sis was thus suspected to be fibrinogen. To determine that the lot of anti-IgM in use (goat anti-human IgM IEP antisera; Kallestad Diagnostics) contained antibodies to both IgM and fibrinogen, we performed immunofixation on a normal plasma sample. As shown in Figure 1 (bottom), this gave a false precipitin band at the same point of migration as fibrinogen.

Fibrinogen is a normal band observed on high-resolution electrophoresis of plasma but not of serum, so detection of fibrinogen warrants careful review of possible causes for its presence. In the present case, the specimen submitted was actually plasma but had not been so identified. Chart review revealed that the patient, a 35-year-old gravida 8 para 1 woman, was receiving heparin adjunctive to hemodialysis for postpartum renal failure. Heparin administered in vivo functionally converts "serum" to plasma.

Immunofixation should be performed whenever a beta-migrating monoclonal restriction is suspected that serum immunoglobulin quantitation does not clearly identify (2). An isolated light-chain restriction should be corroborated by urine immunoelectrophoresis, and an isolated heavy-chain restriction should be confirmed by immunoselective serum electrophoresis (Ouchterlony method). If follow-up studies do not support the immunofixation results, minor cross-reactivities of the antisera should be suspected. The location of the band on high-resolution electrophoresis can guide screening for contaminating antibodies on "monospecific" serum. Anti-fibrinogen antibodies in particular should be considered because of the hazard of misidentification of a fibrinogen band as a beta-migrating monoclonal gammopathy.

References

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More on Albumin and Thyroid Hormones

To the Editor:
We have several comments on the Z index proposed by Beck et al. (1). The patient population they chose contains critically ill patients and patients in the immediate postoperative period. In our experience a high proportion of these patients will have low albumin concentrations, owing to their nutritional state, and low T₃ concentrations, owing to the sick euthyroid syndrome. This emphasizes the statistical maxim: "Correlation is not causation."
Because albumin is a thyroid-hormone-binding protein, we do not find it surprising that the T₃ uptake ratio (T₃U) decreases with increasing albumin concentration. Furthermore, the increased free fatty acids found in some critically ill patients are known to invalidate the T₃U in these cases. Beck et al. (1) have incompletely validated their Z index. They provide no data on the confidence limits for the slopes used in their index, nor have they shown it to be valid in extremes of albumin concentration by demonstrating that it correlates correctly with the patients' clinical conditions.
The fact that the FTI fails to correct for extreme abnormalities of binding proteins should not present a problem: the very low or very high T₃U values that result in such cases should alert the clinical chemist so that additional specialized investigations can then be done.
Lindstedt et al. (2) have drawn attention to the need for statistical analysis to be "an adjunct to, rather than replace, sound pathophysiological considerations." These considerations equally apply to the interpretation of T₃U measurements.

Aqueous-Based Glucose Control Solutions for Use with Glucose Reagent-Strips and Meters

To the Editor:
The use of reflectance photometers to rapidly assess blood glucose concentrations has become a major adjunct to the care of individuals with diabetes mellitus. Differences in reagent-strip chemistry used by various manufacturers, however, have created a major problem in the design of an external quality-control program based on use of a single aqueous glucose standard. In a recent comparison of blood glucose meters, Brooks et al. (1, 2) highlighted anomalous results obtained with both aqueous- and serum-based control materials. When we examined this basic discrepancy in the use of aqueous-based control material, it became obvious that solution viscosity was the major factor affecting the reactivities of different reagent strips.
The major difficulty in using a common aqueous-based control for both
"Glucostix" (Miles Laboratories Aust. Pty. Ltd., Mulgrave North, Victoria) and "BM-TEST-GLYCEMIE 20-800" (BMG 20-800; Boehringer Mannheim Aust. Pty Ltd., North Ryde, N.S.W.) reagent strips was in the response of the Glucostix strip. Because of its membrane and "paper-matrix" pad composition (3), the Glucostix reagent strip is particularly sensitive to solution viscosity, which we soon found had to be particularly high if results were to be reasonable. The BMG 20-800 strips are far less sensitive to viscosity.

