Glycosuria

Glycosuria is the term for glucose present in urine, in amounts that can be detected by the usual techniques.

Pathogenesis

Virtually all the glucose that is filtered through the glomeruli is reabsorbed by the proximal renal tubule and so glycosuria represents an abnormal state. The amount of glucose not reabsorbed by the kidneys is usually less than 0.1%. Adults excrete about 65 mg of glucose per day and standard techniques do not detect this level.

There are two basic causes of glycosuria. One is that the level of blood glucose is so high that the renal tubules are unable to reabsorb all that is presented. The other is a failure of the tubules to reabsorb all glucose at a level where this should be possible. The latter is called renal glycosuria.

The level of blood glucose at which it spills into the urine is called the renal threshold. Under normal circumstances this is around 10 mmol/L. Diastix®, Medi-Test® and Mission Glucose® are plastic strips carrying glucose oxidase and a colour indicator, usually o-toluidine. They are specific and unlikely to give positive results for substances other than glucose. Glucose oxidase strips have superseded older reagents for reducing substances.

Elevated blood glucose

- If glycosuria occurs because a normal renal threshold has been exceeded, this is usually indicative of impaired glucose tolerance or frank diabetes.
- It can occur in a person who doesn't have diabetes if a substantial amount of food high in sugar is consumed and transiently overwhelms the insulin response, causing hyperglycaemia.
- Other conditions which may cause hyperglycaemia include:
  - Thyrotoxicosis.
  - Acromegaly.
  - Cushing's syndrome (including administration of corticosteroid drugs).
  - Severe anxiety states.
- Very rapid gastric emptying, as in dumping syndrome after surgery for peptic ulcers, can raise blood glucose above the threshold.
- Stress hormones elevate blood glucose and in the severely ill patient they may elevate glucose beyond the renal threshold.

Renal glycosuria

Pregnancy

Pregnancy is associated with a reduced renal threshold. This results from increased renal blood flow so that the tubules are presented with a greater volume each minute. Glycosuria in pregnancy, however, must not be dismissed, as it may be the first sign of gestational diabetes.

Urine glucose dipstick analysis is not useful in the detection of gestational diabetes because of its low sensitivity and negative predictive value.
Current National Institute for Health and Care Excellence (NICE) guidance suggests that testing for gestational diabetes mellitus (GDM) should be offered to women who have the following risk factors:1

- BMI ≥30kg/m².
- Previous macrosomic baby ≥4.5 kg.
- Previous GDM.
- First-degree relative with diabetes.
- Family origin with a high prevalence of diabetes (South Asian, black Caribbean and Middle Eastern).

Testing should be undertaken as follows:

- Women who have had GDM in a previous pregnancy should be offered:
  - Early self-monitoring of blood glucose; or
  - A 75 g two-hour oral glucose tolerance test (OGTT) as soon as possible after booking (whether in the first or second trimester), and a further 75 g two-hour OGTT at 24-28 weeks if the results of the first OGTT are normal.
- A two-hour 75 g OGTT to test for GDM should be offered to any women with other risk factors listed above at 24-28 weeks.

NB: fasting plasma glucose, random blood glucose, HbA1c, glucose challenge test or urinalysis for glucose should not be used to assess risk of developing GDM.

Fanconi's syndrome
Inadequate proximal renal tubular resorption of glucose occurs in Fanconi's syndrome. There may be a history of growth failure, rickets, polyuria, polydipsia or dehydration. This may be idiopathic, inherited or acquired.

Renal glycosuria
This is also known as benign glycosuria, familial renal glycosuria, primary renal glycosuria and nondiabetic glycosuria.

Renal glycosuria is a rare inherited disorder resulting in glucose excretion in the urine despite normal blood glucose concentrations. It is most commonly due to mutations in the SLC5A2 gene coding for the glucose transporter SGLT2 in the proximal tubule.2

It occurs in males and females. Renal glycosuria is diagnosed based upon laboratory tests that confirm the presence of glucose in the urine in association with normal or low blood glucose levels. It is usually asymptomatic.

In most affected individuals, no treatment is required. However, some individuals with renal glycosuria may develop diabetes mellitus.

Other causes
Some secondary causes of renal glycosuria are:

- Sodium-glucose co-transporter-2 (SGLT2) drugs can lead to a dose-dependent glycosuria.3
- Oculo-cerebro-renal dystrophy (Lowe’s syndrome).
- Cystinosis.
- Wilson’s disease.
- Intestinal tyrosinaemia.
- Heavy metal poisoning, such as lead, mercury or after use of out-of-date tetracycline.
- Intestinal glucose-galactose malabsorption (where the defective sodium-dependent glucose co-transporter protein is also present in the renal tubules).

Exclusion of these (by appropriate testing) should only be carried out if otherwise clinically indicated.

Misleading results
Testing sticks using glucose oxidase are specific for glucose. Other substances do not cause it to change. The small amounts of glucose normally excreted by the kidneys are usually below the sensitivity range of this test but on occasions may produce a colour between the negative and the lowest positive and may be interpreted by the observer as positive.

Further reading & references

1. Diabetes in pregnancy: management of diabetes and its complications from preconception to the postnatal period; NICE Clinical Guideline (February 2015)

Disclaimer: This article is for information only and should not be used for the diagnosis or treatment of medical conditions. Patient Platform Limited has used all reasonable care in compiling the information but makes no warranty as to its accuracy. Consult a doctor or other healthcare professional for diagnosis and treatment of medical conditions. For details see our conditions.