Urine

24 hour urine

A single sample of urine is normally used to determine whether there are increased amounts of specific substances in your urine, such as glucose, red blood cells, white blood cells, or protein. The urinalysis is a "snapshot" assessment of your urine at one point in time. The urinalysis is a valuable screening tool for urinary tract infections, kidneys diseases, and other conditions.

However, sometimes doctors need to know how much urine your body is producing in a day or how much of a particular substance (for example, protein, aldosterone, sodium, potassium, or urea nitrogen) is eliminated in a day. A single-specimen urinalysis cannot provide this information, so patients are instructed to collect all their urine produced in a 24-hour period. A special container is provided for this purpose, which is returned to the laboratory after you have finished the urine collection at home.

For example, a doctor will order a 24-hour urine collection for creatinine in order to calculate how well a patient's kidneys are functioning. A doctor may also order a 24-hour urine collection for a hormone (5-HIAA) in order to exclude carcinoid syndrome or urine excretion of copper to exclude Wilson's disease (a genetic disorder that can cause excessive copper accumulation in the body and cause hepatitis and brain damage).

Asymptomatic Proteinuria

Proteins are the building blocks for all body parts, including muscles, bones, hair, and nails. Proteins in your blood also perform a number of important functions. They protect you from infection, help your blood clot, and keep the right amount of fluid circulating throughout your body.
As blood passes through healthy kidneys, they filter the waste products out and leave in the things the body needs, like proteins. Most proteins are too big to pass through the kidneys’ filters into the urine unless the kidneys are damaged. The main protein that is most likely to appear in urine is albumin. Proteins from the blood can escape into the urine when the filters of the kidney, called glomeruli, are damaged. Sometimes the term albuminuria is used when a urine test detects albumin specifically. Albumin’s function in the body includes retention of fluid in the blood. It acts like a sponge, soaking up fluid from body tissues.

Protein in the urine is usually not a worrying problem at all, and the commonest cause for it to appear is because of a simple water infection (cystitis). It may also show up if any vaginal mucus has got into the urine sample, or if there is sugar diabetes present.

A high temperature of any cause may also cause it to happen, as may simply standing up or sitting down - this is known as postural proteinuria. There are some rarer causes, usually involving more serious kidney problems but if you are concerned about this, simply take a sample of your urine to your doctor for testing.

Protein is not normally found in large quantities in the urine. However, the presence of protein in the urine can indicate a multitude of disorders.

Urine protein is roughly divided into urine albumin and globulins. Urine protein electrophoresis may be recommended to help determine the cause of protein in the urine, or as a screening test to measure the various proteins in urine.

Normal Results

No significant amount of globulins in the urine.

Urine albumin is less than 50 mg/dL.
What Abnormal Results Mean

Acute inflammation

- Amyloidosis
- Decreased kidney function
- Diabetic nephropathy
- Kidney failure
- Multiple myeloma
- Nephrotic syndrome
- Acute urinary tract infection

Proteinuria describes a condition in which urine contains an abnormal amount of protein is present in the urine.

Inflammation in the glomeruli is called glomerulonephritis, or simply nephritis. Many diseases can cause this inflammation, which leads to proteinuria. Additional processes that can damage the glomeruli and cause proteinuria include diabetes, hypertension, and other forms of kidney diseases.

Research shows that the level and type of proteinuria (whether the urinary proteins are albumin only or include other proteins) strongly determine the extent of damage and whether you are at risk for developing progressive kidney failure.

Proteinuria is also associated with cardiovascular disease. Damaged blood vessels may lead to heart failure or stroke as well as kidney failure. If your doctor finds that you have proteinuria, do what you can to protect your health and prevent any of these diseases from developing.

Several health organizations recommend that some people be regularly checked for proteinuria so that kidney disease can be detected and treated before it progresses. A 1996 study sponsored by the National Institutes of Health determined that proteinuria is the best predictor of progressive kidney failure in people with type 2
diabetes. The American Diabetes Association recommends regular urine testing for proteinuria for people with type 1 or type 2 diabetes. The National Kidney Foundation recommends that routine checkups include testing for excess protein in the urine, especially for people in high-risk groups.

Who is at risk?

People with diabetes, hypertension, or certain family backgrounds are at risk for proteinuria. In the United States, diabetes is the leading cause of end-stage renal disease (ESRD), the result of chronic kidney disease. In both type 1 and type 2 diabetes, the first sign of deteriorating kidney function is the presence of small amounts of albumin in the urine, a condition called microalbuminuria. As kidney function declines, the amount of albumin in the urine increases, and microalbuminuria becomes full-fledged proteinuria.

