Testing Collection Tubes with QC / QA Material: Common Therapeutic Drugs

Marianne Roser, Graham RD Jones, Perry Giannopoulos
Department of Chemical Pathology, St Vincent's Hospital, Sydney, Australia.
mroser@stvincents.com.au

Background

Collection tubes may contain additives or other factors which can affect test results. These may include tube composition (eg glass v plastic), gel-separator, clot activator, anti-coagulant, sealant, anti-foaming agent, other.

Testing collection tube suitability can be a difficult and time consuming process because it can be difficult to find samples with a relevant range of analyte concentrations.

This is especially true for therapeutic drugs where samples for some tests are received infrequently, or where positive results are uncommon (eg salicylates).

Other variables in these studies are the duration of exposure in the tube, the amount of mixing, the volume of sample and the incubation temperature.

Recently Kricka et al (1) proposed using QC material as a tool for rapid testing for interference from collection tubes.

Aim

The aim of the study is to investigate the effect of using gel-separator tubes for the analysis of common therapeutic drugs using a rapid protocol involving QC and QAP material.

Methods

Materials

QC Material: BioRad Liquicheck Immunoassay Plus.
- Level 1 (low drug concentrations)
- Level 2 (medium drug concentrations)
- Level 3 (high drug concentrations)

QA Material: RCPA QAP Chemical Pathology
- General Serum Chemistry material (2006)
- The lowest (1) and 5th lowest (5) analyte concentrations were used.

BD (Becton, Dickinson and Company)
- SST-II tubes (8.5 mL, 13 mm internal diameter)
- PST-II tubes (4.5 mL, 11 mm internal diameter).

Methods

750 uL of QC or QA material was added to two tubes of each type. The tubes were mixed end-on-end for 30 minutes, centrifuged for 6 minutes, and then stored for a total of 4 hours or 24 hours at room temperature. At these times the samples were removed from the gel tubes and analysed as described below.

The following drugs were analysed using an **Abbott AxSYM analyser**: carbamazepine, gentamicin, vancomycin, tobramycin, paracetamol, salicylate, phenobarbitone, theophylline, valproate.

Digoxin was measured on a **Siemens Centaur**

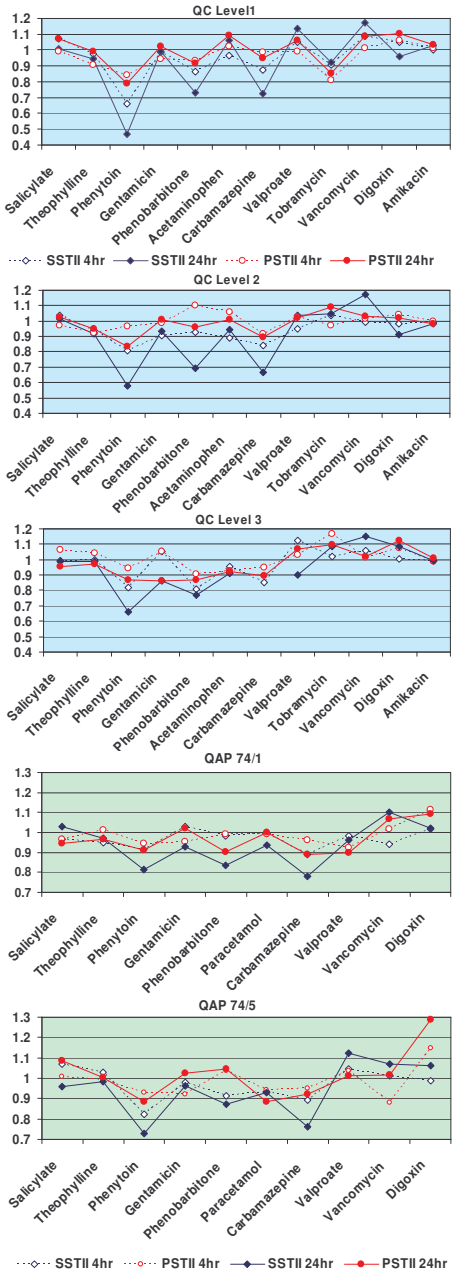
Amikacin was measured on an Abbott **TDx Flx**.

The baseline for the QC or QA material was determined by duplicate measurement after storage in the original container at room temperature for 4 hours.

Results

The measurements at 4 hours and 24 hours for serum and plasma results are shown in the graphs below. Results are expressed as fractions of the starting concentration.

Phenytoin, phenobarbitone and carbamazepine were most commonly affected producing low results with more influence seen in serum SSTII compared to PSTII tubes and at 24 hours compared to 4 hours incubation.



Figures. Fractional recovery of drugs from QC (blue background) and EQA (green background) material stored for 4 hours (open symbols) or 24 hours (closed symbols) in BD SSTII (blue symbols) or PSTII tubes (red symbols).

Discussion

Significantly reduced results were obtained for at least one measurement for phenytoin, phenobarbitone and carbamazapine for all materials tested.

Lower results were seen at 24 hours compared to 4 hours consistent with on-going adsorption to the gel surface.

Lower results were seen in the SST-II tubes compared to PST-II tubes, which may be due to the larger internal diameter and therefore larger gel surface area (SST-II: 133 mm^2; PST II 95 mm^2).

Previous literature regarding gel adsorption of these drugs is inconsistent with adsorption for these drugs reported in some papers (2) and not in others (3). Variables may include volume of collection, time on the gel, temperature and mixing protocol.

Our study shows that interference is possible with the low sample volumes tested and with longer exposure times.

No significant reduction in concentration was found for paracetamol, theophyline, amikacin, digoxin, salicylate, gentamicin, valproate or vancomycin.

Some drug concentrations appeared to increase slightly although the mechanism for this is uncertain.

Importantly our screening study efficiently screened multiple drugs in each tube at clinically important concentrations compared to more labor intensive studies which have used up to 30 samples for each drug.

Conclusions

This method allowed rapid investigation of the effect of BD SSTII and SSTII collection tubes on measured drug levels.

The protocol is sensitive, using low sample volumes, consistent with a screening test for possible tube-dependent effects.

Effects were dependent on time on the gel and surface area of the gel. It is possible that lesser effects may occur if full tubes are used and separated rapidly.

QC and QA material may not exactly mimic patient sample and more detailed investigation of several drugs need to be done if these gel tubes are considered for measurement.

References

(1) Kricka,LJ, Park, JY, Senior, MB, Fontanilla, R. Processing Controls in Blood Collection Tubes Reveals Interference. Clin Chem 2005;51:2422-2423.
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