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Research on the Pre-test Time Variable in Peripheral Blood Routine Analysis

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Abstract: *Objective:* To explore the accuracy and stability of the results of peripheral blood routine tests at different time points after anticoagulation and standing, providing a scientific basis for actual clinical work. *Methods:* In this study, 30 patients who visited the hospital in October 2023 were randomly selected and divided into two groups (15 cases in each group). The same collection method was used for routine blood tests. The tests were performed after anticoagulation and standing for 5 minutes, 1 hour, and 5 minutes, 2 hours respectively, and the routine blood test indicators at different time points were compared. *Results:* After comparison, there were no significant differences in the results of routine blood tests at 5 minutes after mixing, anticoagulating, and standing peripheral blood and those at 1 hour and 2 hours ($P > 0.05$). *Conclusion:* The results of peripheral blood after mixing, anticoagulating, and standing for 5 minutes are stable compared with those after standing for 1 hour and 2 hours. In actual work, the pre-test turnaround time can be appropriately extended.

Keywords: Peripheral blood; Routine blood test; Accuracy

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1. Introduction

The routine blood test is an important blood test method. By analyzing the number and proportion of different types of cells in the blood, it can assist in the diagnosis and treatment of diseases. Peripheral blood, as a collection method, is often used for children and patients who are difficult to have venous blood drawn due to its convenience and less pain [1,2].

The results of peripheral blood routine tests are affected by many factors [3]. Immediate testing after sampling may lead to false elevation of white blood cells and false reduction of platelets, and the results can return to normal after 5 minutes of anticoagulation and standing [4]. Therefore, it is crucial to follow the correct operation process to reduce errors. However, in clinical work, unexpected situations such as laboratory equipment failures, insufficient reagents, and excessive specimens may all extend the test turnaround time.

To explore the impact of anticoagulation and standing time after peripheral blood collection on the results of routine blood tests, our hospital randomly selected 30 patients for comparative analysis.

2. Materials and methods

2.1. Specimen source

In this study, 30 patients who underwent health examinations in our hospital in October 2023 were randomly selected. None of them had blood or coagulation disorders, and they all voluntarily signed the "Informed Consent Form." The samples included 15 males and 15 females, aged 6 months to 12 years old. There were no significant differences in age and disease types.

2.2. Instruments and equipment

In this study, a fully automated blood cell analyzer (BC-5390 CRP) was used to detect routine blood test indicators. The instrument had undergone regular maintenance, the quality control substances were qualified, the performance met the standards, and it was operating normally. The reagents used were all matched and within the expiration date, and the anticoagulation tube contained 5% EDTA-K2.

2.3. Detection method

A disposable blood collection tube was used to draw peripheral blood and inject it into an anticoagulation tube. After thorough mixing, the sample was allowed to stand, then tested on the machine, and the results of the routine blood test were recorded.

2.4. Observation indicators

In this study, the results of routine blood tests of two groups of patients were compared. Through statistical analysis, the differences in various blood parameters were evaluated [3,4].

2.5. Statistical methods

The 24-item blood test data of the two groups of patients were organized using Excel, and analyzed using statistical software (SPSS 27.0). Measurement data were expressed as mean ± standard deviation (SD) and the *t*-test was used. A difference with $P < 0.05$ was considered statistically significant, and a difference with $P > 0.05$ was considered not statistically significant.

3. Results

3.1. Comparison of the results of each test index at 5 minutes and 1 hour

There were no significant statistical differences in the 24 routine blood test indicators after collecting peripheral blood and anticoagulating and standing for 5 minutes and 1 hour [5,6]. The statistical results are shown in **Table 1** and **Figure 1** [7,8].