High blood pressure is the second leading cause of ESRD. Proteinuria in a person with high blood pressure is an indicator of declining kidney function. If the hypertension is not controlled, the person can progress to full renal failure.

African Americans are more likely than Caucasians to have high blood pressure and to develop kidney problems from it, even when their blood pressure is only mildly elevated. In fact, African Americans are six times more likely than Caucasians to develop hypertension-related kidney failure.

Other groups at risk for proteinuria are American Indians, Hispanic/Latinos, Pacific Islander Americans, older people, and overweight people. These at-risk groups and people who have a family history of kidney disease should have their urine tested regularly.
What are the signs of proteinuria and kidney failure?

The kidney does two important jobs in the body. It filters out the waste products in the blood so it can be released in the form of urine. It also reabsorbs those materials the body still needs which got past the original filtering system. However, there are certain things in the blood which do not get past the filtering system of the kidney simply because they are too big. The red and white blood cells are a good example. These cells are entirely too large to pass through the tiny "holes" of the filter. This is good thing because we would otherwise need a blood transfusion every time we went to the bathroom.

Proteins are large molecules which help make up our muscles, important parts of our immune system, and many other portions of our bodies. Most proteins are also too large to pass through the filtering system of the kidney. And since they are not supposed to pass into the kidney, there is no mechanism for proteins to be reabsorbed if they make it in there. Therefore, if protein is detected in the urine, it means there is something going on with the filter (called the glomerulus) that is allowing the proteins to pass.

Infections, diseases that only involve these microscopic filters and diseases which affect the kidney as a whole are all examples of processes that might cause protein in the urine. However, a child who is otherwise growing well, not losing a very large amount of protein in the urine, and has a normal blood pressure, the most common cause of protein in the urine is called benign orthostatic proteinuria. Simply put, it means protein shows up in the urine whenever the child is standing. It causes no harm except to strike fear in concern of the parents of the children who have it.

The diagnosis of benign orthostatic proteinuria is easily made by getting a urine sample from the very first void of the morning. The night before the urine sample is to be obtained; the child completely empties his bladder and then hops right into bed. Then, the urine
A sample is obtained without ever standing in the morning. In other words, the urine is obtained at the bedside. If this sample has no protein in it and the child is otherwise healthy and has a normal blood pressure, the fact that the urine during the day (i.e. when he is standing) has protein in it is much less likely to be concerning.

Large amounts of protein in your urine may cause it to look foamy in the toilet. Also, because the protein has left your body, your blood can no longer soak up enough fluid and you may notice swelling in your hands, feet, abdomen, or face. These are signs of very large protein loss. More commonly, you may have proteinuria without noticing any signs or symptoms. Testing is the only way to find out how much protein you have in your urine.

There are over a hundred different types of proteins in the blood and the kidneys are very good at keeping them from entering the urine. Most of the protein that does make it into the urine are reabsorbed, chewed up and returned to the blood. As a result, less than 150 mg of protein is normal lost in the urine per day. A higher level of protein loss in the urine is called proteinuria and may mean there is kidney disease.

The most important urine proteins found with kidney disease are albumin and antibody fragments. Albumin is the most abundant protein in the blood and it is important in transporting other things around the body as well as keeping fluid from leaking out into the tissues. Antibody fragments result from diseases involving the cells that produce antibodies (such as multiple myeloma). When the kidneys are unable to absorb all of them, they spill over into the urine.

Once protein is found in the urine, it is often important to measure how much is protein is lost in a day. Collecting urine for a 24-hour period (24-hour urine collection) and then measuring all the protein in it been considered the gold standard. However, because it is very inconvenient and prone to error if the urine isn’t collected properly, we usually use the urine protein (or albumin) to creatinine ratio.
instead. It is requires only a small sample of urine and it is relatively accurate and convenient.

Transient proteinuria is the most common cause of proteinuria and been estimated to affect between 4-7% of people. It is a temporary process that is thought to be caused by fever, heavy exercise, and other benign conditions. The amount of protein in the urine is relatively small and usually resolves pretty quickly. Proteinuria that is constant or persistent is more likely to be a problem and may require a workup. It is usually caused by diseases involving the glomerulus, the filtering device of the kidneys. The most common cause is diabetes mellitus but it many other diseases, conditions, and even medications can cause it.

Working Up of Protein in Urine

Unless there is a lot of protein in the urine, the first thing to do is determine if it is persistent (found on three occasions) or not. If it is, a workup is usually started which includes quantifying the amount of protein in the urine, performing a careful medical history and physical exam, looking at the urine under a microscope, and obtaining various laboratory tests. In some cases, particularly if there is severe protein loss or signs of kidney failure, a kidney biopsy may be necessary.

