Your Practical Guide to Urine Analysis

Siemens Healthcare Diagnostics
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1000 B.C. - Hippocrates espoused the use of urine for diagnosis.

1700s - Pouchot and Pouchot (France) described the use of urine for diagnosis.

1789 - Waldeyer and Joubert (Prussia) described the use of urine for diagnosis.

1800s - Thalpe and others described the use of urine for diagnosis.

1810s - Society of investigators described the use of urine for diagnosis.

1840s - Ehrlich and others described the use of urine for diagnosis.

1870s - Ludwig and others described the use of urine for diagnosis.

1880s - Society of investigators described the use of urine for diagnosis.

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1900s - Society of investigators described the use of urine for diagnosis.

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2010s - Society of investigators described the use of urine for diagnosis.

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2100s - Society of investigators described the use of urine for diagnosis.

Sample
- Fresh, uncentrifuged urine is best for routine analysis (most concentrated).
- Void directly into clean, dry container with lid.
- Sterile containers are best.
- Label container where possible.

Preparation
- It is especially important to use fresh urine to obtain the best results with the tests for bilirubin and urobilinogen, as these compounds are relatively unstable and are excreted into the urine at a low concentration. Optimum results can be obtained within 2 hours of voiding.
- Bilirubin is a yellow pigment, and appears in the urine after bile pigments have been metabolicized. It is especially important to use fresh urine to obtain the best results with the tests for bilirubin and urobilinogen, as these compounds are relatively unstable and are excreted into the urine at a low concentration. Optimum results can be obtained within 2 hours of voiding.

Preservation
- Folin introduces a colorimetric method to detect reducing sugars.
- Thymol – a commonly-used preservative, in amounts of 0.1 g/ml (0.1 g/l) or greater, may give false positive reactions for albumin determinations. Formaldehyde may give false positive results for glucose determinations using the tablet test.
- Weakly acidic urine (pH below 5.5) is recommended for 24-hour urine collections. This is the most frequent-use specimen for steroid determinations, and will also preserve urinary steroids.
- Acid is generally added for the preservation of bacteria in urine. However, the concentration must not be excessive as this will prevent growth of bacteria during culture.

Disclaimer
This is a training guide and does not replace the package insert for each test. Prior to preparing any test, please read and operate instruments and strips according to Siemens instructions.
Correct Technique for Visual Reading of Reagent Strip Tests

Procedure

Always check the appearance of the urine sample as it may give useful information.

Siemens tests are scientifically designed to react progressively and produce colour changes in the case of positive reactions at the times specified. Accurate timing is essential for reliable quantitative results.

Use Chek-STIX for checking reactivity of Siemens test strips procedure

Chek-STIX strips offer a convenient method of generating an artificial urine sample which will give a positive or negative result to all Siemens multiple strip tests.

Chek-STIX has been developed specifically so the user can be assured of the reactivity of the reagent areas of Siemens multiple reagent strips. The product may also be used as a check of user technique as well as an aid to teaching.

The control solution generated by Chek-STIX Positive solution gives results on Siemens strips in the same manner as urine specimens. If the strips are reacting properly a positive result will be seen on each test area, with expected values as shown in the pack insert.

1. Place 12 ml of distilled water in test tube provided, by filling to graduation line.
2. Immerse totally one Chek-STIX strip.
3. Cap tube tightly. Invert the tube gently back and forth for 2 minutes. Allow to stand for 30 minutes.
4. Invert tube once more. Remove and discard Chek-STIX strip. Solution is now ready to test reactivity of Siemens strips or user technique.

Quality Assurance

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Expected Results

<table>
<thead>
<tr>
<th>Test</th>
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<tr>
<td>Glucose</td>
<td>5.5 mmol/L</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Positive</td>
</tr>
<tr>
<td>Ketones</td>
<td>Moderate-Large</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>1.000 to 1.015</td>
</tr>
<tr>
<td>Blood</td>
<td>Moderate-Large</td>
</tr>
<tr>
<td>pH</td>
<td>7.0-8.0</td>
</tr>
<tr>
<td>Protein</td>
<td>0.3-1.0 g/L</td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>Positive</td>
</tr>
<tr>
<td>Nitrite</td>
<td>Positive</td>
</tr>
<tr>
<td>Leucocytes</td>
<td>Positive</td>
</tr>
</tbody>
</table>

Expected results may change from the above. Always check the pack insert.

Do

- Read package insert carefully before testing
- Do not take strip out of pack
- Do not touch test areas of the strip
- Do not take out more strips than are required for immediate use

Do not

- Do not use or store strips outside of pack
- Do not use or store strips beyond expiry date
- Do not use or store strips in extreme temperatures
- Do not use or store strips in extreme dryness

Example

<table>
<thead>
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<th>Test</th>
<th>Expected Results</th>
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<td>Positive</td>
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"Expected results may change from the above. Always check the pack insert."
Chemical Principles Reagent Strip Tests

### Glucose

**Sensitivity**
- As little as 0.5 mmol/L

**Chemical Principles**
- Reagents: Sensitive to chromogen, colours ranging from green to dark blue.
- Enzyme reaction: Glucose oxidase and dichloroaniline in a buffer; acetoacetic acid.
- Result: Approximately 5.5 mmol/L (1/4%) glucose excreted in urine other than normal.

#### Specificity
- Ranges from green to dark blue.
- Chromagen: Colours resulting from the reaction of the reagent with acetone or acetoacetic acid.
- Specificity principle: The test is based on the reaction of the chromogen with the peroxidase-like enzyme reaction, which catalyses the reaction of the chromogen with the peroxidase-like enzyme reaction.

