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STUDY OF URINARY LEUKOCYTE ESTERASE AND NITRITE EXAMINATION IN URINARY TRACT INFECTION PATIENTS IN JAMBI CITY IN 2024

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ABSTRACT

Background: Urinary tract infection is a condition of infection due to the growth and development of bacteria and other organisms in the urinary tract (Pardede, 2018). Most urinary tract infections are caused by *E. Coli* bacteria. One of the screening methods to confirm the diagnosis of UTI is a urine dipstick test which is able to detect leukocyte esterase as an indicator of pyuria and nitrite as an indicator of bacteriuria.
Methods: This type of research is descriptive research with a *cross-sectional approach*. This study aims to determine the results of leukocyte esterase and urine nitrite examination in patients with urinary tract infections in Jambi City in 2024. This research was conducted in March-June 2024 with a total sample of 30 urinary tract infection sufferers from several hospitals/health centres in Jambi City using a *purposive sampling technique.* From research conducted on UTI sufferers, positive results for leukocyte esterase were obtained with 1+ and +2 for 12 people (40%) and 3+ for 6 people (20%).
Results: The results were positive for nitrite as many as 17 people (57%) and negative for nitrite as many as 13 people (43%). There were 17 people (57%) who were positive for leukocyte esterase and positive for nitrite, namely 9 people for leukocyte esterase 1+ which were positive for nitrite (75%), and 8 people who were positive for leukocyte esterase 2+ with nitrite (67%).
Conclusion: Meanwhile, 13 people (43%) obtained positive results for leukocyte esterase and negative for nitrite, namely 3 people (25%), 3 people (25%) for esterase 1+ leukocyte 2+, 4 people (33%), 4 people for nitrite negative leukocyte esterase 2+, and esterase leukocyte 3+ who were negative for nitrite were 6 people (100%).

Keywords: Urinary Tract Infection, Leukocyte esterase, Nitrite

INTRODUCTION

One of the diseases that most often attacks the urinary system is urinary tract infection. Urinary tract infections are a health problem that is increasing every year. According to the World Health Organization (2013), the number of people suffering from urinary tract infections worldwide is around 8.3 million people and is expected to continue to increase to 9.7 million people. In 2019, the number of deaths due to UTI globally reached 236,790 people (Yang X, et al, 2022). In one study, around 13,000 people died from urinary tract infections in the United States, which was 2.3 % of the death rate (Maulani, D. & Siagian, E., 2021).
The prevalence of urinary tract infection cases in Indonesia is still quite high. It is estimated that the number of Indonesian people suffering from urinary tract infections is 222 million. According to the Ministry of Health of the Republic of Indonesia (2016), the number of UTI sufferers in Indonesia is 90-100 cases per 100,000 populations per year or around 180,000 new cases per year (Widiyastuti, FS, & Soleha, TU, 2023).

infections are more common in women than in men, because women's urethra is shorter so microorganisms from outside can more easily enter the bladder. This is in line with research by Kumala I., et al (2022) that UTIs are dominated by women, with the number of female respondents (68.47%) being greater than men (31.53%). The high risk of women suffering from UTIs is due to the short urethra and the humidity level in the feminine area which is a favorable condition for bacteria to

grow and reproduce. So bacteria can climb into the urinary tract starting from the urethra and then to the bladder (Triwbowo, G., 2015). Urinary tract infection is a condition of infection due to the growth and development of bacteria and other organisms in the urinary tract (Pardede, 2018). Most urinary tract infections are caused by *E. Coli* bacteria. Other bacteria that can cause UTIs are Enterobacter sp., Enterococcus faecalis, Methicillin -resistant *Staphylococcus Aureus, Klebsiella pneumonia* and *Pseudomonas as well as Kandida sp* fungal infections (Widiyastuti, FS, & Soleha, TU, 2023).

Urine culture examination is *the gold standard* for determining the presence of microorganisms that cause UTI and the amount of colonization is ≥100,000 CFU/ml. The disadvantages of urine culture include that it takes a long time and is quite expensive and is not available in all laboratories. This causes delays in treatment so that new diagnostics are needed that can replace urine culture (Malau UN, & Adipireno P, 2019). One of the screening methods to confirm the diagnosis of UTI is a urine dipstick test which is able to detect leukocyte esterase as an indicator of pyuria and nitrite as an indicator of bacteriuria. The leukocyte esterase urine *dipstick* test can detect the esterase enzyme produced by leukocytes in the urine. The conversion of nitrate to nitrite occurs due to bacteria that produce the enzyme nitrate reductase. This examination can provide results quickly, cheaply and easily (Malau, UN, & Adipireno, P., 2019).