Table 1. Comparison of the results of each test index at 5 minutes and 1 hour (mean ± SD)

Observation index	5 minutes	1 hour	*P*-value
White blood cell count (10^9/L)	9.48 ± 6.66	9.53 ± 6.65	0.983
Red blood cell count (10^{12}/L)	4.86 ± 0.50	4.85 ± 0.51	0.974
Hemoglobin (g/L)	136.53 ± 24.10	137.73 ± 24.16	0.893
Hematocrit (%)	42.07 ± 6.65	41.86 ± 6.78	0.931

Table 1 (Continued)

Observation index	5 minutes	1 hour	*P*-value
Mean corpuscular volume (fL)	86.46 ± 7.53	86.14 ± 7.81	0.910
Mean corpuscular hemoglobin (pg)	28.02 ± 2.84	28.35 ± 2.93	0.759
Mean corpuscular hemoglobin concentration (g/L)	324.07 ± 7.76	328.87 ± 7.42	0.094
Platelet count (10^9/L)	227.33 ± 60.73	228.00 ± 60.16	0.976
Mean platelet volume (fL)	9.03 ± 0.83	9.11 ± 0.81	0.791
Platelet distribution width (fL)	15.91 ± 1.13	15.99 ± 0.35	0.795
Plateletcrit (%)	0.20 ± 0.05	0.21 ± 0.05	0.891
Large platelet ratio (%)	20.93 ± 5.62	21.26 ± 5.71	0.873
Absolute neutrophil count (10^9/L)	5.95 ± 5.89	5.91 ± 5.79	0.983
Neutrophil percentage (%)	56.01 ± 19.73	55.25 ± 19.32	0.916
Absolute lymphocyte count (10^9/L)	2.63 ± 1.60	2.68 ± 1.59	0.933
Lymphocyte percentage (%)	33.39 ± 18.02	33.70 ± 18.08	0.962
Absolute monocyte count (10^9/L)	0.63 ± 0.42	0.68 ± 0.43	0.754
Monocyte percentage (%)	7.59 ± 3.41	8.13 ± 3.42	0.668
Absolute eosinophil count (10^9/L)	0.25 ± 0.27	0.25 ± 0.25	0.955
Eosinophil percentage (%)	2.86 ± 2.84	2.69 ± 2.62	0.869
Absolute basophil count (10^9/L)	0.01 ± 0.01	0.02 ± 0.01	0.334
Basophil percentage (%)	0.16 ± 0.17	0.23 ± 0.15	0.230
Red blood cell distribution width-CV	0.13 ± 0.01	0.13 ± 0.01	1.00
Red blood cell distribution width-SD (fL)	41.99 ± 5.48	41.95 ± 5.57	0.984