Treating Protein in the Urine

Specific treatment depends on diagnosis and amount of protein being lost. Most everyone should be treated with an ACE inhibitor (or angiotensin blocker) and good blood pressure control. Many people with low-grade protein will receive no additional treatment. Some people, especially those with autoimmune or inflammatory diseases, may be started on powerful drugs affecting their immune system. Again, the cause of the proteinuria is key to choosing a particular treatment.

High levels of protein loss can lead to a condition called nephrotic syndrome, which typically causes a lot of problems with fluid...
retention and swelling (edema) as well cholesterol and lipid problems (hyperlipidemia). If it is severe enough, you may develop blood clots, infections or malnutrition.

**Knowing the Prognosis**

The prognosis depends on diagnosis and amount of protein being lost, in general, the larger the protein loss, the worse the prognosis. Many people with no obvious cause and relatively small amounts of protein loss (less than 1-2 grams of protein) do reasonably well without treatment. Unfortunately, there are also a number of serious kidney diseases that can lead to kidney failure.

What are the tests for proteinuria?

To test for proteinuria, you will need to give a urine sample. A strip of chemically treated paper will change color when dipped in urine that has too much protein. Laboratory tests that measure exact amounts of protein or albumin in the urine are recommended for people at risk for kidney disease, especially those with diabetes. The protein-to-creatinine or albumin-to-creatinine ratio can be measured on a sample of urine to detect smaller amounts of protein, which can indicate kidney disease. If the laboratory test shows high levels of protein, another test should be done 1 to 2 weeks later. If the second test also shows high levels of protein, you have persistent proteinuria and should have additional tests to evaluate your kidney function.

Your doctor will also test a sample of your blood for creatinine and urea nitrogen. These are waste products that healthy kidneys remove from the blood. High levels of creatinine and urea nitrogen in your blood indicate that kidney function is impaired.

How is proteinuria treated?

If you have diabetes, hypertension, or both, the first goal of treatment will be to control your blood glucose and blood pressure. If you have diabetes, you should test your blood glucose often, follow a healthy eating plan, take your medicines, and get plenty of
exercise. If you have diabetes and high blood pressure, your doctor may prescribe a medicine from a class of drugs called ACE (angiotensin-converting enzyme) inhibitors or a similar class called ARBs (angiotensin receptor blockers). These drugs have been found to protect kidney function even more than other drugs that provide the same level of blood pressure control. The American Diabetes Association recommends that people with diabetes keep their blood pressure below 130/80.

People who have high blood pressure and proteinuria but not diabetes also benefit from taking an ACE inhibitor or ARB. Their blood pressure should be maintained below 130/80. To maintain this target, you may need to take a combination of two or more blood pressure medicines. Your doctor may also prescribe a diuretic in addition to your ACE inhibitor or ARB. Diuretics are also called "water pills" because they help you urinate and get rid of excess fluid in your body.

In addition to blood glucose and blood pressure control, the National Kidney Foundation recommends restricting dietary salt and protein. Your doctor may refer you to a dietitian to help you develop and follow a healthy eating plan.

Points to Remember

- Proteinuria is a condition in which urine contains an abnormal amount of protein.
- The term albuminuria is also often used because some tests measure this protein specifically and it is the major type of protein in the urine.
- Proteinuria may be a sign that your kidneys are damaged and that you are at risk for end-stage renal disease.
• Several health organizations recommend that people be regularly checked for proteinuria so that kidney disease can be detected and treated before it progresses.

• Groups at risk for proteinuria and kidney failure include African Americans, American Indians, Hispanic/Latinos, Pacific Islander Americans, people who have diabetes or hypertension, and people who have a family history of kidney disease.

• You may have proteinuria without noticing any signs or symptoms. Testing is the only way to find out how much protein you have in your urine.

• If you have diabetes or hypertension, or both, the first goal of treatment will be to control your blood glucose and blood pressure.

What is proteinuria?

Proteinuria means the appearance of protein in the urine. It is usually detected by a simple dipstick test of the urine. In some circumstances it is detected on a routine check. Usually there are no symptoms from it.

What causes proteinuria?

Protein should not normally appear in the urine in detectable quantities. It is usually kept in the blood by the filtering units (glomeruli) within the kidney. Proteinuria is an indicator that the kidneys are damaged in some way. Diseases that affect the filtering units themselves are the most common cause of heavy proteinuria. Sometimes this is called glomerulonephritis, meaning inflammation of the glomeruli. Just as some examples, any of the causes of nephrotic syndrome could be causes of proteinuria.