In previous research, the results showed that 17 people (18.48%) were positive for leukocyte esterase, and 27 people (29.35%) were positive for nitrite and statistically there was a relationship between the presence of leukocyte esterase and nitrite and UTI based on urine culture (*p-value* 0 ,00) (Tuntun, M., & Aminah, S., 2021). Another study, on 50 patients with urinary tract infections who had catheters installed at RSUD Dr. H Abdul Moeloek Lampung showed that the results of the urinalysis examination showed that the number of positive leukocyte esterase was 32 (64.0 %). Meanwhile, in the nitrite examination, more negative results were obtained, namely 43 (86.0 %) (Kumala, I., et al, 2022).

METHODS

This type of research uses a descriptive method with a *cross-sectional approach.* Examination of leukocyte esterase and urine nitrite using dipstick and automatic methods using a urine analyzer.

This study used a sample of patients diagnosed with urinary tract infections at several community health centers/hospitals in Jambi City in 2024. Using purposive sampling technique.

RESULTS AND DISCUSSION

Table 1. Respondent characteristics based on age and gender

	Characteristics	Frequency	Percentage
Gender	Male	13	43.3%
	Female	17	56.7%
Age	Late Adolescence (17-25 years)	4	13.3%
	Early Adulthood (26-35 years)	7	23.3%
	Late Adulthood (36-45 years)	5	16.7%
	Early Elderly (46-55 years)	7	23.3%
	Late Elderly (56-65 years)	6	20.0%
	Seniors (>65 years)	1	3.3%
	Total	30	100%

Based on table 1, it can be seen that the age characteristics are dominated by early adults (26-35 years) and early elderly (46-55 years), namely (23.3%). Based on gender, the female category has a higher percentage (56.7%) than the male category, namely (43.3%). From table 2, it is known that the highest number of leukocyte esterase positive leukocyte esterase was 1 (1+) 70 leu/Ml and positive 2 (2+) 125 leu/Ml, amounting to 12 people each (40%). And the fewest positive

leukocyte esterase 3 (3+) 500 leu/Ml were 6 people (20%).

Table 2. Frequency distribution of the number of leukocyte esterase in urine of UTI sufferers

Leukocyte esterase	Frequency	Percentage (%)
1+ (70 leu/µl)	12	40
2+ (125 leu/µl)	12	40
3+ (500 leu/µl)	12	40

From table 3, it is known that the highest number of nitrite results was positive, amounting to 17 people (57%). Meanwhile, 13 people (43%) had negative nitrite results.

Table 3. Distribution of nitrite frequency in the urine of UTI sufferers

Nitrite	Frequency	Percentage (%)
Negative	13	43
Positive	17	57

Table 4. Frequency distribution of leukocyte esterase and nitrite countsin the urine of UTI sufferers

Test		Nitrite		Total
		Neg	Post	
Leukocytes esterase	Post 1	3 (25%)	9 (75%)	12 (100%)
	Post 2	4 (33%)	8 (67%)	12 (100%)
	Post 3	6 (100%)	0 (0%)	6 (100%)
	Total	13 (43%)	17 (57%)	30 (100%)

The results of research on the description of leukocyte esterase and urinary nitrite in Urinary Tract Infection (UTI) sufferers conducted on 30 samples showed that the majority of respondents were female, namely 17 people (56.7%). This is in line with research conducted by (Kumala, I et al. , 2022) that there are more UTI sufferers found in women compared to men, influenced by the condition of the urethra which is short and anatomically close to the vagina, periuretal glands and rectum, as well as the level of humidity in the feminine area. which is a favorable condition for bacteria to grow and reproduce, so that bacteria can move up the urinary tract from the urethra to the bladder. Meanwhile, in men, there are fewer, namely 13 people (43.3%), urinary tract infections rarely occur because their urethra is longer and also because of the presence of prostatic fluid which has bactericidal properties whose function is to protect against bacterial infections.

Based on table 1, the results of research which was attended by 30 respondents, dominated by early adults (26-35 years) and early elderly (46-55 years), namely (23.3%). The results of this research are in line with research conducted by (Tuntun, M. , & Aminah, S., 2021) the incidence of urinary tract infections increases in patients aged 40 years and over with the highest peak in the elderly group. As people get older , the function of the human body's organs decreases, the physiological function of the body's organs decreases, so that the older you get, the more susceptible you are to suffering from various diseases.

