

CASE REPORT

Inappropriate Positioning of Separator Gel in Blood Collection Tube: A Case Report

Wan Norlina Wan Azman^{1,2}, Noorazliyana Shafii^{1,2}, Siong Hu Wong³, Aniza Mohd Jelani^{1,2}

¹ Department of Chemical Pathology, School of Medical Sciences, Health Campus Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

² Hospital Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia

³ Hospital Sibul, 96000 Sibul, Sarawak, Malaysia

ABSTRACT

Blood collection tubes containing separator gel are widely used in many clinical laboratories because of easy to use, convenience and several other advantages. However, they are not void of limitation. We describe an unusual case with a floating separator gel in the primary blood collection tube. The blood sample was collected into a BD Vacutainer SST II Advance tube, from a 51 years old man admitted for community acquired pneumonia and had history of hyperproteinaemia. Inappropriate positioning of the separator gel was observed after centrifugation, whereby the separator gel floated above the serum. Detection of abnormal separator gel floatation pattern in this patient's sample before analysis had prevented potential technical problem and production of erroneous result caused by aspiration of separator gel. The limitation of blood collection tube with separator gel especially in patients with hyperproteinaemia should be made aware among laboratory personnel and physicians.

Keywords: Blood collection tube, Separator gel, Hyperproteinaemia

Corresponding Author:

Noorazliyana Shafii, MD

Email: noorazliyana@usm.my

Tel: +6097676474

INTRODUCTION

Blood collection tubes with inert, thixotropic separator gel are commonly used by clinical laboratories because of the advantage of the barrier gel that facilitates rapid separation of blood cells from the serum. The principle of barrier formation is the difference in specific gravity of the three components, whereby the intermediate specific gravity of the separator gel (1.040 to 1.050 g/cm³) physically separates the serum (specific gravity 1.026 to 1.031 g/cm³) from the blood cells (specific gravity 1.092 to 1.095 g/cm³) after centrifugation. This barrier formation reduces haemolysis, improves serum analytes stability, enables direct use of primary tube on analyser, and thus, reduces sample manipulation and allows the use of single label (1). Other advantages include increase in serum yield, reduced aerosolisation of hazardous substances, and ease of storage and transport. However, abnormal and incomplete separation can occur.

CASE REPORT

We report an unusual case of floating separator gel in a primary blood collection tube. The blood sample was from a 51 years old man admitted for community

acquired pneumonia. It was collected into a BD Vacutainer SST II Advance tube (Becton, Dickinson and Company, Franklin Lakes, NJ, USA) which contained serum separator gel. The blood sample arrived at the laboratory without undue delay and was promptly centrifuged at room temperature at 4,000 revolutions per minute (RPM) for 4 minutes. After centrifugation, it was found that the separator gel formed the topmost layer, while the serum remained in the middle and the clot at the bottom (Figure 1). Repeat centrifugation was carried out with the same speed and duration. However, the separator gel floatation pattern remained the same suggesting that the serum's specific gravity could be higher than the separator gel.

Attempt to aspirate the serum below the separator gel was unsuccessful as the gel occluded the pipette tip. After checking the laboratory information system (LIS), we discovered that a month ago, the patient's blood result showed hyperproteinaemia with total protein of 129 g/L (reference interval 64-83 g/L). After communicating with the physician in charge, suggestion was given to collect a second sample in a plain tube without the separator gel. The second sample was then analysed and showed hyperproteinaemia with total protein of 147 g/L and reversed albumin/globulin ratio of 0.2 (normal ratio 0.8-2.0). Another significant finding was hyponatraemia of 125 mmol/L (reference interval 135-145 mmol/L), most likely a pseudohyponatraemia in the context of hyperproteinaemia. Patient was subsequently

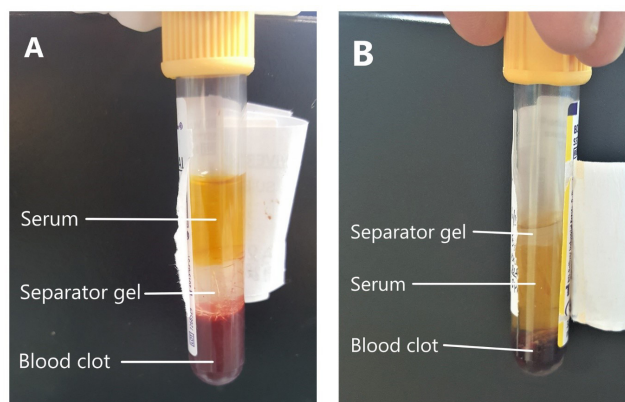


Figure 1: (A) Normal blood sample with serum forming the topmost layer and being separated from the clot at the bottom by the separator gel. (B) Patient's sample with inappropriate positioning of the separator gel forming the topmost layer, followed by the serum in the middle and the clot at the bottom.

diagnosed to have multiple myeloma with serum protein electrophoresis and serum immunofixation electrophoresis showing IgG lambda paraproteinaemia of 98 g/L.

