We think that the most important question in the cTnT-ESRD debate is the prognostic importance of this biochemical abnormality, and particularly whether these patients require some modification of their treatment. We have followed 81 hemodialysis patients over a 20-month period and have found no increase in mortality in those with increased cTnT (7 deaths from 43 patients) compared with those with cTnT within reference values (7 deaths from 38 patients). Other researchers have found otherwise, with increased serum cTnT (4) or CK-MB activity (5) predicting myocardial infarction or death in uremic patients. The results of studies using current methods on large numbers of patients are eagerly awaited.

Serum Ubiquinone-10 in a Pediatric Population

To the Editor:
Ubiquinone-10 is a lipid implicated in several biological functions. In tissues, it has an important role in electron transport and ATP synthesis related to the mitochondrial respiratory chain. The reduced form of ubiquinone protects cells from peroxidative damage (1). In blood, ubiquinone-10 is transported by lipoproteins, is one of the antioxidants within LDL, and prevents free radical damage caused by neutrophils and oxidative injury by endothelial cells in ischemia-reperfusion (1). Adequate serum concentrations of ubiquinone seem necessary to prevent peroxidative damage.

Various procedures to measure total ubiquinone-10 have been described, with HPLC with ultraviolet (UV) detection being the most common (2). Reference intervals for adults (3) and newborns (4) have been reported, but to our knowledge, no data are available for children.

Our aim was to establish serum reference values for a pediatric population in our geographical area with our working conditions.

Specimens were collected from apparently healthy children (by history and analytical data) before minor surgical intervention (n = 102; 38 females and 64 males; ages, 1 month–18 years), in accordance with the Helsinki Declaration of 1975, as revised in 1983. We collected 1.5 mL of 12-h fasting blood samples in Venoject silicone-coated gel tubes (Terumo Corp.), protected the samples from light and centrifuged them (2000g for 10 min at 4 °C). The serum was separated, frozen at −40 °C, and analyzed within 2 weeks. The total ubiquinone-10 (reduced plus oxidized) concentration was measured by HPLC with UV detection (275 nm) according to Zierz et al. (2), with slight modifications (ubiquinone-7 was used instead of ubiquinone-9 as the internal calibrator). Briefly, we added ubiquinone-7 (Sigma Chemical Co.) to 400 μL of serum or calibrator [375 μL of 154 mmol/L sodium chloride + 25 μL of ubiquinone-10 (Sigma Chemical Co.)]. The final concentration of both calibrators was 1.25 μmol/L. They were dissolved in 200 mL/L n-hexane–800 mL/L ethanol. Samples and calibrators were added to 1 mL of methanol containing 10 g/L pyrogallol and were saponified with 50 μL of 500 g/L potassium hydroxide for 10 min at 56 °C. The ubiquinone was extracted with 1 mL of n-hexane, mixed thoroughly for 1 min, desiccated under nitrogen, and dissolved in 200 μL of ethanol.

Chromatographic conditions were as follows: a Perkin-Elmer Integral 4000 HPLC system with a Perkin-Elmer Turbochrom Data Analysis module, a Nucleosil C18 column (150 × 4 mm, 5 μm particle size), and a C18 precolumn. The eluting solvent was 7 g of NaClO3·H2O in 1000 mL of 700 mL/L ethanol–300 mL/L methanol–1 mL/L HClO4; the flow rate was 1.3 mL/min. The equilibration time was 3 min, and the total chromatographic time was 8 min.

The results for ubiquinone-10 were expressed as molar concentration (μmol/L serum) and related to serum cholesterol concentrations (μmol/mol cholesterol). Cholesterol was measured by standard procedures (Cobas Integra Analyzer, Roche Diagnostic Systems).

The within-run imprecision (CV;
n = 20) was 4.4% (0.79 ± 0.035 μmol/L) and 4.7% (1.1 ± 0.051 μmol/L); the between-day CV (n = 18) was 6.7% (0.87 ± 0.058 μmol/L) and 7.5% (1.25 ± 0.093 μmol/L). Linearity was apparent between 0.15 and 10 μmol/L (r = 0.99). The recovery was 101% ± 10%.