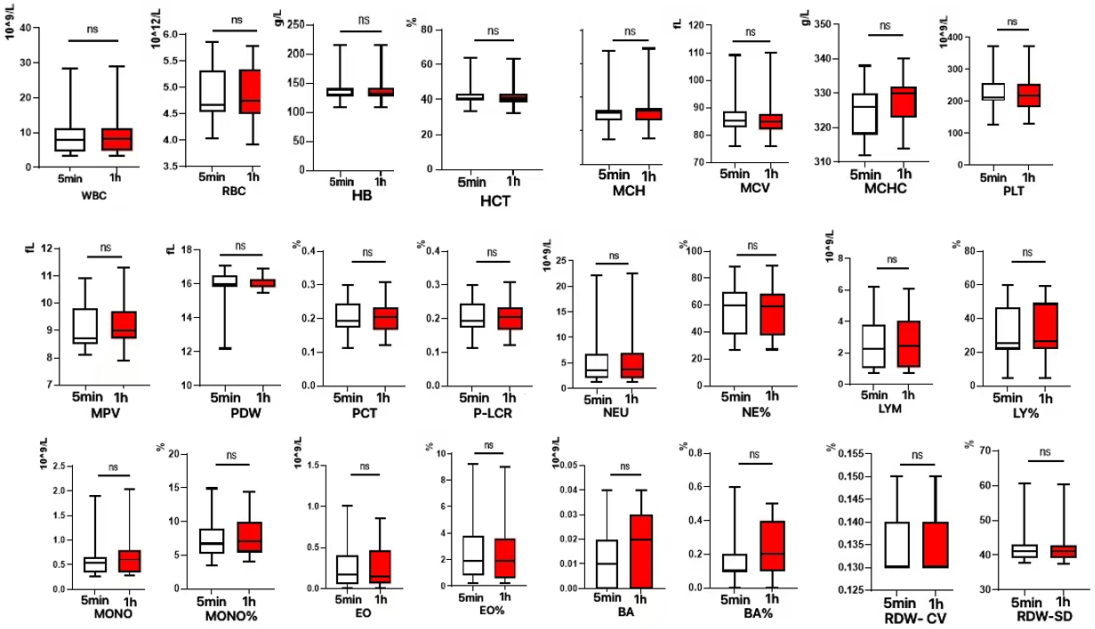

Figure 1. Comparison of the results of each test index after anticoagulation and standing for 5 minutes and 1 hour

3.2. Comparison of the results of each test index at 5 minutes and 2 hours

There were no significant statistical differences in the 24 routine blood test indicators after collecting peripheral blood and anticoagulating and standing for 5 minutes and 2 hours. The statistical results are shown in **Table 2** and **Figure 2**.

Table 2. Comparison of the results of each test index at 5 minutes and 2 hours (mean ± SD)

Observation index	5 minutes	2 hours	*P*-value
White blood cell count (10^9/L)	9.07 ± 5.87	9.01 ± 5.70	0.977
Red blood cell count (10^{12}/L)	4.80 ± 0.66	4.71 ± 0.72	0.729
Hemoglobin (g/L)	127.00 ± 17.93	123.33 ± 16.20	0.561
Hematocrit (%)	38.83 ± 4.33	37.91 ± 3.90	0.549
Mean corpuscular volume (fL)	81.76 ± 10.22	77.52 ± 17.75	0.529
Mean corpuscular hemoglobin (pg)	26.74 ± 3.98	26.53 ± 4.03	0.889
Mean corpuscular hemoglobin concentration (g/L)	326.47 ± 14.40	324.6 ± 14.91	0.730
Platelet count (10^9/L)	239.13 ± 66.35	220.00 ± 71.25	0.453
Mean platelet volume (fL)	9.38 ± 0.72	9.12 ± 0.69	0.30
Platelet distribution width (fL)	15.887 ± 0.29	14.72 ± 2.75	0.125
Plateletcrit (%)	0.22 ± 0.06	0.20 ± 0.06	0.275
Large platelet ratio (%)	23.69 ± 5.50	21.74 ± 5.42	0.337
Absolute neutrophil count (10^9/L)	6.05 ± 4.16	6.02 ± 4.19	0.985
Neutrophil percentage (%)	67.57 ± 10.49	67.34 ± 11.75	0.955
Absolute lymphocyte count (10^9/L)	2.08 ± 1.32	2.07 ± 1.26	0.976
Lymphocyte percentage (%)	22.95 ± 9.43	23.13 ± 9.52	0.959
Absolute monocyte count (10^9/L)	0.77 ± 0.94	0.76 ± 0.82	0.966
Monocyte percentage (%)	7.58 ± 2.64	7.67 ± 3.17	0.936
Absolute eosinophil count (10^9/L)	0.14 ± 0.16	0.15 ± 0.16	0.936
Eosinophil percentage (%)	1.66 ± 1.80	1.73 ± 1.95	0.916
Absolute basophil count (10^9/L)	0.02 ± 0.02	0.01 ± 0.01	0.104
Basophil percentage (%)	0.24 ± 0.20	0.17 ± 0.16	0.270
Red blood cell distribution width-CV	0.15 ± 0.02	0.15 ± 0.02	0.864
Red blood cell distribution width-SD (fL)	42.6 ± 5.09	41.89 ± 4.78	0.695