What is the protein?
A dipstick test of the urine detects albumin, which is an important protein component of the blood. Even small amounts of protein may be detected on dipstick testing. The dipstick test does not give an accurate concentration of protein and can be affected by the overall volume of urine. One way to assess how much protein is passed into the urine per day is to collect all the urine passed over 24 hours in a normal day. Occasionally special tests can be done to detect even a lower level of protein in the urine, called microalbuminuria.

Is the proteinuria always a bad thing?

High levels of proteinuria are always important, however proteinuria that is small in amount and comes and goes is not as significant. Sometimes low levels of proteinuria are early signs of kidney disease that can get worse with time. Some examples of proteinuria that are not so important are:

- When it only occurs following strenuous exercise
- When it only occurs with a fever
- When it is absent in the morning but occurs later in the day (orthostatic proteinuria)
- When it occurs only during a urine infection

Presence of protein in urine requires careful evaluation. Many children have transient excretion of mild quantity of protein in urine. It usually has no obvious cause and resolves spontaneously. Large amounts of protein in urine as detected by a quantitative test on 24 hour urine indicates a problem with the filtration of the kidney as in conditions such as nephritis or nephrotic syndrome. Further blood and urine tests can confirm the diagnosis. Blood in stools do not cause proteinuria nor does epilepsy.

Nephrotic Syndrome
Nephrotic syndrome occurs when there is a heavy leakage of protein, so that the blood levels of protein fall. It often causes ankle swelling and fluid retention, and can cause other problems too. Nephrotic syndrome is described elsewhere if you need to know more about it.

Protein in Urine

There are over a hundred different types of proteins in the blood and the kidneys are very good at keeping them from entering the urine. Most of the protein that does make it into the urine are reabsorbed, chewed up and returned to the blood. As a result, less than 150 mg of protein is normal lost in the urine per day. A higher level of protein loss in the urine is called proteinuria and may mean there is kidney disease.

Types of Urine Protein

The most important urine proteins found with kidney disease are albumin and antibody fragments. Albumin is the most abundant protein in the blood and it is important in transporting other things around the body as well as keeping fluid from leaking out into the tissues. Antibody fragments result from diseases involving the cells that produce antibodies (such as multiple myeloma). When the kidneys are unable to absorb all of them, they spill over into the urine.

Screening for Urine Protein

The easiest method to screen for protein is the urine dipstick. It is good at detecting a large amount of protein the urine, but not as good for smaller amounts (microalbuminuria). In certain people, particularly those with diabetes, it is important to know when there is even a small amount of protein or albumin in urine. In this case, you need to measure the "urine albumin" directly.

Quantifying Urine Protein

Once protein is found in the urine, it is often important to measure how much is protein is lost in a day. Collecting urine for a 24-hour
period (24-hour urine collection) and then measuring all the protein in it been considered the gold standard. However, because it is very inconvenient and prone to error if the urine isn’t collected properly, we usually use the urine protein (or albumin) to creatinine ratio instead. It is requires only a small sample of urine and it is relatively accurate and convenient.

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Persistent Protein in the Urine
Proteinuria that is constant or persistent is more likely to be a problem and may require a workup. It is usually caused by diseases involving the glomerulus, the filtering device of the kidneys. The most common cause is diabetes mellitus but it many other diseases, conditions, and even medications can cause it.

Working Up of Protein in Urine
Unless there is a lot of protein in the urine, the first thing to do is determine if it is persistent (found on three occasions) or not. If it is, a workup is usually started which includes quantifying the amount of protein in the urine, performing a careful medical history and physical exam, looking at the urine under a microscope, and obtaining various laboratory tests. In some cases, particularly if there is severe protein loss or signs of kidney failure, a kidney biopsy may be necessary.

Treating Protein in the Urine
Specific treatment depends on diagnosis and amount of protein being lost. Most everyone should be treated with an ACE inhibitor (or angiotensin blocker) and good blood pressure control. Many people with low-grade protein will receive no additional treatment. Some people, especially those with autoimmune or inflammatory diseases,
may be started on powerful drugs affecting their immune system. Again, the cause of the proteinuria is key to choosing a particular treatment.

Understanding the Complications
High levels of protein loss can lead to a condition called nephrotic syndrome, which typically causes a lot of problems with fluid retention and swelling (edema) as well cholesterol and lipid problems (hyperlipidemia). If it is severe enough, you may develop blood clots, infections or malnutrition.

