

Reliability of investigations in patients with black discoloration of serum

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Abstract

Discolored serum poses a problem in performing laboratory tests. While impact of hemolytic blood sample imparting reddish appearance, lipemic sample imparting milky, and icteric sample imparting yellow green color to the serum is known on the laboratory tests, we present a rare case of black serum and its effect on hematology, biochemistry, and serological tests. We concluded that it is safe and permissible to run samples with black serum on hematology and biochemistry fully automated auto-analyzers. The hematology and serological tests remained unaffected; however, we suggest that a comment of black discoloration of serum, which may affect the quality of results, should be made for biochemistry analytes.

KEY WORDS: Discoloration, black, serum

Introduction

Diagnosis based on laboratory tests is increasingly gaining importance. Also, daily reports of admitted patients are a common feature to monitor the progress of treatment. Correlation of laboratory findings with clinical features on the first time of reporting followed by correlation with treatment and transfusions in subsequent reporting is a constant binding on laboratory staff. In our experience, a clinician's dependence on laboratory overweighs the clinical assessment for final diagnosis. This lays tremendous responsibility on the laboratory, and all factors that can modify results have to be dealt with great caution. While the analyses are technically becoming ever more perfect, it seems to also be ever more important to pay due consideration to different pre-analytical

factors that can influence the laboratory end result.^[1] Several of these pre-analytical factors that modify results are known causes of rejection of blood samples; however, newer factors are being identified and their presence is treated with suspicion and worry in the laboratory. Green serum was reported as a cause of worry in the laboratory by Randell.^[2] We present one such case in which we obtained black serum for hematology, biochemistry, and serology tests. We also received black urine from the patient.

Case Report

A 64-year-old male, a known case of diabetes for 10 years and hypertension for 5 years and on anti-tubercular treatment for 1 month, presented with fever for 1 month and cough for 15 days. A routine hemogram with malaria parasite was advised on admission, which was normal apart from neutrophilia (absolute neutrophil count 7644/mm³) and no parasites were seen on peripheral smear. Two days later, his condition worsened and he started talking irrelevant and became disoriented. Thereafter, blood and urine tests were advised, and after centrifugation, we were surprised and worried to have obtained black serum [Figures 1 and 2]. The cause of concern was whether it was permissible and safe to perform tests with black serum samples on our fully automated equipment: AU-480 (a fully automated Beckman Coulter biochemistry analyzer)

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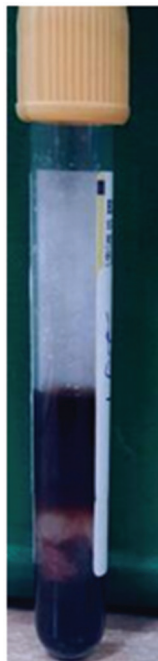


Figure 1: Black discoloration of serum.



Figure 2: Black discoloration of urine.

and AcT 5 Diff Beckman Coulter (a fully automated hematology analyzer) because blockage of probes could damage them. Also whether the results would be reliable or not. We decided to proceed with the tests. Liver function tests were totally deranged with total bilirubin level being 9.6 mg% (direct

bilirubin was 7.70 mg% and indirect bilirubin was 1.9 mg%), alanine amino transferase being 52 IU/L, aspartate amino transferase being 1045 IU/L, and alkaline phosphatase being 203 IU/L. The total proteins albumin and globulin levels were normal; blood urea level was 120 mg%, creatinine level was 9.1 mg/dl; and levels of electrolytes (sodium, potassium, and chlorides) were within normal limits. Serological tests were conducted by rapid kit methods. HIV-1 and 2 and hepatitis C virus were nonreactive and HbsAg was negative. Urine showed albumin and blood; however, no free hemoglobin was detected. A diagnosis of drug-induced hepatorenal failure was made and anti-tubercular medicines were withdrawn. The patient was immediately advised hemodialysis. Post dialysis, we again received his blood for investigations and this time we separated a clear serum. The liver function tests showed a decrease in total bilirubin to 0.89 mg% (direct bilirubin being 0.32 mg% and indirect bilirubin being 0.57 mg%), alanine amino transferase being 10 IU/L, aspartate amino transferase being 18 IU/L, and alkaline phosphatase being 93IU/L. Serum electrolytes, total proteins, albumin, and globulin levels remained the same and blood urea value was 148 mg%. Serum creatinine levels decreased to 7.3 mg/dl. Urine sample was normal while hemogram and serological tests remained unaltered.

Discussion

The physician need not be familiar with technical details of laboratory analysis, although it is favorable to know their analytical precision, reproducibility, and range of physiologic variations. Furthermore, the results are impacted by an array of pre-analytical variables.^[1] Biochemistry analyses are greatly influenced by diet and drugs. Plasma and serum discoloration that we commonly experience are pink or red tinge, orange or green, and yellow or brown tinge. Hemolysis causes pink or red tinge; lipemia imparts milky white color; icteric samples are yellowish brown; certain drugs containing carotenoid derivatives discolor serum orange; and green discoloration is seen due to copper abnormalities (high bilirubin) or an imaging dye^[2,3]. Lipemic samples cause inhomogeneity and therefore hemolysis causes constituents of blood cells to be released in serum. Erroneous biochemistry results can cause direct optical interference because of its intensive color but it also has indirect effects.^[1] Dye discoloration has been reported to make the use of pulse oximetry useless by mimicking true intraoperative hypoxia; however, no reports were found to indicate whether or not this discoloration interferes with pathology tests.^[2] Literature search could not contribute toward whether black serum interferes with any testing or cause problems with analyzers. We carefully performed the tests on this black serum sample and correlated it with tests conducted after plasma clears post dialysis keeping in view the changes expected because of dialysis. The pre-dialysis sample of black serum showed high levels of bilirubin (total, direct, and indirect), alanine amino transferase, alkaline phosphatase, and creatinine, which lowered post dialysis.

This was expected and also reported by Duraimuthamani and Gayathri.^[4] This also explained the improvement in the clinical assessment of the patient as from disoriented state, he became alert and active. The most significant fall in blood levels was observed with alanine amino transferase. However, Duraimuthamani and Gayathri have reported no change in its level post dialysis. According to our studies, electrolyte levels remained unchanged and levels of blood urea became higher.^[4] Sankalia and Tanna^[5] reported that serum sodium does not have significant post-dialysis changes but serum potassium, serum chlorides, and serum urea levels changed significantly post dialysis. We attribute higher levels of blood urea after dialysis to probably dietary factors. Also, according to our observation, the total serum proteins, albumin, and globulin levels remained comparable post dialysis because they were normal even in the pre-dialysis state. The alteration of color was unremarkable as far as hemogram, serological tests, and urine reporting were concerned.

Conclusion

To conclude, we found that black serum was safe to run on advanced fully automated biochemistry and hematology analyzers. The hematology parameters and serology were correctly observed. Biochemistry parameters should also be

analyzed as they form a template to monitor the condition of the patient; however, a comment stating black discoloration of the serum and plasma that may affect the quality of results should be made.

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