

Management of urine specimens with delayed sedimentation in patients suspected of urinary tract infection

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Abstract

Urinary tract infection (UTI) is a common health problem characterized by an increase in the number of leukocytes, erythrocytes, and bacteria in urine sediment. The accuracy of urine tests is greatly influenced by specimen handling, particularly sedimentation time, so delays in testing can potentially affect laboratory results and lead to misdiagnosis. This study aims to analyze the effect of sedimentation delay on the results of leukocyte, erythrocyte, and bacterial tests in the urine of patients with suspected UTI. The study used a quantitative design with a cross-sectional approach and was conducted in the laboratory of Buleleng Regional General Hospital. A total of 30 urine samples from patients suspected of having UTI were examined immediately after collection, after a 30-minute delay, and after a 60-minute delay. The data were analyzed using a one-way ANOVA test to assess the differences in results between examination times. The results showed that delays of up to 60 minutes did not significantly affect the number of leukocytes, erythrocytes, or bacteria in the urine sediment. These findings confirm that although immediate examination remains the standard, delays of up to one hour are acceptable without compromising the quality of laboratory results. Therefore, urine specimens need to be managed appropriately to ensure diagnostic accuracy, and laboratory policies need to take into account operational conditions in the care of patients with suspected UTI.

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1. Introduction

Urinalysis is one of the most frequently performed supporting tests in clinical laboratories to aid diagnosis and evaluate therapy. This test includes chemical, visual, and microscopic analysis, particularly of urine sediment, which aims to identify organic and inorganic components (Soebrata, 2007). Organic elements, such as bacteria and leukocytes, can appear due to inflammation or infection in the kidneys and urinary tract (Fischbach, 2009). Microscopic examination of urine sediment plays an important role in detecting urinary tract abnormalities and evaluating the effectiveness of therapy (Grabe, 2015). Urinary tract infection (UTI) is one of the most common diseases, with a higher prevalence in women due to anatomical differences in the urethra. Clinically, UTI can be characterized by an increase in the number of leukocytes and bacteria in urine sediment (Baratawidjaja, 2009).

Pre-analytical factors, including the time between sample collection and examination, greatly influence the accuracy of urine sediment examination results. To maintain sample integrity, fresh urine should be examined within two hours after collection or stored at 4°C if examination is delayed (Wirawan, 2010). Delaying examination can cause changes in cell and bacterial counts due to degradation processes,

enzyme activity, and changes in urine pH. It has the potential to reduce leukocyte and erythrocyte counts, while bacteria can multiply more rapidly at room temperature (Mubarak, 2017). Therefore, delays in analysis can affect the validity of results and increase the risk of diagnostic errors.

Several previous studies have examined the effect of delay time on urine sediment examination results. Naid et al. (2014) reported a decrease in the number of leukocytes, erythrocytes, and epithelial cells after a delay of 2–3 hours. Anwar and Jais (2021) confirmed that delayed examination can trigger urine sediment lysis due to bacterial activity. Djou (2018) also found that delayed sample processing affects the quality of the analysis results, while Asriyani (2016) showed that examinations conducted in less than 60 minutes had no significant effect on the number of leukocytes. Other studies confirm that the number of erythrocytes and leukocytes begins to decrease significantly after a delay of more than one hour (Utami, 2019; Aristoteles & Puspitasari, 2023). Yulianti (2019) even indicates that delays of up to four hours can affect the detection of positive bacteria. However, the results of the studies still show differences in findings, so further research is needed regarding the impact of delays on urine sediment test results.

Preliminary studies show that health facilities at Buleleng District Hospital often experience delays of 30–60 minutes in testing due to operational constraints. This situation is caused by limited reagents, sample numbers exceeding capacity, and limited human resources and equipment (Guyton & Hall, 2008). This situation highlights the importance of understanding the extent to which delays in examination can affect analysis results, especially in patients suspected of having a UTI. Therefore, this study aims to analyze the effect of delay time (immediate, 30 minutes, and 60 minutes) on the number of leukocytes, erythrocytes, and bacteria in the urine sediment of patients with suspected UTI at Buleleng District Hospital. The study results can provide empirical contributions for medical laboratory technologists (MLTs) in managing urine specimens and serve as a basis for hospitals to establish standard testing time policies to ensure the accuracy of laboratory results.

