gested [3]. Because of the relatively longer increase in plasma FABP compared with myoglobin, the ratio calculated for uremic patients (~3) is similar to that found in patients after heart infarction. Thus, with respect to the discrimination of myocardial infarction from skeletal muscle injury, the decrease of the ratio in chronic renal failure indicates the limitation of the use of this ratio for this purpose.

Serial monitoring of the plasma FABP concentration can also be used to estimate infarct size [6]. However, our results indicate that if the myocardial infarction occurred in a patient with chronic renal failure, the plasma FABP concentration would be relatively higher than in a patient with intact kidneys, thus leading to overestimation of infarct size. Since preinfarct values differ widely among patients, a judgment about infarct size cannot be made.

In conclusion, our data indicate that in patients with chronic renal failure the plasma concentrations of the biochemical markers FABP and myoglobin each are markedly increased. Thus, caution must be taken when using these marker proteins for early diagnosis of myocardial infarction, in case of renal insufficiency, as the preinfarct plasma concentration is very likely to be already high.

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References

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Automated Immunoassay of Cardiac Troponin I in Serum Evaluated

To the Editor:

We evaluated the Opus Troponin I assay (Behring Diagnostics, Westwood, MA), a two-site sandwich, fluorogenic ELISA that uses two goat polyclonal antibodies directed against different protein segments unique to cardiac troponin I (cTnI) [1]. Pipetting, incubations, measurements, and data-reduction steps are performed on the Opus analyzer; the first test result requires 20 min. The assay measures concentrations of cTnI in serum as great as ~135 μg/L.

The calibration appeared to be stable for at least 4 weeks. Serial dilution of a human serum sample with a high concentration of cTnI showed no significant curvature when the curve obtained was tested for linearity [quadratic regression: $y = -0.25 + 96.1x + 6.31x^2$, with the coefficient of $x^2$ not significantly different from 0 ($P = 0.27$)] [2]. Linear regression analysis of these data confirmed the high linearity of the response ($r = 0.9998$). The minimum detectable cTnI concentration, assessed by 10 replicate measurements of a human serum containing no detectable cTnI concentration and defined as the cTnI value corresponding to the fluorescence signal 3 SD greater than the mean found for this serum, was estimated as 0.38 μg/L. The Opus analyzer, however, reports results <0.50 μg/L as “<0.5 μg/L.”

Assay reproducibility was tested by assayin duplicate, once a day for 10 days, two serum samples with concentrations distributed over the measuring range and the three kit controls containing human cTnI [3]. Analysis of variance showed within-run CVs between 3.4% and 7.2% and total CVs between 5.6% and 13.0%. No interferences were detected in assays of lipemic (triglycerides <10 g/L) or hemolyzed (hemoglobin <2.5 g/L) specimens; concentrations of bilirubin >50 mg/L spuriously increased the reported cTnI concentrations in serum.

To compare the Opus assay with the cTnI Pasteur immunoenzymometric assay (Sanofi Diagnostics Pasteur, Marnes-la-Coquette, France; performed manually according to the manufacturer’s current protocol [4]), we assayed 85 unselected individual serum samples with detectable cTnI concentration (>0.04 μg/L as measured with the Pasteur assay). The correlation was good ($r = 0.959$), but the data showed considerable scatter (SD = 10.6 μg/L), the Opus results being relatively higher within the mid-range of values but equal to...
the Pasteur results at concentrations outside the limit of linearity of the instrument. As a whole, the Opus assay led to approximately 10-fold higher values than the Pasteur assay (linear regression equation: Opus = 11.1 Pasteur + 1.5 μg/L). Differences in the calibration materials and in the ways their theoretical values are assigned in the two methods may partially explain this observation. When the three calibrators supplied with the Pasteur kit (S1, S2, and S3 with assigned cTnI concentrations of 0.13, 0.55, and 1.56 μg/L, respectively) were determined with the Opus assay, the results were as follows: 1.21, 4.39, and 11.3 μg/L, respectively.

We used the Opus procedure to measure the concentration of cTnI in sera from subjects in four groups: (a) 46 apparently healthy people, ages 26–82 years; (b) 21 patients with a typical history of myocardial infarction (MI) of <8 h duration, not treated with thrombolytic therapy; (c) 8 patients with severe skeletal muscle damage [total creatine kinase (CK) values 10 240 to 226 000 U/L] but no apparent cardiac injury; and (d) 39 consecutive dialysis patients with no evidence of myocardial injury. CK-MB mass concentrations were determined with the Magic Lite assay (Ciba Corning Diagnostic Corp., Medfield, MA). No cTnI was detected in the healthy subjects (all values <0.5 μg/L). In patients with MI, cTnI peaked at 20.8 ± 8.1 h (range, 8–33 h) after the onset of chest pain, reaching a mean peak concentration of 165 μg/L (range, 3.3–1674 μg/L). Comparing their upper reference limits, we noted a higher relative increase at peak in cTnI than in CK-MB mass concentration (mean, 330- vs 47-fold). Furthermore, unlike the short duration of increased CK-MB concentrations, cTnI remained diagnostic over all the period tested, i.e., from the arrival at the hospital until 96 h after onset of pain, being still >0.5 μg/L in 16 of 18 samples obtained at day 4 post-MI (Table 1).

Consistent with the manufacturer’s declared cross-reactivity of <0.007% with skeletal troponin I [1], cTnI was undetectable in all but one of the patients with severe skeletal muscle damage or chronic renal failure. That patient had a slightly increased cTnI (1.0 μg/L) while receiving continuous ambulatory peritoneal dialysis; clinical evaluation, however, revealed no evidence of myocardial injury. We conclude that the Opus method has the potential to become a valuable aid in specific detection of myocardial injury.

We thank Istituto Behring, Milan, Italy, for supplying reagents for the cTnI assay.

Table 1. Time-dependent sensitivity of Opus cTnI and CK-MB mass concentrations in MI patients studied.

<table>
<thead>
<tr>
<th>Hours post-MI</th>
<th>CK-MB &lt;6 μg/L</th>
<th>CK-MB &gt;6 μg/L</th>
<th>cTnI &gt;0.5 μg/L</th>
<th>cTnI &gt;0.5 μg/L</th>
<th>Chi-squared</th>
<th>P</th>
</tr>
</thead>
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<tr>
<td>0–4</td>
<td>50</td>
<td>90</td>
<td>100</td>
<td>97</td>
<td>89</td>
<td>50</td>
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<td>4–8</td>
<td>(7/14)</td>
<td>(19/21)</td>
<td>(18/18)</td>
<td>(32/33)</td>
<td>(33/37)</td>
<td>(13/26)</td>
</tr>
<tr>
<td>8–12</td>
<td>36</td>
<td>67</td>
<td>83</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>24–48</td>
<td>5 (14/21)</td>
<td>(15/18)</td>
<td>(33/33)</td>
<td>(37/37)</td>
<td>(26/26)</td>
<td>(16/18)</td>
</tr>
<tr>
<td>48–72</td>
<td>17.33</td>
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</tr>
</tbody>
</table>

*Results shown are percent of positive samples per category (and no. of positive samples/total no. of samples).

References

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