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Leaking erythrocytes in laboratory medicine

IMAGES IN MEDICINE

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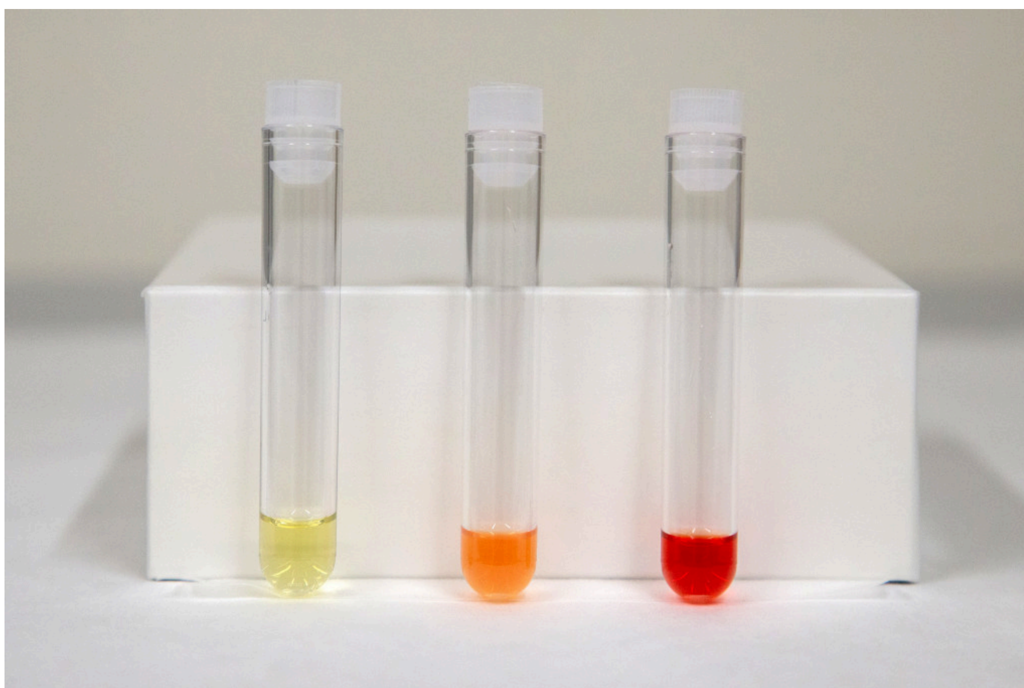

To the left a normal semi-transparent serum sample with a slight yellow tint is shown, whilst the samples in the centre and to the right display moderate and high degrees of haemolysis, respectively – i.e. the presence of free haemoglobin in the sample.

Haemolysis is caused by the destruction of erythrocytes which in turn causes haemoglobin to leak into the plasma / serum. Haemolysis may be classified according to whether the erythrocyte destruction happened within or outside of the body, termed *in vivo* or *in vitro* haemolysis. *In vivo* haemolysis is caused by a range of congenital or acquired aetiologies, conferring haemolytic anaemia in severe cases. As the erythrocytes are somewhat fragile, they are particularly prone to being ruptured during phlebotomy or during the transportation of the sample. *In vitro* haemolysis should therefore be considered an artefact of *in vitro* origin, and is the main cause of haemolysed samples handled by clinical laboratories (1, 2). Common causes are the use of thin sampling cannulas and large sample collection tubes, sampling through peripheral intravenous catheters, underfilled collection tubes, or in association with prolonged tourniquet placement. Additional causes are samples handled with excessive vigour during transportation, mixing or centrifugation (1, 2).

Haemolysis causes a distinct red discolouration of the serum which can interfere with the quantitative measurements of many routinely used assays. Therefore, clinical laboratories need to screen for haemolysis in order to avoid reporting potentially spurious measurements. The degree of haemolysis is evaluated by the laboratory by internally established protocols, and in cases with an increased risk of unreliable results the laboratory should report this to the clinician and recommend a new sample to be taken. An additional issue caused by *in vitro* haemolysis is the leakage of the erythrocytes' intracellular constituents, some of which are of a significantly higher concentration compared to normal plasma concentrations. The analytes mostly affected are potassium, lactate dehydrogenase (LD), aspartate-amino transferase (ASAT) and folate, which may result in falsely elevated results being reported (1).

Adherence to phlebotomy procedures is important to prevent unnecessary costs due to re-sampling, re-analysis and increased turnaround time. Clinical laboratories are cognisant of these important preanalytical issues and should implement necessary procedures to minimise the risk of haemolysis during phlebotomy and transportation of the sample. Moreover, it is important to establish a continuous quality improvement programme between the laboratory and the clinical departments, and provide guidance on best practices with regard to sampling procedures and the preanalytical handling of the sample.

The article has been peer-reviewed.

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