DISCUSSION

Many clinical laboratories prefer to employ blood collection tubes with separator gel due to its convenience and advantages. However, inappropriate positioning of separator gel following centrifugation can occur due to collection tube factors (e.g. specific gravity, density and viscosity of the gel, yield stress and tube material), laboratory factors (e.g. speed of centrifugation, temperature, conditions of storage and acceleration/ deceleration) as well as patient factors (e.g. high serum protein, low haematocrit, use of anticoagulation therapy and iodinated contrast media) (2, 3). In this case, the cause of floating separator gel was hyperproteinaemia, which resulted in the patient's serum specific gravity being higher than the specific gravity of the separator gel (4). This case is similar to that reported by Gerin et al. 2014 in which the same floatation pattern was noted in a patient admitted with pneumonia and later diagnosed with multiple myeloma. Similar findings were also reported in two patients with elevated plasma viscosity and increased total protein in the presence of a monoclonal protein (2). Similar with our case, repeated sample using non-separator-based tube was also revealed hyperproteinaemia.

Hyperproteinaemia in this patient also caused pseudohyponatraemia. The method used for measuring serum electrolytes in our lab is an indirect ion-selective electrode. High protein level increases the nonaqueous or solid phase of the serum and thus causing dilutional effect to serum sodium when using indirect ion-selective electrodes (5).

Core laboratories of high-volume hospital commonly use an automated system for preanalytical and analytical phase, whereby primary collection tubes are processed and analysed after automated centrifugation without direct visual inspection by laboratory personnel. Therefore, the presence of abnormal gel separation may not be identified before analysis, which may cause a potential technical problem or produce erroneous result. Aspiration of gel by laboratory analyser may occlude sample probe, thus compromises correct functioning of analyser, increases turn-around time and burdens the cost of analyses (3). Moreover, aspiration of gel together with sample serum may lead to erroneous result. Fortunately, abnormal separator gel floatation pattern in this patient's blood sample was detected visually before analysis.

Although uncommon, it is important for laboratory personnel to be aware of this limitation of blood collection tube with separator gel. When inappropriate gel separation occurs, obtaining relevant information about patient from LIS and communication with physician aid in troubleshooting, save time and cost of analysis, thus improve in patient's care. As in this case, the history of hyperproteinaemia was obtained from LIS, thus enable us to advice physician to use plain tube without separator gel.

CONCLUSION

There should be awareness among laboratory personnel and physician on the limitation of blood collection tube with separator gel, particularly in patients with hyperproteinaemia. Direct visual inspection of sample following centrifugation is highly recommended to identify inappropriate separation, which can prevent potential technical problem and production of erroneous result caused by aspiration of separator gel.

ACKNOWLEDGEMENT

We would like to thank Hospital USM for the facilities.

REFERENCES

1. Bowen RA, Hortin GL, Csako G, Otacez OH, Remaley AT. Impact of blood collection devices on clinical chemistry assays. *Clinical Biochem.* 2010;43(1-2):4-25.
2. van den Ouweland JM, Church S. High total protein impairs appropriate gel barrier formation in BD Vacutainer blood collection tubes. *Clin Chem.* 2007;53(2):364-5.
3. Haklar G, Sirikci O, Baykan O, Ramazan DC, Gerin F. Abnormal gel flotation in a patient with apperant pneumonia diagnosis: a case report. *Biochemia Medica:* 2014;24(1):180-2.
4. Fat6s M, Franquelo P, Franquelo R. Anomalous

flotation of separator gel: density or viscosity? Clin Chem. 2008;54(4):771-2.

5. Fortgens P, Pillay TS. Pseudohyponatremia

revisited: a modern-day pitfall. Arch Pathol Lab Med. 2011;135(4):516-9.