2. Method

2.1 Research Design and Participants

This study used a quantitative approach with a cross-sectional design to analyze delays in examination time with changes in the number of leukocytes, erythrocytes, and bacterial sediment in the urine of patients suspected of having urinary tract infections (UTIs) during a specific period (Kerlinger & Lee, 2000). Data collection was carried out at the Buleleng District Hospital Laboratory from February to March 2024. The study population consisted of all patients undergoing UTI examination, while the sample was selected using purposive sampling with 30 respondents. The sample size was determined based on considerations of population representativeness and suitability with the study design (Sugiono, 2013; Subhaktiyasa, 2024). The inclusion criteria included patients aged 35–65 years with a clinical diagnosis of suspected ISK and willing to be research respondents. In contrast, the exclusion criteria were patients with diabetes mellitus, a comorbidity that could potentially affect the results of urine sediment examination.

2.2 Instruments and Data Collection

The research instruments included a microscope, centrifuge, test tube rack, micropipette, microscope slides, coverslips, urine pots, and yellow tips as the leading equipment for urine sediment examination. Urine samples were collected from patients suspected of having UTI in the morning using a pre-analytical procedure that began with instructions on how to collect urine correctly, including refraining from strenuous physical activity 48 hours prior, abstaining from sexual intercourse for at least 24 hours prior to collection, and postponing collection for female patients until three days after the end of menstruation to avoid hematuria (Abdurahman et al., 2011; Susianti & Parwati, 2022). In the analytical stage, 10–12 mL of the urine sample was homogenized, then centrifuged at a speed of 1500 rpm for five minutes. The supernatant is discarded, and 20 µL of the sediment is transferred to a glass slide, covered with a cover slip, and then examined using a microscope with 10x and 40x magnification to identify leukocytes, erythrocytes, and bacteria (Riswanto & Rizki, 2015). The analysis was performed immediately, after 30 minutes, and 60 minutes of storage at room temperature (20–28°C) to assess the effect of delayed examination. The post-analytical stage includes reporting results according to classification guidelines, namely leukocytes: – (0 cells/LPB), + (1–10 cells/LPB), ++ (10–50 cells/LPB), +++ (>50 cells/LPB); erythrocytes: – (<5 cells/LPB), + (6–10 cells/LPB), ++ (11–20 cells/LPB), +++ (>20–30 cells/LPB); and bacteria: – (0/LPB), + (1–10/LPB), ++ (10–50/LPB), +++ (>50/LPB) (Graff, 2011; Washington & Winn, 2006).

2.3 Data Analysis

The data were analyzed using Statistical Product and Service Solutions (SPSS) software version 26.0. Descriptive analysis was performed to present the frequency distribution and central tendency related to respondent characteristics and urine sediment examination results, thereby providing an initial overview of the research data (Subhaktiyasa, 2025). Before conducting inferential analysis, the Kolmogorov-Smirnov normality test was used to ensure that the data distribution met the normality assumption. Data proven to be normally distributed were analyzed using the One-way Analysis of Variance (ANOVA) test to test the significance of differences between groups. Furthermore, the Least Significant Difference (LSD) follow-up test was conducted to identify which groups were significantly different.

2.4 Ethical Considerations

This study was conducted in accordance with strict research ethics principles. Research permission was officially obtained from the hospital where the study was conducted from February to March 2024. Prior to data collection, the researchers clearly explained the objectives, procedures, and benefits of the study to all respondents. Participation was voluntary, and respondents who agreed to participate were asked to sign an informed consent form as proof of their agreement to participate in the study. All respondent data was kept confidential, used solely for academic purposes, and treated in accordance with data protection standards to ensure the security and privacy of research participants.

3. Results and Discussion

3.1 Results

Data were obtained from 30 patients who participated in the study. The data were analyzed to obtain an overview of the characteristics of the respondents and the results of the urine test delay test at 0 minutes, 30 minutes, and 60 minutes. The characteristics of the respondents, including gender and age, were processed using descriptive statistics and are shown in Table 1.

Table 1. Respondent characteristics

Characteristics	Category	Frequency (f)	Percentage (%)
Gender	Female	21	70
	Male	9	30
Age (years)	35 – 40	3	14.9
	41 – 45	6	10
	46 – 50	4	20
	51 – 55	9	13.3
	56 – 60	3	30

Table 1 demonstrates that the majority of respondents were female (70%), with the most extensive age distribution in the 51–55 age group (30%). Meanwhile, the 35–40 and 56–60 age groups had the fewest respondents (10% each). Furthermore, the results regarding the effect of delayed examination on the number of leukocytes, erythrocytes, and bacteria are shown in Table 2.

