were then being examined macroscopically and microscopically for bacterial growth. The bacterial colonies were counted and multiplied by 100 to give an estimate of the number of bacteria present per milliliter of urine. A significant bacteria count was taken as any count equal to or in excess of 10,000 colony forming unit (cfu)/milliliter (ml).[16-18]

3. Data Analysis

Data was entered directly into the SPSS-16.0 (statistical package for social sciences). After checking for errors, the data were stratified into the various age brackets and analysed using the statistical package for social sciences SPSS version 15.0. The respondents were grouped into four (table 1), namely: True Positives (a): Those who had UTI (positive culture) and were also positive for the parameter being analysed; True Negatives (d): Those who were culture negative and at the same time negative for the parameter being analysed; False Positives (b): Those who were culture negative but were positive for the parameter being analysed; False Negatives (c); Those who were culture positive but were negative for the 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 clinical 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.

3.1. 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 voluntarily.

4. Results

4.1. Age Distribution of Respondents

Three hundred (300) randomly selected women 18-64years who attended the General Practice Clinic of the University of Benin Teaching Hospital, Benin City were selected for the study. Table 1 below shows the age distribution of all the respondents. The modal age range for all of them was 36-41years. 36-41years also represent the modal age range for the symptomatic respondents. However, the modal age range for the asymptomatic respondents was 24-29 years. The highlighted figures in table 2 below represent the various frequencies of the modal ages for each group of the respondents.

Age Range (Years)	Symptomaticic		Asymptomatic		All	
	Count	%	Count	%	Count	%
18-23	17	10.4	16	11.8	33	11.0
24-29	21	12.8	26	15.9	47	15.7
30-35	33	20.1	19	14.0	52	17.3
36-41	46	28.0	21	22.8	67	22.3
42-47	16	9.8	18	13.2	34	11.3
48-53	9	5.5	11	8.1	20	6.7
54-59	15	9.1	14	10.3	29	9.7
60-64	7	4.3	11	8.1	18	6.0
TOTAL	164	100	136	100	300	100

Table 2: Age Distribution of All the Respondents.

4.2. The Distribution of Marital Status of all the Respondents.

Table 3 below shows that 58.3% of the respondents were married, and they accounted for the majority of the respondents. Most of the respondents (58.3%), whether symptomatic (65.3%) or asymptomatic (50.0%) were married.

Marital Status	Symptomatic		Asymptomatic		All	
	COUNT	%	COUNT	%	COUNT	%
Single	35	21.3	45	33.1	80	26.7
Married	107	65.3	68	50.0	175	58.3
Divorced	2	1.2	1	0.7	3	1.0
Separated	10	6.1	9	6.6	19	6.3
Widowed	10	6.1	13	9.6	23	7.7
Total	164	100	136	100	300	100

Table 3: Distribution of Marital Status among All the Respondents.

4.3. Distribution of Urinary Clinical Features among Symptomatic Respondents

Figure 1 below shows the respective prevalence of the individual urinary symptoms and signs among the 164 symptomatic respondents. Ninety (54.9%) of the symptomatic respondents had suprapubic pain. This was the most common symptom. Urinary frequency was present in seventy (42.7%) respondents. Nineteen (11.6%) of the symptomatic respondents had dysuria, fifteen (9.1%) had loin pain, thirty-eight (23.2%) had urgency, thirty-six (22.0%) had nocturia, fifty-two (31.7%) had suprapubic tenderness, while eight (4.9%) had renal angle tenderness.

