A Rapid Screening Test for Urine by Insurance Company Laboratories

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Testing of urine samples by insurance companies is a useful, albeit time-consuming, method of screening applicants for hypertension, renal disease, and diabetes mellitus. It can also contribute to the evaluation of vascular diseases and disorders of the lower urinary tract. At Union Mutual, standard urinalysis has consisted of pH measurement, specific gravity by hydrometer, Clinitest* and Diastix** tests for glucose, Kingsbury's sulfosalicylic acid test\(^1\) for albumin, and microscopic evaluation of the sediment of centrifuged urine for the presence of red blood cells, leukocytes, casts and crystals.

Development of Chemstrip-L, a product of Bio-Dynamics Division of Boehringer Mannheim, has made it possible to use a simple, plastic strip on which are attached different reagent papers for detection of leukocytes, pH, protein, glucose, and blood in the urine. This method has proved to be a rapid and reliable test in fresh urine samples\(^2,3,4\). Urine obtained for analysis by Union Mutual contains preservatives which are present in a tablet within the sample containers. The object of this twelve-month study is to compare test results of the Chemstrip-L with those of the standard urinalysis procedures in all urine specimens submitted.

**METHODS**

Urine specimens were tested with pH paper, and specific gravity by hydrometry, if adequate volume was present. Diastix was used to test for glucose, and if positive, Clinitest tablet was used to verify the concentration of glucose present.

The remaining urine sample was centrifuged for five minutes, the supernatant decanted and tested for albumin with sulfosalicylic acid solution, prepared according to Kingsbury's method. The residue after decanting was prepared for microscopic analysis under high-and-dry magnification with a binocular microscope. The number of red blood cells and white blood cells observed on at least three high power fields was averaged, and the result reported as such. The presence of cells in casts was also noted.

For each urine sample, a Chemstrip-L strip was immersed in each urine sample prior to centrifugation. The pH reading was recorded immediately, while the glucose, protein and blood results were observed and recorded after sixty seconds. After fifteen minutes, the leukocyte reading was recorded by comparing the color changes with the standards provided with the Chemstrip-L strips.

The preservative tablet present in each urine sample contains the following ingredients:

- potassium acid phosphate 0.100g
- sodium benzoate 0.050
- benzoic acid 0.065
- urotropine 0.050
- sodium bicarbonate 0.010
- mercuric oxide red 0.001

A sample of water added to a urine container with a preservative tablet was analyzed by Chemstrip-L to demonstrate that the contents of the tablet did not affect the accuracy of the reagent strips. Thereafter, positive test results could then be attributed to the ingredients within the urine alone.

**RESULTS**

During the twelve-month study, 3969 consecutive urine samples submitted to Union Mutual were analyzed by the standard methods and by the Chemstrip-L test strip. Random samples of water added to a preservative-containing vial failed to indicate positive results with the Chemstrip-L, indicating that the ingredients of the preservative

![Graph A](image-url)

Graph A

- Positive by both methods
- Positive by standard testing
- Positive by Chemstrip-L testing
- Positive by either method

\(^*\)Clinitest Reagent Tablets, Ames Division, Miles Laboratories, Inc., Elkhart, Indiana, 46515.

\(^**\)Diastix Reagent Strips for Urinalysis, Ames Division, Miles Laboratories, Inc., Elkhart, Indiana, 46515
did not influence Chemstrip-L results when testing urine samples with preservative tablets.

**Glucose:**
A total of 147 urine samples (3.7% of 3969) were found to contain glucose as detected by the standard method plus the Chemstrip-L. The latter detected 141 (95.9%) of the 147. Graph A depicts the results of all methods.

It is noteworthy that Chemstrip-L detected 88 of the 94 samples containing glucose by standard methods. Of the 6 samples undetected by Chemstrip-L, all contained "trace" amounts of glucose.

**Protein:**
One hundred and forty-seven urine samples (3.7% of 3969) contained protein on standard analysis, in addition to the Chemstrip-L, which detected 108 (73.5%) of these. Graph B illustrates the results of all methods.

