How to prevent clots in EDTA blood tubes

Correct blood sampling procedure can eliminate delays

In the haematology laboratory, we often receive queries from clinical colleagues about decisions we have made, such as rejecting a sample or being unable to provide a result. For the vast majority of tests, samples are collected in EDTA (Ethylenediaminetetraacetic acid) specimen tubes. EDTA is an anticoagulant additive that coats the inside of the tubes to prevent blood clots from forming.

Clots cause delays

Collecting a blood sample to send off to the laboratory for tests is common practice for frontline health professionals. Unfortunately, finding that your patient’s sample was not processed because it had clotted is also not unfamiliar. This delays the blood results, adds to your workload and, most importantly, can affect the appropriate and timely care of your patients.

When we receive requests for investigations, such as a full blood count, we carry out preanalytical sample integrity checks. During this process, we often observe that a clot has formed in the sample tube. For haematological investigations that require individual blood cells to be either counted or examined, a blood clot of any size within the tube can cause alterations in the cellular composition of the specimen. This makes any data collected unreliable, and as such we would reject these specimens.

How coagulation happens

Coagulation, or clotting, is a complex aspect of an even more complex process called haemostasis. In normal physiological conditions, it is an inherent property of the blood that prevents excessive blood loss following damage to blood vessels.

In a healthy person, this process begins almost immediately after damage to the endothelial tissue that lines blood vessels is sustained. Venepuncture is a common cause of this damage.

When a blood vessel is damaged, it constricts to reduce blood flow, while circulating platelets stick to the site of injury. With the help of a plasma protein called the von Willebrand Factor, this causes the ‘activation’ and ‘aggregation’ of platelets, leading to the formation of a ‘platelet plug’ at the site of damage. This is known as primary haemostasis.

It is swiftly followed by secondary haemostasis; a clot made entirely of platelets is not robust enough to withstand the blood pressure in many blood vessels, so various other plasma proteins are recruited to strengthen the plug. In a series of interlinked enzyme reactions, these proteins help to make fibrin strands, which form a strong and supportive mesh around the platelet plug. This series of events is known as the ‘coagulation cascade’.

The moment you break the endothelial lining of your patient’s blood vessel to collect a sample, this cascade is initiated and can continue inside the blood tube after collection; this is why we sometimes observe clots in blood sample tubes.

As well as acting as an anticoagulant, the EDTA inside the tube preserves the blood sample to ensure that the constituents to be analysed are not significantly changed before the analytical process.

Work quickly but carefully

Primary haemostasis occurs immediately after venepuncture, so staff must work promptly. Practitioners tasked with collecting blood samples must be appropriately trained and competent, and ensure they always follow local standard operating procedures for venepuncture.

A common cause of clotted samples is improper mixing of sample tubes after collection. This can often be overcome by inverting the tube eight to ten times immediately after collection to mix the blood thoroughly with the EDTA.

These should be gentle inversions, not rigorous shaking. When this is done correctly, the EDTA blocks the coagulation cascade and the sample remains suitable for analysis for up to 24 hours.

When syringes are used to collect blood samples into EDTA tubes, they are sometimes overfilled, leaving too little air space to enable proper mixing.

All blood sample tubes have an expiry date, so it is important to check the date on the tube before using it – if the tube has expired, replace it.

Like nurses, biomedical scientists have standards of proficiencies to which we must adhere. Knowingly reporting results that do not accurately reflect the in-vivo activity of patients contradicts these standards and our professional code of conduct, and compromises patient safety.

No specimen is ever rejected lightly – it is always done in the best interests of the patient.