Use of a Screening Procedure for Blood Urea Nitrogen

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The results of a paper strip test for blood urea nitrogen were compared with the values obtained by automatic analysis. The short procedure satisfactorily differentiates normal from abnormal levels and can be conveniently used for emergency determinations.

A constant problem in the hospital clinical laboratory is the emergency order which arrives with great regularity after the routine run of a particular analysis has been finished. With automation the problem has increased, particularly in laboratories where one automatic instrument is used for several different procedures in turn. There are three possible solutions. One is to perform the test manually. This requires, generally, a second set of standards, control, and reagents, and a more-or-less different method for each type of assay from that usually performed automatically. Furthermore, these single determinations are highly unpopular with the technical personnel, who as a consequence often resort to the second solution, which is to reset the automatic instrumentation to run this single determination. This is uneconomical for the laboratory with regard to both time and money. The third solution lies in the fact that frequently an absolute answer is not immediately required and the physician is satisfied with knowing at the moment whether the determination on the patient's specimen is normal or abnormal, and receiving the actual value the next day. For this purpose a screening test which can differentiate the normal from the abnormal with accuracy, requires little or no reagent preparation and only a few minutes of technologists' time is very convenient. This report describes the use of such a test for blood urea nitrogen.*

In 1959 Appleton et al. (1) described the use of this strip test as a survey procedure to separate specimens with normal urea nitrogen levels from those with abnormal levels, and in a large series they reported "an overall error of ± 10% from the actual analytic values." In 1960 Martin

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and Seibel (2) reported that the results by this procedure for a few patients compared well with those obtained by a direct colorimetric acid-diacyetyl method.

In this study the urea nitrogen was determined on heparinized plasma from 240 patients by the strip test procedure at the time the specimen was received. The plasma was then refrigerated and the urea nitrogen determined within 24–48 hours (using diacyetyl monoxime) by an automated method (3). The paper strip determinations were made singly by technologists, technicians, or medical students working part-time in the laboratory, and were interpreted by simple visual estimation of the height of the colored column compared to a color chart. The manufacturer now has a procedure for accurately determining column height and relating it to urea nitrogen concentration, but in order to keep the method as simple as possible, no attempt was made to use any refinements or special teaching procedures during this study. It was noted, however, that experience alone improved reading ability somewhat.

Urea nitrogen values to and including 18 mg./100 ml. of plasma were considered within the normal range. Of the 240 patients, 105 had normal values by both procedures, and in all but one of these the values differed by one reading or less (5 mg./100 ml.) on the color chart. Ninety-three patients had an elevated urea nitrogen by both methods (up to 134 mg./100 ml.), and these values also differed by less than one reading on the color chart (which has a 15 mg./100 ml.) difference between readings above the 30–75 mg./100 ml. range) (Fig. 1).

Nine patients having values within the normal range were read as outside this range on the chart although in no case was the difference greater than 10 mg./100 ml., nor would it have affected the patient's treatment. Thirteen patients whose values by the automatic method ranged from 19 to 22 mg./100 ml. were reported as 14–18 mg./100 ml. from the color chart. For 12 others with values ranging from 21 to 39 mg./100 ml. urea nitrogen, there were differences of 11–21 mg./100 ml. in the two procedures. Some of these differences were undoubtedly due to the fact that
the color chart gives values only at 20, then 30, and then 45 mg./100 ml. in this range. Use of a more accurate reading mechanism could be expected to reduce this group.

As might be expected, the greatest discrepancies were found in some patients (8) with very high urea nitrogen levels (60–126 mg./100 ml.). Here it is essential that the proper diluent be used in the paper strip procedure (serum is recommended), and obviously any error in chart reading will be multiplied by the dilution. Nevertheless, in all these cases the initial report was a markedly elevated urea nitrogen level, sufficient information for instigating treatment.

It has been found that the strip test procedure accurately differentiates between the normal and abnormal urea nitrogen levels and is a satisfactory screening procedure. It is essential that the manufacturer’s directions regarding glassware and all steps in the procedure be followed exactly. Claims that very accurate results may be obtained by following the recommended technics and measurements have not been investigated in this study.

References