### Clinical Significance of Test Results

#### Significance of Positive Results
- In patients without diabetes mellitus, a positive result indicates the presence of an increased concentration of glucose in the blood.

#### Commonest Causes
- Ketosis, e.g. severe starvation, diabetes mellitus.

#### Decreased Uptake by Kidney
- Renal failure; hereditary defect in renal tubules.

#### Excess Albumin in Urine
- Albuminuria; bacterial urinary tract infection; haematuria; renal disease; malignancy; idiopathic proteinuria.

#### Significant Haemolysis
- Due to urinary tract infections, haematuria; renal disease; malignancy; idiopathic proteinuria.

#### Urinary Tract Infection
- Due to urinary tract infections, haematuria; renal disease; malignancy; idiopathic proteinuria.

#### Significant Haemolysis
- Due to urinary tract infections, haematuria; renal disease; malignancy; idiopathic proteinuria.
### Factors Affecting Urine Chemistry Tests on Siemens Reagent Test Strips

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<tr>
<th>Component</th>
<th>Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>Elevated readings may be obtained in the presence of 1-7.5 g/L protein</td>
</tr>
<tr>
<td>Urea</td>
<td>Urines containing glucose or urea greater than 1% may cause a low specific gravity reading relative to other methods</td>
</tr>
<tr>
<td>pH</td>
<td>For increased accuracy, 0.005 may be added to the readings from urines with pH equal to or greater than 6.5.</td>
</tr>
</tbody>
</table>

### Specific Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Affect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood</td>
<td>Increased reactivity may be obtained in the presence of 1-7.5 g/L protein</td>
</tr>
<tr>
<td>Leucocytes</td>
<td>An acid high protein diet may cause false + reaction</td>
</tr>
<tr>
<td>Urobilinogen</td>
<td>An alkaline diet high in vegetables, citrus fruits, milk and other dairy products may cause false + reaction</td>
</tr>
</tbody>
</table>

### Common Causes of False Positives

- **Azo dye metabolites** and other highly coloured compounds, e.g. rifampicin and phenazopyridine may mask a small reaction (May give red and other colours)
- **Phenothiazines** high doses can cause hepato-cellular damage giving true +
- **Chlorpromazine metabolites** can also cause false + by reacting with the reagent area.
- **Urine not freshly voided** may give false –
- **Lodine** may give false +
- **Protein** elevated readings may be obtained in the presence of 1-7.5 g/L protein
- **Ascorbic acid** high concentrations may cause false –
- **High specific gravity** sensitivity is reduced
- **Azo dye metabolites** (phenazopyridine) could mask or mimic + reaction.

### Common Causes of False Negatives

- **High specific gravity** presence of Cephalexin, Cephalothin, oxalic acid or Tetracycline may cause decreased reactivity
- **Nitrofurantoin** (brown urine) any substance that causes abnormal urine colour
- **Boric Acid** inhibits reaction to varying degrees.

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*For technical and product support information or queries, please contact our Technical Solutions Centre on: 0845 600 1955*
Test Selection Made Easy

<table>
<thead>
<tr>
<th>Test</th>
<th>Code No.</th>
<th>Product</th>
<th>Pack size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine</td>
<td>2877</td>
<td>Hema-Combistix* 50</td>
<td>50</td>
</tr>
<tr>
<td>Albumin</td>
<td>2857</td>
<td>Uristix* 50</td>
<td>50</td>
</tr>
<tr>
<td>Leucocytes</td>
<td>2816</td>
<td>Hemastix* 50</td>
<td>50</td>
</tr>
<tr>
<td>Nitrite</td>
<td>2810</td>
<td>Labstix* 100</td>
<td>100</td>
</tr>
<tr>
<td>Urobiligen</td>
<td>2814</td>
<td>Bili-Labstix* 100</td>
<td>100</td>
</tr>
<tr>
<td>Protein</td>
<td>2815</td>
<td>N-Labstix* 100</td>
<td>100</td>
</tr>
<tr>
<td>pH</td>
<td>2283</td>
<td>GP 25</td>
<td>25</td>
</tr>
<tr>
<td>Blood</td>
<td>2740</td>
<td>N-Multistix* SG 100</td>
<td>100</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>2741</td>
<td>Multistix* SG 100</td>
<td>100</td>
</tr>
<tr>
<td>Ketones</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bilirubin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glucose</td>
<td>2300</td>
<td>Multistix* 10SG 100</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>2304</td>
<td>Multistix* 8SG 100</td>
<td>100</td>
</tr>
</tbody>
</table>

Testing Pathway

This approach gives the power to confidently avoid sending non-infected urine samples for microscopy and culture, and enables appropriate, timely and cost-effective patient management in the clinic, ward or surgery.

If ALL of the following are NEGATIVE:
- Nitrite
- Leucocytes
- Blood
- Protein

DISCARD
Report as no evidence of infection

If ANY of the following are POSITIVE:
- Nitrite
- Leucocytes
- Blood
- Protein

Urine Specimen → Visual Appearance → Clear
Test with Multistix* 8SG/10SG
Culture + Microscopy

Obviously infected or blood stained
Culture + Microscopy

+ + +
Siemens Healthcare Diagnostics, the leading clinical diagnostics company, is committed to providing clinicians with the vital information they need for the accurate diagnosis, treatment and monitoring of patients. Our comprehensive portfolio of performance-driven systems, unmatched menu offering and IT solutions, in conjunction with highly responsive service, is designed to streamline workflow, enhance operational efficiency and support improved patient care.

Multistix and all associated marks are trademarks of Siemens Healthcare Diagnostics Inc. All other trademarks and brands are the property of their respective owners. Product and service availability may vary from country to country and is subject to varying regulatory requirements. Please contact your local representative for availability.

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