Urine Glucose and Ketone Determinations

Historically, urine glucose and ketone determinations were the only practical way for people with diabetes to regularly assess their glycemic control. However, the development of small, convenient, and reasonably accurate blood glucose meters has made urine glucose testing obsolete for most patients. Self-monitoring of blood glucose (SMBG) is now common and is the preferred way to monitor glycemic control. SMBG is recommended for all patients who use insulin (1,2). Recommendations for testing urine for glucose and ketones as part of diabetes management are described here.

URINE GLUCOSE TESTS—The basis for urine glucose measurements is the fact that glucosuria is roughly correlated with hyperglycemia. Urine testing is painless and less expensive than SMBG. However, the use of urine glucose concentrations to estimate blood glucose concentrations in diabetes management is undesirable for the following reasons:

1. The renal threshold for glucose excretion in healthy adults corresponds to a plasma concentration of ~10 mM (180 mg/dl). In many adults, particularly those with long-standing diabetes, this threshold may increase substantially (3). Thus, marked hyperglycemia may exist without glucosuria. Conversely, some individuals, particularly children and pregnant women, may have very low or variable renal thresholds, resulting in glucosuria with euglycemia (4). Thus, urine glucose levels imprecisely represent blood glucose concentrations.
2. Fluid intake and urine concentration can affect urine test results.
3. The test reflects an average level of blood glucose during the interval since the last voiding and not the level at the time of the test.
4. A negative urine test does not distinguish between hypoglycemia, euglycemia, and mild or moderate hyperglycemia. Therefore, urine testing is of little help in achieving the management goal of avoiding hypoglycemia and hyperglycemia.
5. Urine testing methodology, which involves comparing the color of a test strip against a printed chart, is less accurate than a digital readout of a blood glucose meter. Furthermore, it poses a problem for patients who are color blind or have other visual impairments.
6. Some drugs may interfere with urine glucose determinations.

Considering these points, the American Diabetes Association recommends that all patients who use insulin should self-monitor their blood not urine glucose. SMBG is also desirable in many patients who do not require insulin. Testing urine for glucose is a less desirable alternative for insulin-using patients only if they are unable or unwilling to perform SMBG. Health-care professionals should repeatedly encourage the latter group of patients to switch to SMBG.

URINE KETONE TESTS — Unlike urine glucose tests, urine ketone determinations remain an important part of monitoring diabetic control, particularly in patients with insulin-dependent diabetes. Urinary ketones may be an indication of impending ketoacidosis, a condition that requires immediate medical attention. Urine must be tested for ketones during acute illness or stress, when blood glucose levels are consistently >13.4 mM (240 mg/dl), during pregnancy, or when any symptoms of ketoacidosis (e.g., nausea, vomiting, abdominal pain) are present.

ORIGINALLY APPROVED OCTOBER 1990.

References

1. ADA Position Statement: Standards of medical care for patients with diabetes mellitus. *Diabetes Care* 12:365–68, 1989
2. Consensus statement on self-monitoring of blood glucose. *Diabetes Care* 10:95–99, 1987
3. Skyler JS: Monitoring diabetes mellitus. In *Diabetes Mellitus*. 9th ed. Galloway JA, Potvin JH, Shuman CR, Eds. Indianapolis, IN, Lilly, 1988, p. 160–73
4. Mogenssen C, Østerby R, Gundersen H: Early functional and morphological vascular renal consequences of the diabetic state. *Diabetologia* 17:71–76, 1979