

# Is Plasma the Answer? An evaluation of BD Vacutainer® Barricor™ to meet ED Turnaround Time requirements.

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## Background

Emergency Departments (EDs) across the National Health Service (NHS) in England have seen increasing attendances over the past few years. This pattern increases even more during winter months and results in crowding and failure to meet the 4 hour target to treat, admit or discharge patients. Pathology plays a key part in the ED patient pathway and laboratories need to help meet these challenges by innovation.

Providing rapid turnaround times for critical Clinical Biochemistry tests for the ED has been a key target for pathology labs in the UK following the RCPATH guide published in 2013. The initial target was to provide 90% of results within 1 hour of receipt, with a further target of 1 hour from needle to authorisation. In Derby we consistently achieve 95% within an hour, but even that is not ideal for patient care in a very busy ED.

## Introduction

Most UK Labs use serum but this requires 30 minutes clotting before a 10 minute centrifugation. These samples are preferred because the serum has very low cellular contamination in comparison with lithium heparin plasma.

However, the requirement to wait for 30 minutes for the blood to clot, centrifugation for 10 minutes, possible pseudohyperkalaemia from the clotting process and micro fibrils or clots causing delays in sample processing post-centrifugation, makes achieving this target very difficult if not impossible.

Samples may also be delayed in the pre-laboratory pathway. An audit carried out in November 2016 showed that only 26.5% of samples were received by the laboratory within 60 minutes of the order being placed.

In order to make a significant change to the laboratory part of the patient pathway, we evaluated a new lithium heparin blood tube from BD, the Vacutainer® Barricor™. This sample type requires no clotting time and only a 3 minute spin time.

The BD Barricor employs a novel separation device made of elastomer which distends during centrifugation to allow cells and platelets to pass down and plasma to pass above the device. When the centrifugal force is removed, the elastomer retracts to form a barrier between cells and plasma.

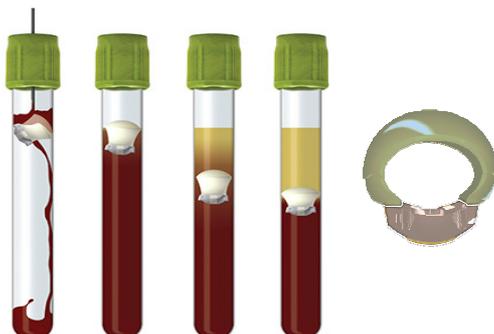


Figure 1. BD Barricor Tube with elastomer separation device

## Methods

BD Barricor blood collection tubes were collected in the same draw as BD Vacutainer® SST™ II Advance tubes in 497 patients seen in the ED. The samples were analysed on Roche cobas® 8000s only for the tests requested by ED. Plasma samples were processed in tandem with the ED serum samples but did not get authorised with the same priority. The plasma results reported only to the laboratory.

## Results

In the study at the Royal Derby Hospital carried out in March 2016, 458 duplicate blood samples were collected from ED patients. All assays were carried out using Roche cobas 8000 analysers running Roche assays, except for Acetaminophen (Cambridge Life Sciences).

Plasma results were comparable across the range of tests measured (see table 1). Sample quality was very good with only one plasma sample reported as clotted.

Unexpectedly, the rate of haemolysis in plasma samples was half of that of the SST II tubes taken in the same draw. Haemolysis was assessed as a haemolysis index greater than 60, the point at which a comment is added to reports to identify potential interference. The average improvement in turnaround time of Barricor over SST II Advance for 125 requests was 23 minutes, ranging from 0 minutes to 76 minutes.

