Int.j.pathol.2018;16(1):33-36

Viability of Hemoglobin Concentration, Red Blood Cells, White Blood Cells and Platelets Counts in Blood Specimens Stored Overnight at Room Temperature

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Abstract:

Introduction: Delayed analysis in pathology laboratories is a common problem because of large number of samples to be tested every day. But this delay causes sample aging and affects directly diagnostic test results. Complete blood picture is most widely done test in laboratory analysis provides basic information regarding diagnosis as well as monitoring of patient's health. So, accuracy of such diagnostic test is very important to assure correct diagnosis that leads to right therapy.

Objective: The aim of current research work is to evaluate the viability of blood specimen for complete blood count at different time intervals at room temperature.

Patients and Methods: For this purpose, 128 samples were collected during routine laboratory work at the different time of the year. Collected samples were analyzed at the time of collection and after 24 hours. Parameters studied includes hemoglobin concentration, RBC counts, WBC counts and Platelets counts. Results were analyzed by using student T-test.

Results: Parameters Hemoglobin concentration, RBC, and WBC remain stable over 24 hours at room temperature as there was no statistically significant difference between fresh and delayed sample. However, Platelets values differed significantly ($p<0.05$) and indicate that this parameter needs special storage in case of delayed analysis.

Conclusion: Thus, it is concluded that forPlatelet counts sample requires special storage conditions to assure reliable results. While only hemoglobin concentration, RBC and WBC counts can be accurately measured even after 24 hours at room temperature.

Keywords: Blood Complete Picture (CP), Diagnosis, Pathological test, RBCs, Stability, Viability, WBCs, Platelet

Introduction

Diagnostic tests are key factors in the determination of patient's pathological condition. Rationale therapy is directly related with correct diagnosis. So, it is very important to assure the precision of these tests[1]. The first step in diagnostic test is sample collection. Guidelines for handling and storage of collected sample describes accurate methods and precautions. International committee of hematology standardization (ICSH), recommends that the blood count sample for CBC remains viable up to 6 hours at 18-22˚C and 24 hours at 2-6˚C[2]. Stability of collected sample govern the reliability of the results.

In daily routine, there are a large number of samples to be tested in pathology laboratories. Usually, all samples are not tested on the day of collection. But not all parameters under study remains same at the different time. Stability of blood sample is very crucial. Handling and storage of blood specimen govern the reliability of the results of CP. Delayed analysis affects the actual result that directly influence the diagnosis and the therapy[3].

Climate of Pakistan is arid and vary from cold in January to hottest in June. In such climatic situation, maintenance of controlled room temperature i.e. 25˚C is very important. Sample handling and stability in such fluctuation of temperature is crucial. Temperature and humidity also affects the reliability of the results[4]. To assure the effectiveness of particular

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method, pre-analytical preparation plays pivotal role. If sample deteriorate before analysis then test gives false results. Pre-analytical analysis includes sample collection, handling and storage. Majority of error occurs because of improper handling and storage conditions. So, pre-analytical guidelines need to be monitored properly [5]. This research work is designed to assess the effect of delayed analysis of blood specimen. There are few studies conducted to determine the reliability of collected blood samples in Pakistan. This research work provides guideline for preanalytical sample analysis. The study result is useful for peripheral pathology laboratories where maintenance of low temperature in the laboratories and transmission of specimens for different reasons is dependent on numerous variables beyond the control of the laboratory setup.

Patient and Method

In the present study, viability of white blood cells, red blood cells, hemoglobin concentration and platelets were analyzed for 24 hours at controlled room temperature during different time of the year. We analyzed sample at different time period of the year to assess the temperature effect on CP sample at room temperature (25-28˚C). For this purpose, cross-sectional descriptive study was designed. Data was collected prospectively by directly taking sample from available patients at pathology laboratory. Sampling method is convenient and patients were selected randomly. Sample size is based on availability of number of patients at our laboratory.

128 Blood samples were collected during routine work at peripheral pathology laboratory in Attock Rawalpindi, Pakistan. Samples were collected in dipotassium EDTA-anticoagulant containing tubes. Collected sample was tested immediately and results were recorded. Then samples were kept at room temperature for 24 hours and after 24 hours again tested by automated blood cell counter. The difference between fresh and 24 hours delayed sample were compared. Data were analyzed by MS-Excel 2017 and results were statistically evaluated by student T-test.

Result

Our results showed that there is no significant difference between the fresh sample and 24hours stored sample of hemoglobin at room temperature as depicted in figure 1 ($p>0.05$). Red blood cells and white blood cells remain stable over 24hours at room temperature as shown in Table-1 ($p>0.05$).

