SHORT COMMUNICATION

Comparison of overall cost of plasma separation card with that of plasma preparation tube

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Abstract

For Hepatitis C Virus Ribonucleic Acid (HCVRNA) testing, blood has to be collected in plasma preparation tubes (PPT), centrifuged, refrigerated, and transported in cold chain. All these steps are time consuming and add to the testing cost. Plasma separation card (PSC) does not need any such steps. The present study was conducted to compare the cost of preparation and transportation of the PSC with that of PPT for the detection of HCVRNA. Blood samples from 100 HCV cases from one union council of Khairpur were collected in PPTs and also spotted on the PSCs and sent to the programme laboratory in Karachi (500 km distance) for HCVRNA testing. The cost for each step for PPT and PSC was taken into account. The preparation and transportation of PSC was noted to be much easier and 50% more cost effective than that of PPT.

Keywords: Cobas Plasma separation card, Plasma preparation tubes, HCVRNA detection.

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Introduction

Detection of viral RNA is essential for the diagnosis of hepatitis C virus. Following blood collection in a plasma preparation tube (PPT), the sample has to be centrifuged to separate the plasma and prevent haemolysis. Later, it has to be transported to the main laboratory at 2-8 degree temperature for detection of virus. Any shortfall at these steps can lead to compromised results for HCVRNA.[1] In low-middle income countries like Pakistan these issues are faced daily because many primary collection sites do not have a centrifuge, or the transportation occurs in two steps, i.e. from the primary site to the district site and from the district site all blood samples from different primary sites are sent as a batch to the main laboratory. At times, the fridge at the district site is non-functional or there are electricity outages leading to temperature control issues; sometimes during long transportation, the icepacks are unable to maintain the required temperature.[2] The courier charges from the primary site to the district site and then to the main laboratory add further costs.

The Cobas Plasma Separation Card (PSC) is a matrix to prepare dried plasma spots for PCR analysis with no requirement for centrifugation of the sample and no cold chain is required, thus facilitating sample collection in remote, underserved areas.[3] In our previous study, it was noted that PSC is a much easier and quicker way to transport blood from site A to B without cold chain without compromising on the HCVRNA results.[4] According to the manufacturer, 140 microliters of blood is to be collected from the finger prick using the provided capillary tubes.[5,6] It was considered a bit cumbersome and, therefore, we directly spotted whole blood from the syringe onto the spot and observed good correlation of the PCR results.[7]

In this study, the cost of sample transportation via PPT with that of transportation of PSC from one union council of interior of Sindh to its main laboratory at Karachi (land distance of 500 km) has been compared.

This study was conducted to compare the cost of preparation and transportation of the PSC with that of PPT for the detection of HCVRNA.

Methods, Results and Discussion

Khairpur district is the largest district of Sindh which is situated in the northern part of the province. It has HCV prevalence of 8.3%. One Union council (UC) of Khairpur was selected for the study and those living outside the selected UC and those on treatment or already treated in the past were excluded. After taking informed consent, 100 anti-HCV reactive patients (over the age of 18 years) were randomly selected for this non-interventional study. A total of 5 ml of venous blood was collected, 3 ml was transferred in the yellow capped plasma preparation tube (PPT) and 2 ml in CBC tube, while 12 drops of blood were directly spotted from the syringe onto each of the three spots of PSC. The PPT was centrifuged and stored in the district

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Table-1: Cost of commodities and transportation at various levels.

Steps in blood transportation	Cost PPT (PKR)	Cost PSC (PKR)
Rider cost for transportation of PPT from community to the district lab (2-3 km in cool box)	100	100
Yellow tube for plasma storage	15	Nil
Total cost	115	100
At the district leve		
Centrifuge machine cost divided by the depreciation (50,000/depreciation 10 years@3650 days)	13	Nil
Personnel cost undertaking centrifugation (40,000/month)	1600	Nil
Electricity for 20 minutes@25 units	25	Nil
Pipette cost (12,000 divided by 2 years)	15	Nil
Fridge cost divided by the depreciation (80,000/ depreciation 10 years=3560 days)	15	Nil
Fridge electricity	25	Nil
Courier/ transportation cost to main lab (500 KM) including cool packs and cool box	500	250
Total District cost	2193	250
Main laboratory		
Freezer cost (-40) 1400,000/depreciation over 10 years= 140,000@ 3650	38	Nil
Electricity cost for freezer.	50	Nil
Personnel cost at	1600	1600
Total	1688	1600
Overall cost	3996	1950

hospital fridge for three to four days. All samples collected over three to four days were couriered to the hepatitis main laboratory in Karachi. All PSC were sent via the same courier without temperature control in their plastic bags containing the desiccant. At the central laboratory, PPT and PSC were run on Cobas 5800 for HCVRNA. All patients with detected HCVRNA were supplied treatment through the hepatitis programme.

The study was started on October 16, 2024 and completed on December 21, 2024. The cost of transportation of PPT and PSC from Khairpur to Karachi was calculated using the receipts, while other costs (refrigeration, centrifuge, machines) were calculated using their per unit cost.

The overall cost of blood handling and its transportation was divided into three parts, i.e. cost at the site of blood collection, cost at district level, and the cost at the main laboratory (Table 1). Overall cost at the collection site and at the main laboratory in Karachi did not show much difference. The handling and transportation of PPT was eight times higher as compared to PSC because of centrifugation, refrigeration, courier, cool boxes, and cool packs. The overall cost saving in PSC was almost 50% and this can be further improved if PSC samples are sent in large numbers (PSC samples can be stored at room temperature for 28 days).

The present study showed that PSC was a very safe and quick way of transporting blood for HCVRNA without using centrifuge or cold chain. The same has been reported by others.[3-6] The cost saving in PSC was almost eight times lower than that of the PPT at the district level while overall cost saving was 50%. The overall cost can be further reduced if the PSC samples are sent on four weekly bases instead of weekly (the PSCs can be stored at room temperature for 28 days after collection). Our earlier study had showed that direct spotting of venous blood from a syringe onto PSC is an alternative to pipetting of venous or capillary blood and for these a minimum 10 drops (24-gauge needle) are required for optimal agreement with plasma.[7] No significant difference was seen in HCV viral load in the plasma as against that from 10 or 12 drops of blood collected in the PSC spots. Direct sampling onto the PSC may, therefore, be used as an alternative to capillary sampling in resource-limited settings and in patient populations for whom finger prick and capillary blood collection is challenging.

The limitations of this study are that it was carried out at one site and the cost will vary according to the distance covered. Sites having freezers and manpower will not have these additional charges.

Conclusions

The present study showed that PSC is a very safe and quick way of transporting blood for HCVRNA testing without the need for centrifugation, separation of plasma/serum and even maintaining a cold chain. No significant difference was seen in viral load between PSC and plasma.

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Conflict of Interest: None.

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Author Contribution:
GH: Undertook the PCR in his laboratory.
AQL: Undertook the PCR testing in her laboratory.
ZD: Provided kits for PCR testing.
SEA: Performed the statistical analysis.