Test	Intercept	Slope	Bias
Albumin	0.80	0.98	0.10
ALP	1.60	0.97	-1.38
ALT	-0.07	0.98	-0.42
Amylase	-4.22	1.08	1.11
Calcium	0.21	0.90	-0.03
CK	1.44	0.97	-3.55
Creatinine	-0.79	1.01	0.15
CRP	-0.18	1.01	0.12
GGT	2.00	0.97	-1.60
Glucose	0.04	1.00	0.06
Potassium	0.13	0.91	-0.24
Magnesium	-0.01	1.01	0.00
Sodium	7.93	0.94	-0.17
Phosphate	-0.03	0.99	-0.05
Total Bilirubin	0.10	0.99	0.02
TNT-HS	0.12	0.96	-0.92
Total Protein	7.63	0.94	3.39
Urea	0.20	0.97	0.02

Table 1. Summary of slope and intercept between serum and plasma

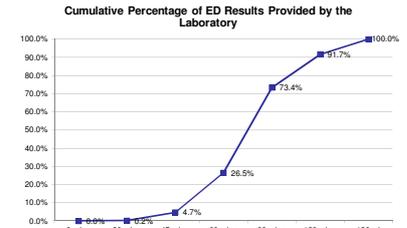
	SODIUM [mmol/L]	POTASSIUM [mmol/L]	UREA [mmol/L]	CREATININE (Enzymatic) [µmol/L]	MAGNESIUM [mmol/L]	PHOSPHATE [mmol/L]	CALCIUM (TOTAL) [mmol/L]	AMYLASE [iU/L]	TOTAL BILIRUBIN [µmol/L]	ALKALINE PHOSPHATASE [iU/L]	ALANINE AMINO TRANSFERASE [iU/L]
Mean Difference Between Duplicates	0	0.26	0.0	0	0.00	0.05	0.03	-1	0	1.3	0.4
Data Points	489	484	489	489	60	65	492	98	451	486	486
	GAMMA GLUTAMYL TRANSFERASE [iU/L]	TOTAL PROTEIN [g/L]	ALBUMIN (BCP) [g/L]	HAEMOLYSIS INDEX	LIPAEMIA INDEX	ICTERUS INDEX	C-REACTIVE PROTEIN (CRP) [mg/L]	CREATINE KINASE [iU/L]	TROPONIN-T HS [ng/L]	GLUCOSE [mmol/L]	
Mean Difference Between Duplicates	1	-3.4	0.0	8.3	-7.5	0.5	-0.1	3.4	2.1	-0.1	
Data Points	124	486	486	488	516	516	442	139	132	445	

Total Number of duplicate samples: 517

Difference = Serum value - Plasma value

A positive value indicates that the results in SERUM are generally higher.

A negative value indicates that the PLASMA results are generally higher.



Data from November 2016 Royal Derby Hospital ED. Time shown is between order placement in ED and sample receipt in the laboratory.

SST II Only	32
Barricor™ Only	8
Both Haemolysed	13
<b>Total Collections with Haemolysed Samples</b>	<b>53</b>

Table 3. Frequency of sample haemolysis [HAEMI >60]

## Conclusions

BD Vacutainer® Barricor™, has a smaller blood draw than SST™ II Advance (4.5 mL vs 5 mL), which is a significant improvement for patients, without compromising the ability of labs to assay samples. At the Royal Derby ED this would reduce the volume of blood collected from patients by around 28 litres per year.

The innovative barrier between cells and plasma removes the potential problems of sample probe blockages with gel. If the probe touches the elastomer it does not cause any transfer, damage or blockage of the probe.

Barricor provides a faster time from receipt to analysis as it removes clotting time and spin times are 7 minutes faster.

Barricor reduces the problems of microfibrils and samples clotting on the analysers seen in serum samples, reduces the incidence of pseudohyperkalaemia and potentially provides a reduced rate of sample haemolysis. In this study we saw a marked reduction in haemolysis rates.

Using heparin plasma and the BD Barricor tube could reduce the laboratory part of the patient pathway by 23 minutes, thus improving the speed of assessment and the decision to admit or discharge. This time reduction could help to ease the crowding and improve patient flow through ED.

Table 2. Summary of mean differences between serum and plasma