

ORIGINAL RESEARCH

Evaluation of the Diagnostic Method of Urinary Nitrite

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Abstract: **Introduction:** Nitrite test is a simple, inexpensive method for diagnosing urinary tract infections. This paper evaluates the efficiency of nitrite test in the diagnosis of urinary infections. In doing so, we analyzed patients in Khatam-ul-Anbia Hospital of Zahedan City and determined the sensitivity and specificity of this test. **Material and Methods:** This is a cross-sectional study involving 200 randomly selected patients with urinary infection symptoms in Khatam-ul-Anbia Hospital. Urine samples were tested for the presence of nitrite and urine culture was performed. **Results:** We selected 200 patients, out of which 100 had negative nitrite test and 100 had positive nitrite test. Out of 100 patients with negative nitrite test, only 4 had positive urine culture. Out of 100 patients with positive nitrite test, 98 had positive urine culture with colony count of more than 105 CFU/ml (sensitivity: 98%, specificity: 96.9%). **Conclusion:** As an inexpensive and easy method, nitrite test is a valuable test which can obviate the need for urine culture before treatment.

Keywords: Adult; Nitrite; UTI

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1. Introduction

Urinary tract infections are anatomically divided into upper and lower infections. They are highly prevalent among females, occurring in 1-3% of schoolgirls. The prevalence significantly increases as puberty begins. The most common germs which develop UTI are negative gram-bacilli, 80% of which is *Escherichia Coli* (1, 2). To diagnose urinary infections, urine analysis tests and urine culture are performed. In urine analysis tests, pyuria, hematuria, and bacteriuria may be indicative of infection, which is confirmed by a urine culture with colony count of equal to or more than 105 CFU/ml (3, 4). Among other tests used to diagnose urinary infection is nitrite test. Nitrates, absorbed through daily foods, are changed into nitrites by negative gram-bacteria when they occur in urine. To produce nitrite, urine needs to remain in bladder for at least 4 hours so that bacteria have enough time to convert nitrate to nitrite (5, 6). Nitrite test is carried out by special strips and can offer a sensitivity of 85% and specificity of 65% in infections with colony count of equal to or more than 105 CFU/ml (5, 7). This test is easy to do and can diag-

nose urinary infections faster than urine culture. Given the advantages of this test, we compared the results of nitrite test and urine culture in the diagnosis of urinary infections (5, 8). The present study is unique in its kind. However, Anderson and Chamber have studied the use of nitrite and leukocytosis in the diagnosis of infants with urinary infections. They reported a sensitivity of 40% where nitrite was analyzed together with leukocytosis, which is yet lower than reputable sources (9). In the present study, we demonstrated the efficiency of nitrite test in the diagnosis of urinary infections.

2. Material and Methods

This is a cross-sectional, random, and double-blind study performed at Khatam-ul-Anbia Hospital of Zahedan City during 1996-1997. The case group includes 100 persons (63 women, 38 men) between the age of 18-75 years and the control group includes 100 persons (51 women, 49 men) between the age of 18-71 years. Patients with urinary infection symptoms (burning in urination, frequent urination, and emergency urination) at Khatam-ul-Anbia Hospital were referred to the laboratory and urine samples were randomly collected. The samples were taken in the early morning and from the middle of urination. First, a portion of sample was cultured in blood and EMB agar environments and then nitrite test was carried out within 5 minutes. In doing so, spe-

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cial strips were placed in urine for 2 minutes and then the result was recorded. After 72 hours, slide was prepared from the cultured samples and a microbiologist reported positive cultures, type, and number of organism and antibiogram.