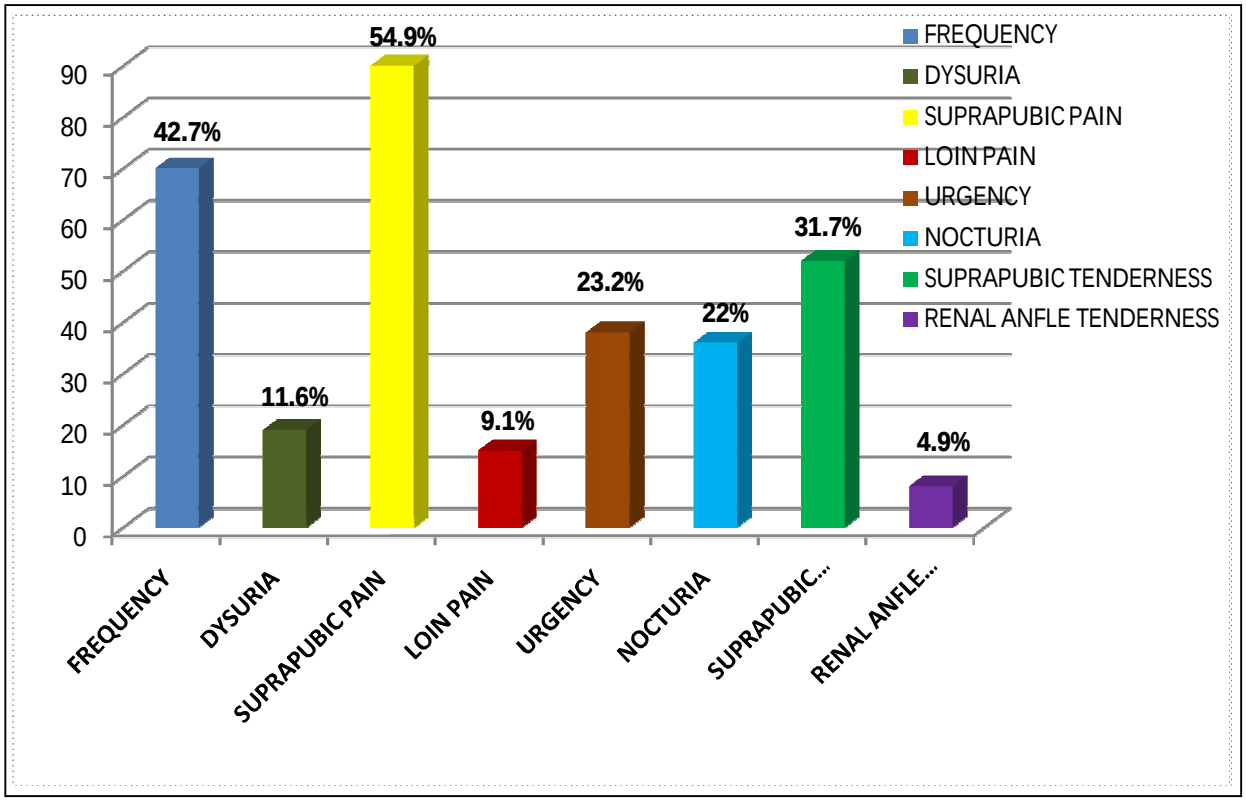

Figure 1: Distribution of the Urinary Clinical Features among the Symptomatic Respondents

4.4. The Distribution of Positive Culture Results among Symptomatic and Asymptomatic Respondents

Table 4 below shows that 43 (26.2%) 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.

	Symptomatic	Asymptomatic	
Culture Positive	43 (26.2%)	0	43 (14.3%)
Culture Negative	121 (73.8%)	136 (100%)	257 (85.7%)
Total	164	136	300

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

Table 4: Distribution of positive culture results among symptomatic and asymptomatic respondents

4.5. The Distribution of Positive culture results among the Symptomatic Respondents

Table 5 below shows that the following urinary symptoms were more frequently distributed among respondents who were culture positive: Urinary frequency (50.0%), dysuria (84.2%), urgency (79,0%), and nocturia (63.9%).

Urinary Symptoms	Count		Percentage
	Total	Culture Positive	
Urinary Frequency (F)	70	35	50.0
Dysuria (D)	19	16	84.2
Suprapubic Pain	90	31	34.4
Loin Pain	15	4	26.7
Urgency (U)	38	30	79.0
Nocturia (N)	36	3	63.9

Table 5: Distribution of Positive Culture Results among the Symptomatic Respondents.

