Cystatin C Can Be Measured Reliably in Capillary Blood Samples, Sheila A.R. Kort,1,2 Anna A. Bouman,1 Marinus A. Blankenstein,1 and Arend Bökenkamp2 (Departments of 1 Clinical Chemistry and 2 Pediatrics, VU University Medical Center Amsterdam, The Netherlands; * address correspondence to this author at: Department of Clinical Chemistry, VU University Medical Center Amsterdam, De Boelelaan 1117, 1081 HV, The Netherlands; fax 31-20-4443895, e-mail S.Kort@vumc.nl)

Cystatin C offers a promising alternative to serum creatinine as a marker of glomerular filtration (1,2). In children, cystatin C is particularly useful because its concentration is constant after the age of 1 year (3). Unlike creatinine, cystatin C does not need to be corrected for weight or height to estimate glomerular filtration rate (4).

In young children, capillary blood sampling is often preferred over venipuncture and is used for many biochemical tests. Capillary blood is not suitable for all biochemical tests, however, because it is a mixture of venous and arterial blood and may be contaminated with interstitial or even intracellular fluid. Cystatin C is produced by all nucleated cells in the body (5) and enters the interstitium and, from there, the bloodstream. The concentrations of cystatin C have been comparable in most body fluids studied (e.g., blood, tears, milk, saliva, and synovial fluid), and it undergoes only minimal extrarenal metabolism (6).

On the basis of these findings, we concluded that large differences in cystatin C concentrations between blood and interstitial fluid are unlikely, and we hypothesized that cystatin C concentrations are similar in capillary and venous blood samples.

In a pilot study, we measured cystatin C in venous and capillary serum samples. Forty-one adult volunteers, staff members of the Departments of Clinical Chemistry and Pediatrics (median age, 40 years; range, 21–57 years), were asked for informed consent to give blood by both venipuncture and finger capillary puncture. Blood from venipuncture was collected in blood collection tubes (Vacutainer; BD). Capillary puncture was done with Microtainer safety flow lancets, and blood was collected in 0.6-mL tubes (Microtainer; BD). Both devices contained separation gel without anticoagulant. Preanalytical preparation included centrifugation for 10 min at 2000g for venous and 4 min at 21 000g for capillary samples. Serum samples were stored in polyethylene cryovials (Naïgene Labware) at −20°C until measurement.

Cystatin C was measured by a standard particle-enhanced immunonephelometric assay (N-Latex Cystatin C) on a BN ProSpec nephelometer (Dade Behring). The minimum serum volume needed was 150 µL. The assays were performed according to instructions of the manufacturer. To determine the differences and variation between the two sample types, we performed Passing and Bablok regression (7) and Bland–Altman analysis (8), using MedCalc, Ver. 7.4.20 (MedCalc Software).

Differences between means were tested with the paired t-test. A P value <0.05 was considered statistically significant. The statistical power to detect a difference in cystatin C concentration of 0.02 mg/L between the two sampling techniques was 90% (9).

For 41 paired capillary (y) and venous (x) samples, the Passing–Bablok regression equation was: y = 1.0357x – 0.0255 mg/L. The 95% confidence intervals were −0.1145 to 0.0648 mg/L (not significant) for the intercept and 0.9086–1.1600 for the slope (not significant). The mean difference between the two methods was 0.006 mg/L (95% confidence interval, −0.053 to 0.064 mg/L) with no evidence of a concentration-related bias (Fig. 1). The paired t-test gave a t value of 1.189 (not significant).

Capillary blood sampling is widely used, but variations in local skin perfusion may lead to differences in sample...
composition (10). For cystatin C, we saw no systematic difference between venous and capillary blood samples. The small differences seen (Fig. 1) included the analytical impression of the assay, which in our hands performed according to NCCLS EP5 was 5% (CV) at 1.9 mg/L and 4% at 0.8 mg/L. Therefore, the scatter between venous and capillary concentrations appears clearly acceptable in clinical practice.

Our study had at least two limitations. The first limitation is that the cystatin C concentrations were within our laboratory’s reference range and thus our findings might not apply to patients with renal failure. The study suggested, however, good equilibration of cystatin C between the compartments potentially involved in capillary blood sampling, suggesting that this possibility is unlikely. The other limitation is that we did not study children. Previous studies comparing capillary and venous blood sampling of various analytes in children and adults did not suggest an effect of age on the agreement of results with these sampling techniques (11–13).

In conclusion, our findings indicate that cystatin C can be measured reliably in serum samples obtained by capillary finger puncture and with use of a commercially available particle-enhanced immunonephelometric assay for the protein.

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References

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Screening for Dysbetalipoproteinemia by Plasma Cholesterol and Apolipoprotein B Concentrations, Dirk J. Blom, Frans H. O’Neill, and A. David Marais* (Division of Lipidology, Department of Medicine, University of Cape Town, Cape Town, South Africa; * address correspondence to this author at: Lipid Laboratory, 5th Floor, Chris Barnard Bldg., UCT Faculty of Health Sciences, Anzio Road, 7925 Observatory, South Africa; fax 27-21-4066396, e-mail dmarais@capeheart.uct.ac.za) Dysbetalipoproteinemia (type III hyperlipidemia) is a highly atherogenic mixed hyperlipidemia characterized by the accumulation of remnants of triglyceride-rich lipoproteins (chylomicrons and VLDL) (1). The binding of these remnants to hepatic lipoprotein receptors is mediated by apolipoprotein E (apoE). At the apoE gene locus, there are three common alleles: ε2, ε3, and ε4 (2). ApoE2 binds poorly to hepatic lipoprotein receptors, leading to impaired remnant clearance. Consequently, remnants become enriched with cholesterol and migrate abnormally on electrophoresis. More than 90% of dysbetalipoproteinemic patients are homozygous for apoE2, but only a minority (1 in 20) of apoE2 homozygotes will be overtly hyperlipidemic. Remnant accumulation sufficient to cause hyperlipidemia usually occurs only when a second metabolic hit increases lipoprotein production (e.g., diabetes) or further decreases remnant clearance (e.g., hypothyroidism) (3).

Dysbetalipoproteinemia is highly atherogenic but responds well to lifestyle changes and lipid-modifying medications. Genetic counseling is important, particularly in areas where there is a high local prevalence of autosoma.