3. Results

A total of 200 patients were involved in the study, out of which 100 (62 females and 38 males) had positive nitrite test and 100 (51 females and 49 males) had negative nitrite test. Out of 100 patients with negative nitrite test, only 4 had positive culture, with 2 having pseudomonas (both being male) and 2 having staphylococcus aureus (both being female) (tables 1 and 2). Out of 100 patients with positive nitrite test, 62 were female (all having positive blood culture) and 38 were male (with only 2 having negative nitrite test). Out of 100 patients with negative nitrite test, 51 were female (with 2 having positive blood culture) and 49 were male (with 2 having positive blood culture) (tables 3 and 4). Germs obtained from 102 patients with positive blood culture were *Escherichia Coli* (68 patients, 67.5%), *klebsiella* (21 patients, 20.5%), *proteus* (9 patients, 8.8%), *staphylococcus aureus* (2 patients, 1.9%), and *pseudomonas* (2 patients, 1.9%). Antibiogram was performed with antibiotics of gentamicin, nalidixic acid, amikacin, cotrimoxazole, nitrofurantoin, ceftizoxime, kanamycin, toyocamycin, keflin and cephalixin. Among them, only one case of persistent burning from *staphylococcus aureus* was observed (table 5).

4. Discussion and Conclusion

Nitrite test is an inexpensive, easy-to-do test which can detect bacteriuria in a short time. Konin (1975) carried out three nitrite tests on a small group of patients and reported 70% positive result in patients with positive blood culture (10). Where *Escherichia Coli* existed in urine, bacteriuria conformed to blood culture results by 93%. No false positive result was reported in his study (11). In our study, *Escherichia Coli*, *klebsiella* and *proteus* all conformed to blood culture by taking only one correct sample and reading 100% of positive nitrite test results. Two false positive cases were observed, which could not be explained due to shortage in equipment. Moreover, four cases of negative nitrite test leading to positive culture were strains being unable to produce nitrite in urine (2 *staphylococcus* and 2 *pseudomonas*). The most prevalent organism in our study was *Escherichia Coli* (67.5%) and the least prevalent were *staphylococcus aureus* and *pseudomonas* (1.9%). The sensitivity and specificity of nitrite test were very high in our study, which suggests that this test is a valuable method for diagnosing urinary infections. Nevertheless, blood culture remains necessary for determining the type of organism and antibiogram (7). The great advantage of nitrite test, however, is that it enables to

prescribe antibiotic very quickly (in cases where starting antibiotic is subject to positive blood culture) (7). Considering the most prevalent organism, nalidixic acid is an appropriate antibiotic to start treatment. Although upper and lower infections of urinary tract have not been separated in our study, nitrite test can be effective for both as the most prevalent organism in both upper and lower infections is negative gram-bacteria. Obviously, this test cannot be sensitive for positive gram-bacteria and *pseudomonas* as pathogenic agents in urinary infections, as they are unable to produce nitrite in urine. So, a positive nitrite test indicates that pathogen organisms are negative gram-bacteria and allows us to quickly prescribe antibiotic.

5. Appendix

5.1. Acknowledgements

None.

5.2. Author contribution

All the authors have the same contribution.

5.3. Funding/Support

None.

5.4. Conflict of interest

No conflict of interest.

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Table 1: Results of nitrite test and urine culture for all patients

	Positive Nitrite	Negative Nitrite	Total
Positive Culture	98	4	102
Negative Culture	2	96	98
Total	100	100	200

Table 2: Organisms cultured from urines

Organism	Female	Male	Positive Nitrite	Negative Nitrite
Escherichia Coli	44	24	68	-
Klebsiella	12	9	21	-
Proteus	4	5	9	-
Staphylococcus Aureus	2	-	-	2
Pseudomonas	-	2	-	2

Table 3: Results of nitrite test and urine culture in females

	Positive Nitrite	Negative Nitrite	Total
Positive Culture	62	2	64
Negative Culture	-	49	49
Total	62	51	113

Table 4: Results of nitrite test and urine culture in males

	Positive Nitrite	Negative Nitrite	Total
Positive Culture	36	2	38
Negative Culture	2	47	49
Total	38	49	87

Table 5: Number of germs sensitive to antibiotics in antibiogram

	Escherichia Coli	Klebsiella	Proteus	Staphylococcus reus	Au- Pseudomonas
Cephalexin	64	15	7	1	-
Keflin	66	17	7	1	-
Nalidixic Acid	68	20	9	-	-
Amikacin	68	21	9	-	2
Cotrimoxazole	43	11	5	-	-
Nitrofurantoin	40	13	4	-	-
Gentamicin	60	16	7	-	1
Kanamycin	68	21	9	-	2
Toyocamycin	68	21	8	-	2
Ceftizoxime	68	21	9	1	1