Based on the results of research conducted on the number of leukocyte esterase and urine nitrite in UTI sufferers, it was found that all 30 respondents were declared positive for leukocyte esterase (100%) with leukocyte esterase 1+ and 2+ totaling 12 people each (40%) and leukocyte esterase 3+ totaling 6 people (20%). The results of this study are in line with research by Kumala I et al (2022), which found that 32 respondents (46%) were positive for leukocyte esterase. Leukocyte esterase indicates the presence of leukocytes in the urine which can be a marker for urinary tract infections (Inayati & Falah K. , 2014). Some disadvantages of leukocyte esterase examination that cause false negative results, namely the use of antibiotics and high levels of ascorbic acid in the urine. Meanwhile, false positive results can be caused by several things, such as inappropriate sampling in women (urine contaminated with fluid from the vagina), the presence of trichomonas, oxidizing agents and formalin (Tuntun, M., & Aminah, S., 2021).

For nitrite positive results, there were 17 people (57%) and 13 people (43%) negative for nitrite. So there is theoretical agreement with research conducted by Guspa, BR et al., (2018) which found positive results for nitrite

of 26.2% in patients with urinary tract infections. The nitrite test in the dipstick test is based on the ability of bacteria to convert nitrate into nitrite with the help of the enzyme nitrate reductase, the enzyme nitrous oxide reductase and nitrous oxide reductase. The bacteria that are often found in urine are a group of Gram-negative bacteria (Tuntun, M., & Aminah, S., 2021).

Based on table 4, the frequency distribution of the number of leukocyte esterase and nitrite in the urine of UTI sufferers showed positive results for leukocyte esterase and nitrite in 17 people (57%), namely leukocyte esterase 1+ which was positive for nitrite, there were 9 people (75%), and leukocyte esterase 2+ which was positive for nitrite. There were 8 people (67%) positive for nitrites. UTI is a condition that indicates the presence of microorganisms in the urinary tract which is characterized by bacterial colonization in the urinary tract. Detection of leukocyte esterase is an indirect indication of bacterial infection. Pyuria, which is a condition where white blood cells are present in large numbers in the urine, indicates the possibility of a urinary tract infection (UTI). Meanwhile, nitrite is an indicator of bacteriuria, therefore positive leukocyte esterase and nitrite strongly indicate the presence of a urinary tract infection (Inayati & Falah K., 2014).

The results were positive for leukocyte esterase, negative for nitrite, 13 people (43%), namely leukocyte esterase 1+ which was negative for nitrite, there were 3 people (25%), leukocyte esterase 2+ which was negative for nitrite, there were 4 people (33%), and leukocyte esterase 3 + there were 6 people who were negative for nitrite (100%). Negative nitrite results cannot rule out the possibility of a UTI, because there are certain conditions that can cause negative nitrite results in patients with UTI, such as infections caused not by bacteria but by fungal infections such as *candida sp* , infected by bacteria that cannot produce nitrites such as Pseudomonas sp, or Enterococci, whose nitrite test results are negative, or the urine examined is urine that has not been stored in the bladder for a long time, it takes >4 hours for the bacteria to convert nitrate into nitrite. Therefore, the examination must be continued with urine culture as the gold standard for UTI examination (Parwati, PA & Cahyani AAAE., 2023).

CONCLUSION

Based on the research results, it can be concluded that based on age, the highest number of respondents was dominated by early adults (26-35 years) and early elderly (46-55 years), namely (23.3%). Based on gender, the female category has a higher percentage (56.7%) than the male category, namely (43.3%). The results of leukocyte esterase in patients with urinary tract infections showed that all 30 respondents were positive for leukocyte esterase with 1+ and 2+ respectively 12 people (40%) and 3+ 6 people (20%). The nitrite results in patients with urinary tract infections were 17 people (57%) positive for nitrite and 13 people (43%) negative for nitrite. Positive results for leukocyte esterase and positive for nitrite were obtained by 17 people (57%), namely 1+,(+) nitrite by 75%, and 2+,(+) nitrite by 67%, while positive results for leukocyte esterase and negative nitrite were obtained by 13 people (43%), namely 1+, (-) nitrite by 25%, 2+, (-) nitrite by 33%, and 3+, (-) nitrite by 100%.

It is hoped that future researchers will need to carry out urine cultures on people with urinary tract infections so they can find out the type of bacteria that is infecting them and help determine antibiotics for treatment.

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CONFLICT OF INTEREST

The author declares there is no conflict of interest.

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