4.6. The Predictive Values of the Four Urinary Symptoms for UTI

Table 6 shows that the single most sensitive but least specific urinary symptom for UTE was urinary frequency. Dysuria (D) was the least sensitive but the most specific. It also had the highest positive predictive value of 0.84. The presence of urinary frequency (F) and dysuria, or nocturia (N) was more predictive of the presence or absence of UTI (see highlighted figures in table 6 below).

Urinary Symptoms	Sensitivity (Sens.)	Specificity (Spec.)	Positive Predictive Value (PPV)	Negative Predictive Value (NPV)
F	0.81	0.8	0.50	0.97
D	0.37	0.99	0.84	0,90
U	0.70	0.97	0.79	0.95
N	0.53	0.95	0.64	0.92
F + D	0.68	1.00	1.00	0.97
F + U	0.92	0.99	0.92	0.99
F + N	0.86	1.00	1.00	0.99
D + U	0,60	1.00	1.00	0.98
D+N	0.41	1.00	1.00	0.95
U + N	0.75	0.99	0.94	0.98
F + D + U	0.53	1.00	1.00	0.97
F + D + N	0.30	1,00	1.00	0.94
F+ U + N	0.28	1.00	1.00	0.89
D + U + N	0.24	1.00	1.00	0.94
ALL FOUR	0.11	1.00	1.00	0.87

Table 6: The Predictive Values of the Four Urinary Symptoms for UTI, Independently and in Combination.

5. Discussion

In this study, the prevalence of UTI among symptomatic respondents was found to be 26.2% . This finding was similar to that of Othman et al[19] who found a prevalence of 25% among the symptomatic respondents. This may be as a result of similarity in both study designs.

The most common urinary clinical parameter was suprapubic pain which was 54.9% among symptomatic respondents. In the descending order, urinary frequency was 42.7%, suprapubic tenderness was 31.1%, urgency was 23.2%, nocturia was 22%, dysuria was 11.6%, loin pain was 9.1%, while renal angle tenderness was 4.9% (Figure 2), These above findings were lower than those obtained by Medina-Bombardo et al[20] who found a relative frequency of 78.9% for urinary frequency, 57.6% for dysuria and 65% for urgency. This difference may have been due to the inclusion of elderly women who may have background urinary problems and those as young as 14 years of age who may be hygienically naive, in his study.

Othman et al[3] found that symptoms of dysuria and frequency were present in three quarter (75%) of his respondents, a finding that was higher than the result in this study. Urgency was found in 34% of his respondents which was more than 23.2% obtained in this study (Figure 2). The difference in result may also be as a result of the inclusion of the elderly to his study.

Table 5 and 6 show the relative frequencies of the urinary symptoms and their respective predictive values. Dysuria was the single most important urinary symptom that was most suggestive of UTI. Table 5 shows that 84.2% of the respondents who had dysuria were eventually diagnosed of UTI while by inference the remaining 15.8% may likely have had

urethritis that may eventually result in cystitis due to ascending infection. The presence of dysuria plus either of urinary frequency or urgency or nocturia, was diagnostic of UTI, i.e. PPV of 100%. Similarly, the presence of urinary frequency plus nocturia was diagnostic of UTI, i.e. PPV of 100%. The presence of more than 2 clinical parameters further strengthened the diagnosis of UTI.

6. Limitation

Unlike in the temperate countries where many individuals are well informed, and kept medical diaries, obtaining information about past history of UTI from respondents was difficult due to ignorance of the nature of medical condition previously treated.

7. Conclusion

In poor resource countries, an accurate diagnosis of UTI can be made on clinical grounds alone and empirical antibiotics should then be administered promptly. The presence of dysuria plus either of urinary frequency or urgency or nocturia, was diagnostic of UTI. The routine ordering for microscopy, culture and sensitivity may be a waste of resources.

8. Recommendation

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 centers that are run by health extension workers.

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