Derbyshire Pathology

Authors: Stacey Glasgow, Duncan Elks, Will Gallacher*

NHS
University Hospitals of Derby and Burton
NHS Foundation Trust

Novel Heat Storage Flasks to Optimise Temperature Regulation for Cryoglobulin Analysis

Background

The initial method for collecting cryoglobulin samples was difficult to standardise and control. The laboratory was re-evaluating assays to determine whether they met ISO 15189:2012 standards.

Preliminary work indicated that the temperature of cryoglobulin samples fluctuated during the sample collection process from the wards and Phlebotomy clinic, transportation to the laboratory and the sample preparation stages within the laboratory

The Brief

-To modify the current process to keep the temperature of the samples ≥ 37°C from collection to separation.

-Keep the process as straight forward and practical as possible for a busy laboratory.

Optioneering

Create a Transport Method to Keep the Samples ≥ 37°C from Collection until Receipt in the Laboratory.

1 – **Vacuum flasks and thermometers** were provided to wards and clinics to allow staff to ensure the samples were immersed in water and kept at 37°C until received by laboratory – however, flasks were often taken days before required leaving the laboratory short of flasks, and the thermometers were regularly stolen!

2 – **Vacuum flasks filled with heated sand** were investigated to keep the samples warm from collection until they reached the laboratory – although sand was an easily-obtained, effective option, it was too messy and could not be contained within the flasks. Sending laboratory staff onto the wards to aid in the collection of samples using sand flasks was impractical and time-consuming.

3 – **Pre-heated Vacuum flasks filled with expanded polystyrene** to keep the samples warm, however, the samples did not remain ≥ 37°C for as long as required.

4 – **Vacuum flasks were fitted with a custom support frame** that would hold four standard blood tubes. These were designed using Solid Edge 3D Computer Aided Design (CAD) software and were manufactured using polylactic acid on a Hicktop 24V 3D printer. The flask was then filled with cement, surrounding the frame. Only the blood tube lids are visible in the flask. These flasks fitted the brief and were easy to use.

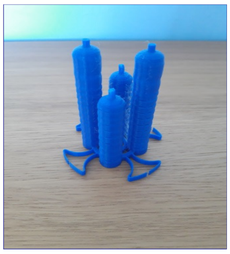

Figure 2 – Custom Support Frame

Figure 1 – Vacuum Flasks Used for Cryoglobulin Collection

Procure Laboratory Equipment to Allow All Stages of the Sample Preparation to Remain ≥ 37°C

Initial situation - no current equipment available to heat the flasks to the required temperature before use. The heating block currently used to keep the samples warm during the clotting process is unable to keep the whole of the tube evenly warm.

Centrifuging the samples immersed in warm water (37-40 °C) – this was ineffective; too much heat was lost to the centrifuge. Heating the centrifuge internally before use by spinning polypropylene tubes filled with hot water proved to be effective but this was time-consuming and potentially dangerous.

Solution - Two bench-top incubators were purchased from Thermo Scientific; one for the laboratory and one for the hospital Phlebotomy clinic to allow the flasks to remain ≥ 37°C at all times until required. The laboratory incubator is also used to keep the samples ≥ 37°C during the clotting process removing the variability of the heating block.

A new centrifuge was purchased – a Sigma 2-16KL – that would enable the samples to be kept ≥ 37°C during centrifugation.

Figure 3 – New Laboratory Equipment Purchased for Cryoglobulin Analysis

Verification of Equipment

To ensure the new equipment performed to the required specifications outlined in the brief, the following investigations were performed:

Time	Temperature (°C)
Start	37.3
2 hrs	37 (Plain) 36.9 (EDTA)

Table 1 – Investigation to ensure samples within the new heat storage flasks were ≥ 37°C from collection to receipt by the laboratory. Both serum and EDTA plasma were tested.

Time (mins)	Temperature (°C)
0	37
10	38

Table 2 – Investigation to ensure the sample temperature remained ≥ 37°C for the duration of centrifugation.

By setting the centrifuge to 42°C it ensured the samples remained above 37°C for the 10 minute centrifugation time. The temperature of the incubator is continuously recorded and reviewed daily using COMARK. The temperature of the incubator is set to 40°C to ensure the flasks are thoroughly warmed before use.

Implementation

Three flasks are kept in the incubator in Phlebotomy for outpatient requests. The flasks are replenished with empty blood tubes and returned to the incubator by laboratory staff who check the incubator and rotate the flasks.

Ward staff collect a flask from the laboratory incubator; these are signed out by laboratory staff who ensure they are returned within two hours. Flasks returned from the wards are kept in the incubator for 24 hrs before being used again to ensure they return to the correct temperature.

All the flasks are colour-coded and numbered to ensure they are rotated appropriately and are returned to the correct locations after use.

Attached to all the flasks are information sheets outlining the new collection and transportation procedure.

Conclusion

The new flasks and equipment have greatly improved the laboratory service we offer for cryoglobulin screening. They have eliminated the need for ward and Phlebotomy staff to use water to transport the samples to the laboratory which often were inappropriately warmed and occasionally rejected as unsuitable.

Since the introduction of the pre-heated storage flasks, no samples have been rejected or repeated as a result of poor temperature regulation.

EXCEPTIONAL Care Together

References

Cryoglobulin evaluation: best practice? Ravishankar Sargur, Peter White and William Egner.

Laboratory testing for cryoglobulins, Motyckova et al. Am. J. Hematology

Acknowledgements

The authors would like to thank Emma Jones for her contribution in starting the project and Richard Glasgow for manufacturing the support frames.

stacey.glasgow@nhs.net

* Will Gallacher CEng – Consulting Chartered Engineer