Of 128 samples which contained leukocytes on microscopic analysis, Chemstrip-L detected 63 (49.2%). Table 2 lists those samples which the Chemstrip-L failed to identify:

**Red Blood Cells:**
Fifty-five samples (1.4% of 3969) contained red blood cells as determined by microscopic analysis, plus Chemstrip-L. Of these 55, Chemstrip-L detected 46 (83.6%). Graph D depicts the results.

Leukocytes:
A total of 204 samples (5.1% of 3969) contained leukocytes on microscopic examination, plus the Chemstrip-L method which identified 139 (68.1%) of the total. The display of the results is shown on Graph C.
were not detected by Chemstrip-L, and the distribution of these by number of red blood cells is shown in Table 3:

<table>
<thead>
<tr>
<th>Result</th>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>rare RBC's/hpf</td>
<td>2 samples</td>
</tr>
<tr>
<td>occasional RBC's/hpf</td>
<td>1</td>
</tr>
<tr>
<td>0-5 RBC's/hpf</td>
<td>5</td>
</tr>
<tr>
<td>4-8 RBC's/hpf</td>
<td>1</td>
</tr>
</tbody>
</table>

**DISCUSSION**

**Glucose:**
Chemstrip-L contributed to the identification of a greater number of urine samples than did the standard methods (141 vs. 94). Only 88 samples were positive by both methods. Of the 6 samples which contained “trace” amount of glucose and not detected by Chemstrip-L, none is of clinical importance for screening by insurance companies and little additional risk is assumed by accepting them as “negative” for glucose.

**Protein:**
The standard testing procedure identified protein in 66 urine samples, of which Chemstrip-L failed to identify 43. If one agrees that clinically significant proteinuria consists of more than 50 mg.%, then Chemstrip-L failed to detect protein in 4 of the 66 samples (6.1%). Review of the raw data does not explain the discrepancy in reporting of the sample which contained 200 mg.%, although faulty transcription of the data to the reporting form by the laboratory technicians may have been responsible.

Chemstrip-L detected many more protein-containing samples than did the standard testing procedure, and since it failed to detect only 6.1% of those samples which were shown to contain protein by standard testing, it appears to be a useful, accurate testing method for proteinuria.

**Leukocytes:**
Chemstrip-L detected pyuria in 139 urine samples, while microscopic analysis identified 128, 65 of which were not recorded on the Chemstrip-L. Of these 65 samples, 61 contained 5 or fewer WBC’s/hpf, and are generally not of clinical significance. Thus only 4 samples of 128 (3.1%) failed detection by Chemstrip-L when pyuria was recognized by light microscopy.

The sensitivity of the Chemstrip-L method of analyzing the esterases present in polymorphonuclear leukocytes is evident by the greater number of positive results with Chemstrip-L than by microscopy (139 vs. 128). If leukocytes were lysed during shipment or storage to the laboratory at Union Mutual because of improper function of the preservative tablet, fewer samples would contain recognizable forms on light microscopy, but the presence of esterases would result in positive testing by Chemstrip-L.

Review of the data does not explain the discrepancy observed between the two methods for three samples with 5-10 WBC’s/hpf and one sample with more than 10 WBC’s/hpf, all of which were not detected by Chemstrip-L. One possible explanation may reside in the variance of the three laboratory technicians who processed the urine samples during the study period. The experience of each with preparation of samples and with microscopic analysis of cellular forms differed, and though the author attempted to review slides which were questioned, not all were properly subjected to scrutiny if a discrepancy between the reports of the methods were noted.

**Red Blood Cells:**
Chemstrip-L correctly identified 46 urine samples of 55 which were positive for red blood cells on microscopic analysis. Six of the 9 samples which were not correctly identified by Chemstrip-L contained significant hematuria, and the explanation for this discrepancy probably lies within the variability of the technicians who processed the samples.

The small number of samples with hematuria by microscopy (20) is likely explained by lysis of the red blood cells despite the preservative tablet. The Chemstrip-L detected 46 samples (83.6% of the 55) and thus appears to serve as a more sensitive screening test than analysis by light microscopy.

**SUMMARY**
Chemstrip-L provides a rapid, accurate, and time-efficient method of screening urine samples at insurance companies which perform this analysis within home-office laboratories. The more costly and time-consuming methods previously employed at Union Mutual's laboratory will be available, particularly if significant hematuria or pyuria is detected.

**References**

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