in accordance with the current revision of the Helsinki Declaration.

The detection limit for the assay was 0.006 μg/L. In the linearity studies, the hypothesis of a linear fit was accepted for all examined samples \( P > 0.11 \), and \( r \) values were >0.9989 for dilution with a negative serum pool and >0.9978 for dilution with buffer. All mean recoveries were within ±10% of the native concentrations. The following results for assay imprecision were obtained (total CV and mean cTnl concentration): CV = 14% at 0.019 μg/L; CV = 8.2% at 0.044 μg/L; CV = 6.3% at 0.065 μg/L; CV = 6.3% at 0.086 μg/L; CV = 8.1% at 0.14 μg/L; CV = 6.0% at 0.22 μg/L; and CV = 4.3% at 0.39 μg/L. Because a total CV ≤10% at the MI decision limit is recommended, the cTnl concentration corresponding to this analytical imprecision was determined from the intercept of the total CV (\( y \) axis) equal to 10% on the imprecision proﬁle curve (Fig. 1). The lowest cTnl concentration yielding a CV of 10% was 0.036 μg/L. This value is therefore recommended as a de facto cut-off for detection of myocardial necrosis. In the group of apparently healthy individuals, 97% of the cTnl values were <0.010 μg/L, whereas only four individuals (two males and two females) had measurable cTnl concentrations, i.e., 0.010, 0.014, 0.016, and 0.029 μg/L. The calculated 99th percentile of the cTnl value distribution was 0.015 μg/L. The evaluated assay was close to meeting the 10% CV at the 99th percentile value, with 10% CV/99th percentile ratio of 2.4.

In conclusion, the Aio! second-generation cTnl assay has improved performance compared with data published earlier for the corresponding first-generation assay (12).

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Early Detection of the Selectivity Loss of the Cobas Integra Analyzer Chloride Ion-Selective Electrode

To the Editor:

Electrolyte measurements predominantly use ion-selective electrodes (ISEs) for sodium, potassium, and chloride. In contrast to the reliability of the sodium and potassium electrodes, erroneous chloride ISE values have occasionally been reported (1–3). We recently observed an increasing number of falsely high chloride concentrations in patient plasma samples. These results appeared at unpredictable intervals after replacement of the electrode on a Cobas Integra analyzer (Roche Diagnostics). Repeat analyses with a coulometric method yielded significantly lower results.

The falsely high values appeared not to have been caused by a general low selectivity of the chloride electrode, which responds to other ions such as iodide, thiocyanate, nitrate, and bromide (1–3). More likely was a time-dependent deterioration of the chloride electrode, for which the manufacturer claims a lifetime of 3 months but which needed to be changed more frequently. To attain reliable chloride ISE results, electrodes could be changed on a more frequent schedule (e.g., weekly), but that approach is expensive. Hence we aimed to introduce a reliable and inexpensive indicator of deterioration of the electrode.

Routine blood specimens were collected in tubes containing ammonium heparin (Sarstedt) and immediately centrifuged after arrival in our laboratory. Selectivity of the ISE was checked by comparison with chloride concentrations measured by coulometric titration on a Model 925 chloride analyzer (Corning). For quality control we used DuotrolTM abnormal (Biomed; target value, 127 mmol/L; control A) and Preci-normTM U (Roche Diagnostics; target value, 111 mmol/L; control B). As a selectivity control we used ISE solution 1 (Roche Diagnostics) supplemented by an aqueous KSCN solution. Briefly, we added 25 μL of 5
mmol/L aqueous KSCN (Merck), corresponding to 12.5 μmoles of KSCN, to 10 mL of ISE solution 1, which contains 115 mmol/L NaCl. Because of the high sensitivity of the chloride electrode for KSCN, this solution mimics a chloride concentration of ~120 mmol/L. A loss of selectivity should lead to markedly increased values.

After placement of a new electrode, results for the selectivity control solution gradually increased with a final peak at 2–6 weeks (Fig. 1). After replacement of the electrode, selectivity control solution results returned to the expected concentration range (Fig. 1). Results for control A showed this effect less well and could not demonstrate unambiguously deterioration of the electrode (Fig. 1). Control B varied statistically around the target value (Fig. 1) and therefore was not a suitable indicator.

The time dependence of the deterioration was consistent with an “aging” of the electrode, which could be the reason for the emerging loss of selectivity. One possible explanation for this effect could be the coating of the membrane with protein, particularly fibrinogen. Daily preventive maintenance performed according to the manufacturer’s instructions did not improve our results sufficiently. After such a procedure the selectivity of a worsening electrode was reconstituted for some hours only. We believe that this short-lived reconstitution was attributable to partial peeling of the electrode surface. After the maintenance procedure, falsely increased results for patient samples were detected more frequently than in the first hours after reconstitution. Repeat analyses with the coulometric reference method revealed significantly lower chloride concentrations [mean (SD) difference, 3 (3.7) mmol/L] in most cases. In 3% of those patient samples, the differences were >10 mmol/L.

Replacing the chloride electrode whenever the result for selectivity control solution exceeded its 3 SD limit reduced the rate of falsely high (difference for ISE minus coulometry >10 mmol/L) results to 0.3%. The mean difference between ISE and coulometry has been halved [mean (SD) difference, 1.7 (1.75) mmol/L]. Thus the introduction of this selectivity control solution offers a novel and inexpensive way to achieve a maximum useful lifetime of the chloride electrode.

Roche Diagnostics supported our work by substitution of defective electrodes free of charge.

References


Interference in the Vitros CREA Method When Measuring Urine Creatinine on Samples Acidified with Acetic Acid

To the Editor:

The addition of additives to stabilize one analyte in a sample can adversely affect the measurement of other analytes. Urine samples for homovanillic acid (HVA) and vanillylmandelic acid (VMA) analysis are acidified to pH 2–4 to maintain analyte stability. This is typically done with either glacial acetic acid or HCl. In a pediatric population, we analyze random urine samples rather than 24-h collections, and report the ratio of either HVA or VMA concentration to creatinine concentration. We investigated the effects of acetic acid and HCl on the creatinine assay performed on the Vitros 950 analyzer (Ortho-Clinical Diagnostics). The Vitros CREA instructions state that for urine “The following preservatives have been tested and demonstrated an effect of <2% on creatinine results...” with glacial acetic acid and 12 mol/L HCl included in the list (1). We have verified that HCl causes negligible interference but have found significant positive interference with the use of acetic acid.

For 20 urine samples, two 5-mL aliquots were apportioned and acidified to pH 3. pH was measured with colorpHast pH strips, pH range 0–6.