Knowing the Prognosis
The prognosis depends on diagnosis and amount of protein being lost in general, the larger the protein loss, the worse the prognosis. Many people with no obvious cause and relatively small amounts of protein loss (less than 1-2 grams of protein) do reasonably well without treatment. Unfortunately, there are also a number of serious kidney diseases that can lead to kidney failure.

What further investigations are needed?
In trying to find out the cause of proteinuria doctors will want to know about any previous illnesses, operations and treatment that you may have had for any medical condition in the past. They will also want to know if anyone in your family has had any kidney diseases. It will also be important to know about your general health, and particularly to know your blood pressure and the results of some tests of how well the kidney works. You will be tested for diabetes. More detailed tests may include the analysis of a 24 hour collection of urine and kidney scans or X-rays. Sometimes a kidney biopsy may be suggested, although this is not usually required unless the level of protein leakage is high, or if there are other signs of kidney disease.

Measurement
Proteinuria is often diagnosed by a simple dipstick test although it is possible for the test to give a false negative even with nephrotic range
proteinuria if the urine is dilute. False negatives may also occur if the
protein in the urine is composed mainly globulins or Bence-Jones
Proteins because the reagent on the test strips, Bromphenol blue, is
highly specific for albumin. [6][7] Traditionally dipstick protein tests
would be quantified by measuring the total quantity of protein in a
24-hour urine collection test, and abnormal globulins by specific
requests for Protein electrophoresis.[8][9]

Alternatively the concentration of protein in the urine may be
compared to the creatinine level in a spot urine sample. This is
termed Protein/Creatinine Ratio (PCR). The 2005 UK Chronic Kidney Disease guidelines states that PCR is a better test than 24
hour urinary protein measurement. Proteinuria is defined as a
Protein:creatinine ratio >45 mg/mmol (which is equivalent to
Albumin:creatinine ratio of >30 mg/mmol) with very high levels of
nephrotic syndrome being for PCR > 100 mg/mmol.[10]

Associated conditions

Proteinuria may be a sign of renal (kidney) damage. Since serum
proteins are readily reabsorbed from urine, the presence of excess
protein indicates either an insufficiency of absorption or impaired
filtration. Diabetics may suffer from damaged nephrons and develop
proteinuria.

With severe proteinuria, general hypoproteinemia can develop which
results in diminished oncotic pressure. Symptoms of diminished
oncotic pressure may include ascites, edema, and hydrothorax.

Conditions with proteinuria as a sign

Proteinuria may be a feature of the following conditions:[7]

- Nephrotic syndromes (i.e. intrinsic renal failure)
- Pre-eclampsia
- Eclampsia
- toxic lesions of kidneys
• Collagen vascular diseases (e.g., systemic lupus erythematosus)
• Dehydration
• Glomerular diseases, such as membranous glomerulonephritis, focal segmental glomerulonephritis, minimal change disease (lipoid nephrosis)
• Strenuous exercise
• Stress
• Benign Orthostatic (postural) proteinuria
• Focal segmental glomerulosclerosis (FSGS)
• IgA nephropathy (i.e., Berger's disease)
• IgM nephropathy
• Membranoproliferative glomerulonephritis
• Membranous nephropathy
• Minimal change disease
• Sarcoidosis
• Alport's syndrome
• Diabetes mellitus
• Drugs (e.g., NSAIDs, nicotine, penicillamine, gold, ACE inhibitors, antibiotics, opiates especially heroin. [11]
• Fabry's disease
• Infections (e.g., HIV, syphilis, hepatitis, post-streptococcal infection)
• Aminoaciduria
• Fanconi syndrome
• Heavy metal ingestion
• Hypertensive nephrosclerosis
• Interstitial nephritis
• Sickle cell disease
• Hemoglobinuria
• Multiple myeloma
• Myoglobinuria
• Organ rejection- kidney transplant patients may have gamma-globulins in their urine if the kidneys start to reject. [12]
• Ebola hemorrhagic fever
• Nail Patella Syndrome
• Familial Mediterranean fever
This list is an incomplete list

Conditions with proteinuria consisting mainly of Bence-Jones proteins as a sign

- Waldenstrom's macroglobulinemia
- Chronic lymphocytic leukemia
- Amyloidosis
- Malignancies (e.g., lymphoma, other cancers)
- multiple myeloma

How to prepare for the test:

Your health care provider may tell you to temporarily stop taking any drugs that can interfere with test results.

Drugs that can affect measurements include:

- Acetazolamide
- Aminoglycosides
- