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Serum Separation Problem on Gel Tubes: Is It a Problem or a Clue of Some Clinical Conditions?

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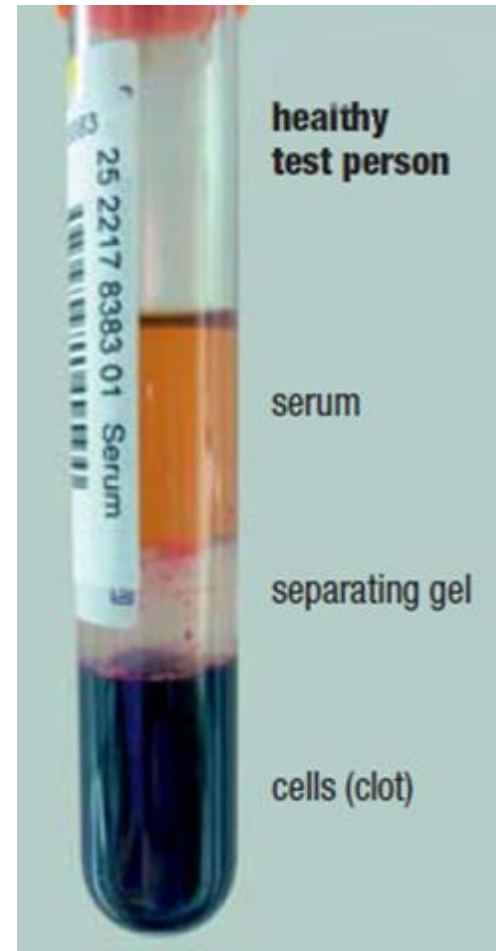
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Introduction

- Serum separator tubes which contain separator gels are widely used by many laboratories to obtain serum for laboratory tests.

Introduction

- After centrifugation, the inert acrylic gel at the bottom of the tube normally occupies the middle position between the cells (clot) and the serum (**Figure 1**).



Introduction

- The gel, because of its intermediate density (**1.04 g/cm³**), physically separates the liquid component of the blood from the cells (densities of **1.03** and **1.09 g/cm³** respectively).

Introduction

- The gel forms a physical barrier between the liquid phase and the cells, preventing contamination of the serum with cellular components.
- However, recent cases have been reported in which some anomalies in the formation of this separating barrier can occur.

Introduction

- Here, we report a case with serum separation problem in a patient hospitalized for recurrent epistaxis and regulation of hypertension.

Material and Methods

- The patient was 85 years old female followed in internal medicine department.
- Her known diseases were diabetes, hypertension, asthma and Alzheimer disease.
- The blood sample was collected into a **BD Vacutainer SST II Advance (Becton Dickinson, NJ, USA)** which contains serum separator gel.

Material and Methods

- Sample was centrifuged at room temperature at 1500 x g for 10 minutes.
- After centrifugation, pipetting error alerts were triggered and we observed that the gel did not constitute a separating barrier and the serum did not occur **(Figure 2)**.

Material and Methods

- This atypical separation pattern suggested that the density of the serum could be higher than the gel layer.
- We evaluated that the underlying causes of this condition could be multiple myeloma, any radio-contrast dye usage or dialysis catheters.

Material and Methods

- But she has neither radio contrast usage nor anticoagulant medication, nor any catheters.
- We consulted the patient's doctor that multiple myeloma may be the underlying diagnosis of the patient.

Material and Methods

- A second sample was collected into **BD Vacutainer CAT (Clot Activator Tube, gel-free)** and the serum did not occur, also **(Figure 2)**.
- A subsequent blood sample was collected into **BD Vacutainer Barricor LH Plasma tube (Figure 3)** which has a mechanical separator and after centrifugation biochemical analyses were performed with plasma **(Figure 4)**.