Table 1: Results of stability of blood sample

Blood specimen: Fresh and after 24 hours sample analysis report												
	Hemoglobin			RBCs			WBCs			PLTs		
	fresh	after 24 hrs	diff	fresh	after 24 hrs	diff	fresh	after 24 hrs	diff	fresh	after 24hrs	diff
Average of 128 samples	13.02	12.14	1.19	7.25	7.20	0.35	7.67	7.65	0.23	321.57	289.40	66.71

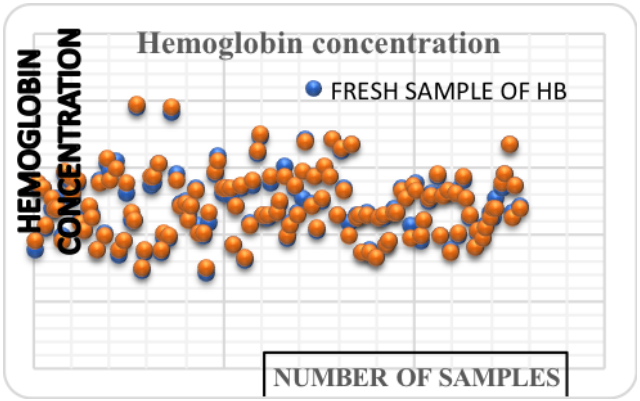

Figure 1: Result of hemoglobin concentration of the fresh and delayed analysis

Platelets did not remain constant as result of fresh and 24 hours stored sample vary significantly (figure 2).

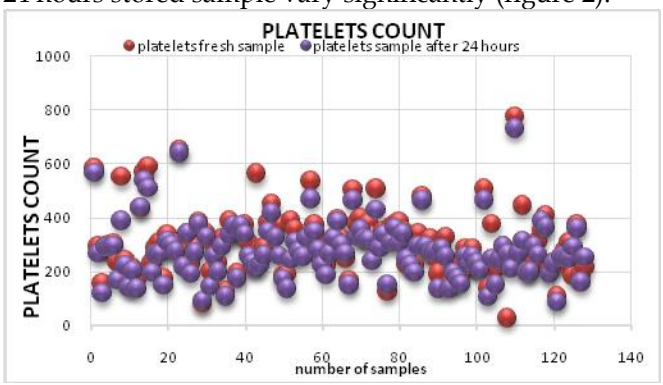

Figure 2: Platelet Count for fresh and delayed sample

Colour page

This indicated blood sample for cellular count can be performed after 24 hours but complete blood count involving platelets count need special storage condition if the sample cannot be tested immediately. Sample aging greatly affects platelets among CP parameters tested in this study.

Discussion

Pathological tests are the basic requirement to ensure rationale for therapy. Right diagnosis is the preliminary step towards the selection of right therapy. If this preliminary step is neglected then all the steps in deciding therapeutic regimen affect directly. So, to assure rational therapy rigorous control of diagnostic test is mandatory. Standardization of laboratory parameters is a key requirement to minimize error in the diagnostic test. This includes calibrated equipment's, validated methods for analysis control of storage conditions among which temperature is crucial[5].

Handling of blood specimen in routine laboratory work is not rare. Blood samples require more careful handling to remain viable. Blood Complete Picture (CP) involves exact counting of red blood cells, white blood cells, Platelets and hemoglobin concentration. These parameters are altered by temperature duration and storage. Particularly platelets result was greatly influenced by time of analysis after collection of the sample. In another study, CP parameters were studied at the different time and results revealed that sample remains stable over 6 hours after collection of the specimen at room temperature while 48hours.[6]CP parameters greatly affected by the aging of the sample at room temperature after 24 hours to 48 hours [7].

In Pakistan, there is need of such research projects to assure the quality of laboratory practices. Data of this study provides a baseline for the pathological laboratories to maintain storage condition for delayed analysis. Meanwhile to assure the reliability of diagnostic test standard guidelines must be monitored. Such research work promotes the implementation of standard operating procedures and guidelines,particularly for peripheral pathology laboratories. Thus, for the precise and accurate results, all pathological laboratories need to minimize pre-analytical errors by strictly employing good laboratory practices.

Conclusion

It is concluded that Platelet count in blood specimen does not remain stable at room temperature over 24 hours. However, hemoglobin concentration, RBCs and WBCs count can be tested accurately after 24 hours as these parameters remain stable at room temperature.

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Date Received:	17-05-2018
Date Sent for Reviewer:	04-06-2018
Date Received Reviewers' Comments:	06-06-2018
Date Received Revised Manuscript:	28-07-2018

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