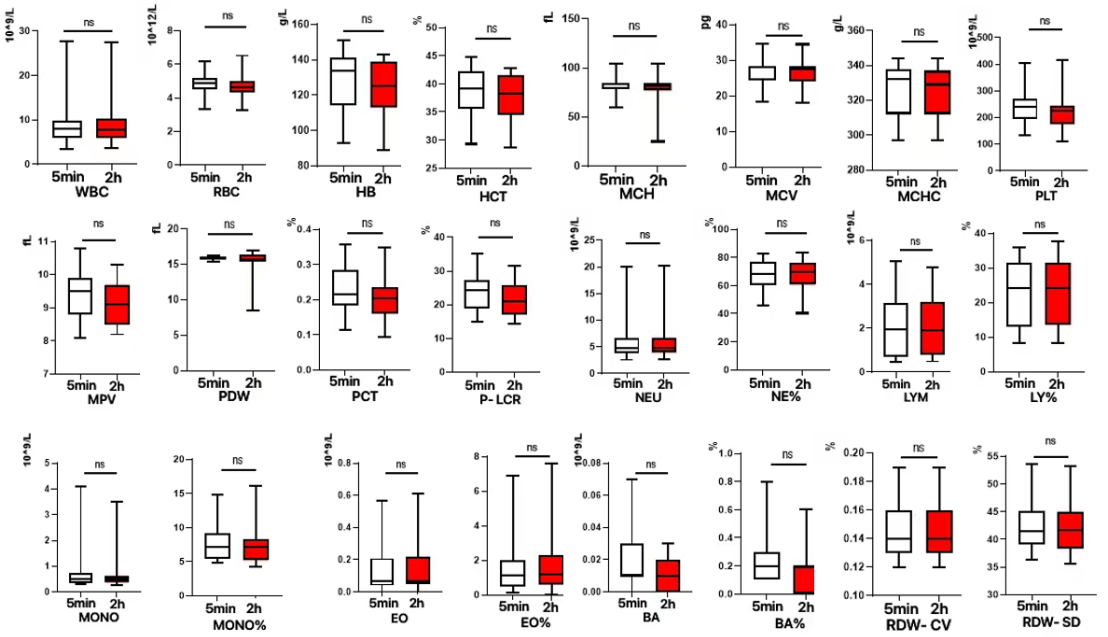

Figure 2. Comparison of the results of each test index after anticoagulation and standing for 5 minutes and 2 hours

4. Discussion

This study investigated the impact of the standing time on the accuracy of routine blood tests. By comparing the test results of blood samples from two groups of patients at different time points, it was found that prolonging the standing time had no significant impact on the results.

Although peripheral blood has the advantages of less blood collection volume, simple operation, and less pain, its stability is insufficient and it is easily affected by many factors [9,10]. Especially when a routine blood test is performed immediately, platelet morphological changes may occur, leading to abnormal white blood cell and platelet counts [11,12]. However, with the action of the anticoagulant EDTA-K2, platelet aggregation is inhibited, the platelet morphology returns to normal, and the count becomes stable.

This study increases the flexibility of clinical use of peripheral blood. Especially in cases of a large number of samples or long transportation times, prolonging the standing time has no negative impact on the test results, ensuring the reliability of diagnosis and treatment. At the same time, it emphasizes the importance of quality control in clinical laboratories. Optimizing the collection and processing processes can improve the reliability of test results [13,14].

Although this study provides important insights, due to the limited sample size and the lack of in-depth investigation of factors such as temperature and transportation, it is recommended that future research expand the sample size and explore these factors to optimize the testing process [15].

This study shows that anticoagulating peripheral blood and allowing it to stand for 5 minutes to 2 hours has no significant impact on routine blood tests. It helps to eliminate false platelet aggregation, does not affect the accuracy of the results and clinical decision-making, provides a practical guide for clinical practice, and improves the testing efficiency.

5. Conclusion

This study indicates that there is no significant difference in the results of complete blood count tests between peripheral blood anticoagulated and left to stand for 5 minutes compared to those left to stand for 1 hour and 2 hours. This suggests that in practical work, the pre-test turnaround time can be appropriately extended without affecting the accuracy of the test results and clinical decision-making.

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Disclosure statement

The authors declare no conflict of interest.

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