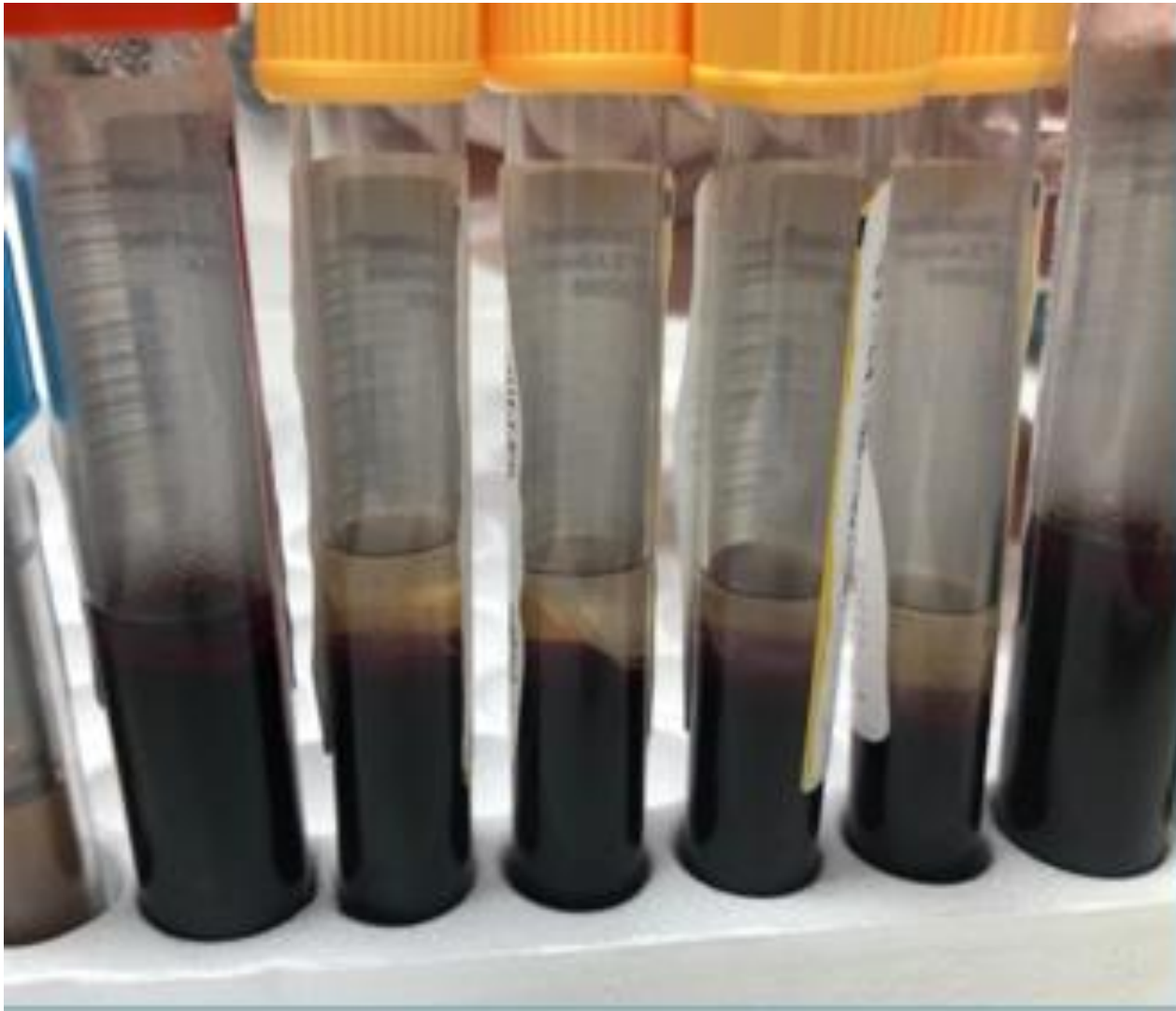


Figure 2. Improper serum separation in clot activator tube and serum separator gel tube.