Table 2. Average results of delayed examination of leukocyte, erythrocyte, and bacterial counts

Examination Time (minutes)	n	Mean		
		Leukosit	Eritrosit	Bakteri
0	30	28.210	28.943	16.507
30	30	26.677	27.680	18.300
60	30	24.493	23.033	19.703

Table 2 indicates a downward trend in the number of leukocytes and erythrocytes as the examination time is delayed. The lowest average was observed at 60 minutes. Meanwhile, the number of bacteria tended to increase after a delay, with the highest value at 60 minutes. Further analysis was performed using the Kolmogorov-Smirnov normality test and the One-way ANOVA test, as shown in Table 3.

Table 3. Tests for differences in leukocyte count show delays in leukocytes, erythrocytes, and bacteria

Examination parameters	n	p-value		
		Leukosit	Eritrosit	Bakteri
0, 30, and 60 minutes	90	0,332	0.189	0.160

The results of the Kolmogorov-Smirnov test showed that the data were normally distributed, as indicated by p-values greater than 0.05. Therefore, the analysis was continued using a parametric test with one-way ANOVA. Table 3 presents the significance values for leukocytes, erythrocytes, and bacteria in urine sediment. The p-values for all three parameters were greater than 0.05, indicating that there were no statistically significant differences across the measurement times.

3.2 Discussion

This study aims to analyze the effect of delaying examination time on the number of leukocytes, erythrocytes, and bacteria in the urine sediment of patients with suspected UTI. The results show that a delay of 30 to 60 minutes does not significantly affect these three parameters. These findings are consistent with the studies by Asriyani (2016) and Aristoteles & Puspitasari (2023), which reported no significant variation in leukocyte counts despite differences in examination times. Utami (2019) and Naid et al. (2014) also found that changes in red blood cell counts due to delayed testing remained within normal limits, thus not significantly affecting clinical interpretation.

Although the results demonstrate relative stability of urine sediment components within the first 60 minutes, the potential for degradation still needs to be considered. Ahmad (2021) emphasizes that swelling and cell lysis can affect leukocyte counts, while Entjang (2003) explains that bacteria can multiply rapidly in favorable environmental conditions, so that an increase in the number of bacteria in delayed urine may occur due to the multiplication process, rather than the actual clinical condition. It highlights the importance of caution in interpreting laboratory results when there is a delay in testing.

These findings support the laboratory policy of continuing to recommend immediate testing after sample collection to minimize the risk of urine component degradation, as recommended by Gandasoebrata (2013) and Wirawan (2010). However, the results also provide room for laboratories with limited resources to delay testing for up to 60 minutes without causing significant differences in leukocyte, erythrocyte, and bacterial results. Medical Laboratory Technologists (MLTs) must ensure that specimen management remains efficient while maintaining the validity of test results. However, this study has several limitations. The relatively small sample size, which was only conducted in one regional hospital laboratory, means that the results may be influenced by local conditions, including sample storage quality and technical variations in testing. In addition, this study did not further explore the effects of delays longer than 60 minutes, so the tolerance limit for longer testing times cannot yet be determined. Therefore, further research is needed to explore the effect of delays exceeding 60 minutes, even up to 2 hours, in accordance with international standards. Follow-up studies could also assess other factors such as urine pH, storage temperature, and technical variations that may potentially affect the results.

4. Conclusion

This study concluded that delaying urine sediment examination for up to 60 minutes in patients suspected of having urinary tract infection (UTI) did not significantly affect the number of leukocytes, erythrocytes, or bacteria. However, there was a general tendency for a decrease in leukocytes and erythrocytes and an increase in the number of bacteria. These findings indicate that urine sediment examination can still be performed within this time frame without significantly reducing the validity of the results. The results of this study emphasize the importance of proper specimen management and immediate examination to maintain diagnostic quality, while providing realistic time tolerance for laboratories with limited resources. This study has limitations, including a relatively small sample size and a single hospital location. Therefore, further research is recommended to involve a larger sample size, expand the study location, and assess the effects of delays exceeding 60 minutes, including other parameters such as ketone and nitrite levels, to strengthen the understanding of urine specimen stability in the context of laboratory diagnostics.

Conflict of Interest

The author declares no conflict of interest.

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