In early experiments involving the use of solutions of polyethylene glycol 6000 (PEG-6000), a concentration range of 150–250 g/L was found necessary for a meaningful response. Below this range, glucose values were factitiously high; above it, the opposite effect was noted. Moreover, other important factors included the buffering capacity and pH of the final solution.

Guided by our overall findings, we prepared two solutions for more detailed evaluation. Solution I contained PEG-6000 (150 g/L), sodium phytate (10 mmol/L), Na₂HPO₄·2H₂O (100 mmol/L), Tween 20 surfactant (4 g/L), and phenol (2 g/L); the pH was adjusted to 6.5 with phosphoric acid. Solution II contained PEG-6000 (220 g/L), Tween-20 (7 g/L), and phenol (2 g/L) in Clarke and Lube buffer, pH 6.0 (4). A trace of neutral-red indicator was added for coloration, and the solutions were allowed to equilibrate at room temperature for at least two days before use.

Table 1 summarizes the results for Solutions I and II. As indicated in previous studies (1), and consistent with the results in Table 1, glucose is more precisely estimated by use of the BMG 20-800 reagent strips than with Glucostix strips. Solution II is not totally suitable for the BMG 20-800 reagent strip, however, because no meter reading is obtained for glucose concentrations below 4.5 mmol/L. The high CVs for the Glucostix reagent strip with Solution I are a consequence of the strict adherence to procedural requirements that are necessary if an acceptable value is to be obtained. Shorter or longer intervals before the sample is "blotted" on the reagent pad markedly influence the final result. For these latter reasons, estimates with Solution II are markedly more precise. Both solutions, stored at room temperature, gave the same measured glucose concentration for at least two months.

Although both reagent strips have an obvious positive bias at lower glucose concentrations, we consider this of secondary importance compared with precision, because the prime application of control solutions is to assess the performance of the analyst with respect to the established characteristics of the solution being used. Moreover, the concept of a "true" value is not strictly applicable to blood-glucose meters, because manufacturers use algorithms to convert the reagent-strip's rate of reaction to whole blood, capillary blood, or plasma glucose equivalents. Comparison with a respective laboratory glucose estimation may therefore be invalid unless the manufacturer unequivocally states the calibration medium for the meter/reagent strip combination (5).

References

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Estimation of Brain Lesion Size Based on Quantifying CK-BB in Serum

To the Editor:

Schwartz et al. (1), in describing their attempt to use the quantification of serum creatine kinase (CK, EC 2.7.3.2) activity, CK-BB isoenzyme activity, and the ratio of these two determinations as indices of the size of brain lesions from various causes, found no correlation between any of the factors studied and the size of the brain lesions. They attributed this lack of correlation to an intact blood–brain barrier, the rapid elimination or inactivation of CK-BB, or a combination of these factors. They failed to consider that their findings could also be expected if the distribution of CK and CK-BB was not homogeneous from region to region throughout the brain.

In a study of canine brain (2), we reported a definite regional variation in activity concentrations of CK isoenzymes, with CK-BB varying by more than twofold from region to region. However, we could not identify any definitive pattern for grey vs white matter. The only other CK isoenzyme present in brain, mitochondrial CK, also showed a regional variation in activity concentrations in tissue. If the distribution pattern of CK isoenzymes

Table 1. Evaluation of Aqueous-Based Glucose Controls by Use of BMG 20-800 and Glucostix Reagent Strips

<table>
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<th></th>
<th>Glucose, mmol/L*</th>
<th>n</th>
<th>Found, mmol/L</th>
<th>CV, %</th>
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<tr>
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<td>8.4</td>
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<td>20</td>
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<td>2.5</td>
<td>B</td>
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<tr>
<td>15</td>
<td>20</td>
<td>16.1</td>
<td>7.6</td>
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</tr>
<tr>
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<td>106g</td>
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<td>10.9</td>
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</tr>
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* Actual concentration prepared.  B, BMG 20-800; G, Glucostix.  Number of individuals analyzing the solution.  Purchased from Miles Aust. Pty. Ltd.; stated range for the solution is 5 to 7 mmol/L.