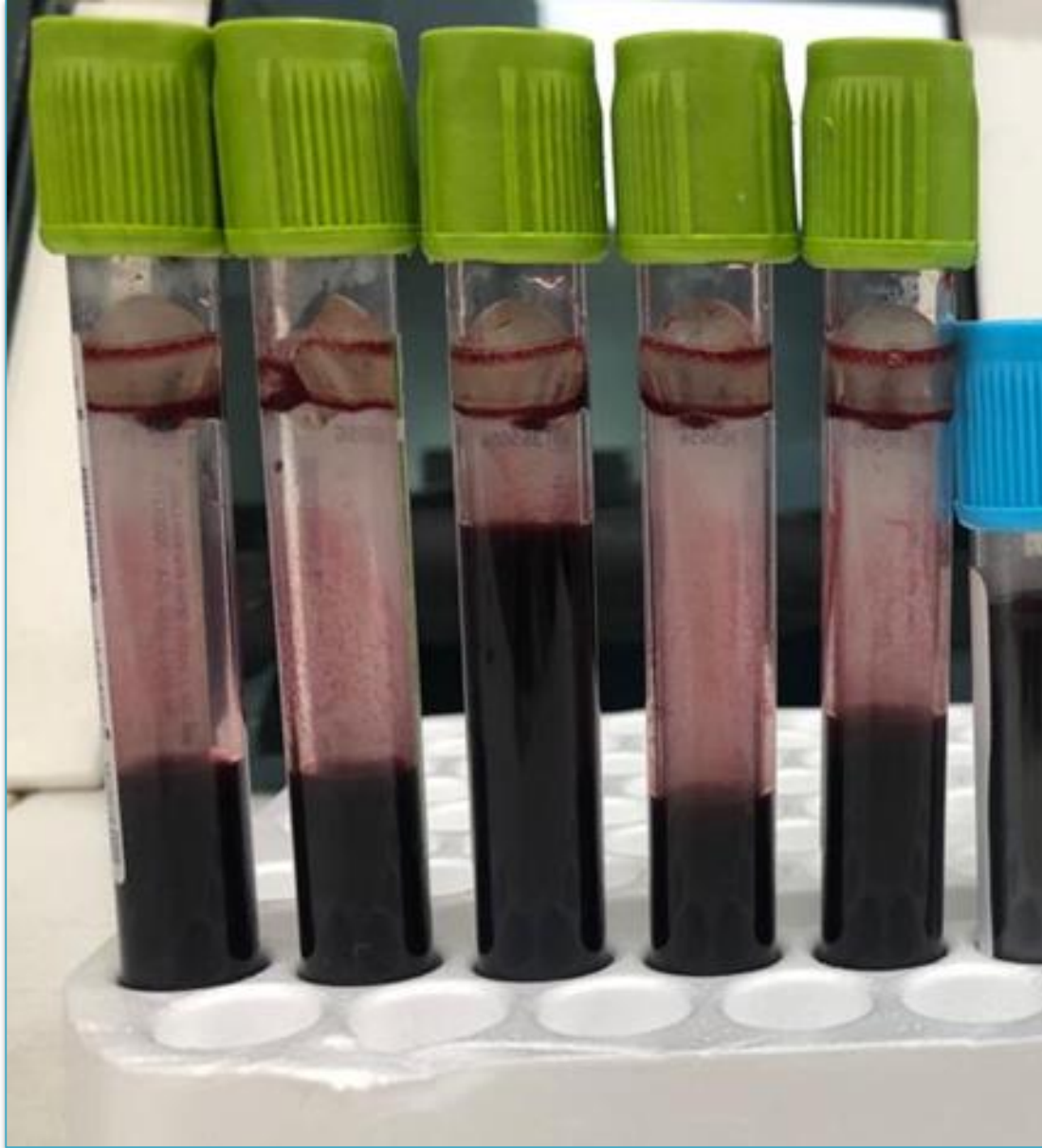


Figure 3.BD Vacutainer Barricor LH Plasma tubes before centrifugation

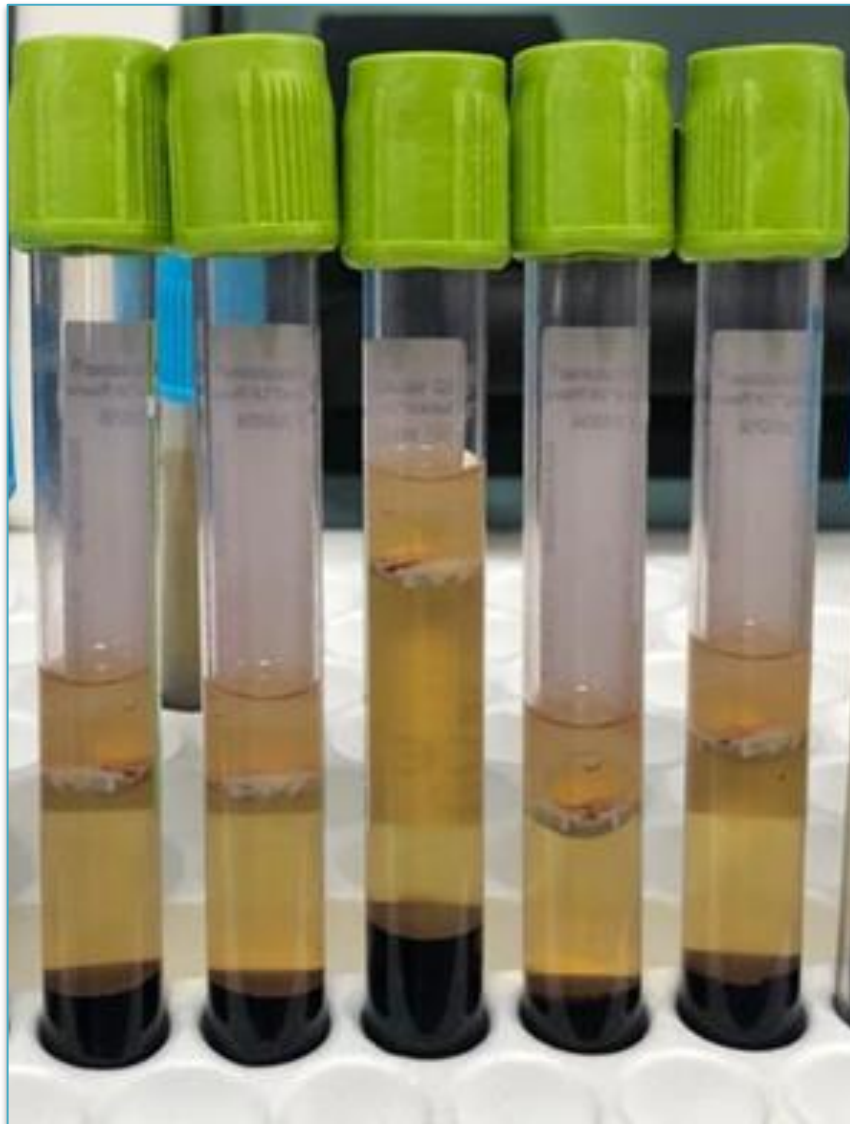


Figure 4. BD Vacutainer Barricor LH Plasma tubes after centrifugation

Results

	Patient's Result	Reference Range
Ig G	111 g/L	7.51-15.6 g/L
Total Protein	120.32 g/L	66-83 g/L

- With our consultation, a bone marrow examination was performed and the patient was diagnosed with Multiple Myeloma.

Conclusions

- Separator gels markedly improve serum and plasma analyte stability, removing the need for aliquoting serum, and facilitating storage and transport.

Conclusions

- *Factors affecting the gel position*

1. Manufacturer - dependent variables (specific gravity, yield stress, viscosity, density, and tube material)
2. Laboratory conditions (centrifugation speed, temperature, acceleration and deceleration conditions, and storage conditions)
3. Patient factors (heparin therapy, low hematocrit, elevated plasma protein, specific gravity)

Conclusions

- Rarely, hyperproteinemia or high concentrations of radio-contrast dye cause high specimen specific gravities and the serum or plasma may not float above the gel.
- In these particular cases, subsequent blood drawings should be collected in non-separator-based blood collection tubes and laboratory tests should not be performed, even if the serum is extracted from beneath the gel barrier.

Conclusions

- In this case improper serum separation was an important step on the way to diagnosis and it made us think that this should be interpreted as a clue for diagnosis rather than a problem.
- To sum up, our results confirm that laboratories and tube manufacturers should be aware of the limitation of the separator gel tubes in patients who have high plasma density because of the presence of high total protein concentrations.



Thank you for your patience.