Because serum ubiquinone-10 values in our sample pediatric population did not follow a gaussian distribution (assessed by the Kolmogorov–Smirnov test), we calculated the median and the 2.5 and 97.5 percentiles for reference values. The ubiquinone concentration was independent of sex (P >0.05, Mann–Whitney test) but decreased significantly with age (r = −0.383, n = 102, P <0.0001 for ubiquinone in μmol/L; r = −0.384, n = 102, P <0.0005 for ubiquinone in μmol/mol cholesterol), whereas cholesterol values did not change with age. Ubiquinone concentrations correlated with cholesterol concentrations (r = 0.485, P <0.00001, Spearman test). After applying statistical analysis to all age groups (Kruskal–Wallis), we established two groups whose ubiquinone concentrations (in μmol/L and μmol/mol cholesterol) were the most significantly different from one another (Mann–Whitney, P <0.005): 1 month–7 years [n = 62; median, 0.8 μmol/L (interval, 0.46–1.38 μmol/L) and 203 μmol/μmol cholesterol (interval, 137–341 μmol/mol cholesterol)], and 8–18 years [n = 40; median, 0.57 μmol/L (interval, 0.34–1.03 μmol/L) and 169 μmol/mol cholesterol (interval, 111–248 μmol/mol cholesterol)].

HPLC with UV detection is a rapid and useful procedure for the quantification of total ubiquinone and correlates well with other procedures (5). We established reference intervals for serum ubiquinone in a Mediterranean pediatric population, showing a decrease of ubiquinone related to age, as was also reported by other authors in several tissues (1). Dietetic habits may influence serum ubiquinone-10 concentrations (6). Therefore, little difference in serum ubiquinone-10 values would be expected between several populations. In our experience, both ubiquinone-10 and ubiquinone-9 are present in substantial amounts in serum (data not shown). Ubiquinone-9 is not synthesized by humans; however, small amounts have been found in serum by some authors (7) but not by others (2). Interestingly, vegetable oils are the richest sources of ubiquinone-9 (6), an important food in Mediterranean area. Consequently, ubiquinone-9 is not suitable for use as internal calibrator to assay serum ubiquinone-10, at least in our population; we, therefore, chose ubiquinone-7.

Serum ubiquinone results are usually reported as molar concentrations but rarely are related to cholesterol (8). The reference intervals thus obtained are different, and the ubiquinone-to-cholesterol ratio yields a more adjusted reference interval. Moreover, ubiquinone-10 in serum protects lipoproteins from peroxidation. Therefore, the relationship between ubiquinone and cholesterol concentrations seems the best means of assessing its biological function in blood.

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References

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Positive Interference of Icodextrin Metabolites in Some Enzymatic Glucose Methods

To the Editor:
The glucose polymer icodextrin has become widely used in continuous ambulatory peritoneal dialysis (CAPD) (1). Icodextrin is hydrolyzed in the systemic circulation to oligosaccharides such as maltose, maltotriose, and maltotetraose. The use of icodextrin leads to substantial concentrations of these icodextrin metabolites in the blood, where they are not normally found (2). The presence of these metabolites could have an effect on enzymatic glucose measurement. A common complication in diabetes mellitus patients is renal insufficiency, which may lead to dialysis. Patients with diabetes mellitus treated by icodextrin-CAPD are at risk for having erroneous blood glucose measurements.

To evaluate the possibility of interference of the icodextrin metabolites in various glucose assays, glucose was measured in 2–11 sets of four heparinized blood samples (800 μL); each set was obtained from a single specimen. These samples were supplemented with 10 μL of 9 g/L NaCl solution as a blank sample or 10 μL of a solution of maltose, maltotriose, or maltotetraose (all sugars from Sigma Chemical Co.), achieving final concentrations for the icodextrin me-