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To Evaluate the Effect of Aging on Complete Blood Count Parameters Done by Automated CBC Analyzer

DR YOGENDRA MADAN — TUTOR, M. D. PATHOLOGY, M. P. SHAH MEDICAL COLLEGE, JAMNAGAR

Dr R Varadharaja Perumal — 3RD YEAR RESIDENT, PATHOLOGY DEPARTMENT, M. P. SHAH MEDICAL COLLEGE, JAMNAGAR

DR VANI SANTOSH JOSHI — 3RD YEAR RESIDENT, PATHOLOGY DEPARTMENT, M. P. SHAH MEDICAL COLLEGE, JAMNAGAR

ABSTRACT

Introduction: Complete blood count (CBC) is one of the most common and conventional blood test done as daily routine. However the results of this test are affected by different factors such as, the duration of incubation,

Aim: This survey was to evaluate the effect of time of incubation on CBC.

Method: In a cross-sectional study of 400 randomly selected adequate blood samples collected in k2EDTA vacutainer were analyzed by fully automated three part hematology analyzer at time interval of 20 min, then after 2, 8, 24, 72 hours at room temperature.

Result: MCV, MPV, Hct and RDW increases significantly with passage of time while MCHC decreases. WBC and platelet count were reliable upto 24 hour at room temperature. MCH, RBC and hemoglobin values were stable parameter for more than 72 hours.

Conclusion: It is better to do the CBC test after blood taking as soon as possible. Various parameter change significantly with passage of time. RBC and hemoglobin values were stable if test is carried out following a delay.

KEYWORDS : COMPLETE BLOOD COUNT, AUTOMATED HEMATOLOGY ANALYZER, DURATION OF INCUBATION.

Introduction

Transportation of collected blood to centralized laboratories can lead to delay of several hours. Some time a repeat test is ordered by clinician after few hour of collection. According to recommendations of international committee of hematology standardization maximum storage interval for CBC and differential count is 6 hour at room temperature [3]. For centralized laboratories it is critical to know storage conditions well and expected changes in different parameter if test is carried out following a delay. Limited number of studies has been conducted with all the currently used hematology analyzer to study the effect of storage.

Material and method

Present study is carried out on 400 randomly selected blood samples. Each sample was drawn into 4 ml capacity K_2EDTA BD vacutainer tubes. After adequate mixing samples were analyzed by sysmex KX-21(impedance method) three part hematology analyzer at 20 minutes of venipuncture (baseline measurement). Repeat values were taken at 2, 8, 24 and 72 hours and obtained Data were statistically analyzed. During the study period room temperature is measured by standard thermometer as a part of quality control. Range of room temperature was 25 to 30 degree celsius.

Calibration and quality control of analyzer were done as per NABL guidelines. Two level quality control samples were run twice daily by using Bio-Red laboratories samples and L-J chart was plotted. External quality assurances services (EQAS) was carried out with hematology department, AIIMS, New Delhi. Quality control reports are among the goals of performance.

RESULTS

The finding of this study showed that in different times a number of RBC indices changed significantly. The changes in MCH, RBC and hemoglobin were not significant even after 72 hours, with increasing the time MCV, MPV, Hct and RDW increases significantly. MCHC decreased after 8 hours. WBC and platelet count were reliable upto 24 hour at room temperature.

Table 1: Mean percent changes induced by storage of normal specimens at room temperature

Normal (n=400)	Fresh (within 2 hours)	8 hours	24 hours	72 hours
WBC (x 109/L)	7.7	7.7	7.6	7.2
RBC (1012/L)	4.73	4.70	4.68	4.71
HGB (g/dL)	13.6	13.5	13.5	13.6
HCT (%)	40.6	40.6	41.1	42.3
MCV (fL)	85.9	86.3	87.8	89.8
MCH (pg)	28.9	28.7	29	28.9
MCHC (g/dL)	33.3	33.0	32.9	32.1
RDW (%)	13.8	14.2	14.8	15.5
PLT (x 109/L)	250	251	250	248
MPV (fL)	8.7	9.0	9.3	10

DISCUSSION

The study of Hogman and Knutson in 1999 showed that the level of 2, 3- bisphosphoglycerate (2, 3-BPG) could be changed by incubation the blood sample [1, 2]. According to recommendations of international committee of hematology standardization maximum storage interval for CBC and differential count is 6 hour at room temperature. Hematology analyzer manufacturers often quote that blood specimens kept at either at room temperature or at +4ºC up to 24 hours generally reveal reliable results for complete blood count and automated differential count. The recent trend towards large centralized laboratories has brought some obligations about the transfer and storage times of the blood specimens properly. Laboratories now test specimens that have been dispatched over a long distance and the testing is often delayed by several hours or in some cases for days.

In this study the effects of incubation time on blood indices in CBC test WBC count was evaluated. The parameters measured directly like WBC, RBC, hemoglobin and platelet remained stable for 2 days at room temperature as stated earlier in the study by Gulati et al [4]. In WBC counts we found that after 2 and 8 hours of incubation there was an decrease in the numbers of WBC but was not significant. Vogelaar et al [5] that evaluated 304 blood samples of 17-70 years old individuals have reported that incubation blood samples in room temperature for 48 hours did not change the number of RBC, WBC and platelets. According to the study of Hirase et al [6], the blood cells were stable after one week of incubation, but in Wood's survey [7] the incubation of samples for 24 hours resulted in the increase of WBC counts. The WBC counts in our survey was similar to the research of Gulati et al who has reported that WBC counts would not change in first 3 days of incubation [4]. The number of RBC in our study was similar like Gulati et al [4] who has reported that the RBC counts was constant up to 7 days in room temperature. The change in hemoglobin concentration in this experiment was in consistent with Gulati et al [4] study that found that Hb concentration was constant up to 7 days at room temperature. The decrease in MCHC is caused by hematocrit increase when the hemoglobin level is still stable. As it is commonly known, MCHC is a parameter calculated by the ratio of hemoglobin to hematocrit multiplied by 100. Changes in the components of this equation will also lead to a change in MCHC value. Our results in MCV and MCH were similar to the results of Gulati et al[4]. Our findings showed that platelet counts was almost constant after 72 hours, like Gulati et al [4] which reported that platelets counts did not change up to 4 days incubation at room temperature. In Zhang study [8] the cause of platelets increasing explained as increase in whole blood viscosity. Uchida [10] in 2000, Shortland in 1997 and Qi [9] in 2001 have reported that raising the temperature leads to changes in platelets' morphology and movement. It has also been reported in a comprehensive study by Ho et al [11] that different temperature and time of incubation can affect in platelets counts and hemoglobin concentrations.

CONCLUSION

Overall the results of this study showed that delay in doing the CBC test can leads to changes in some parameters, therefore the blood samples should not be leaved in the laboratory and the test should be done on blood samples as soon as possible.

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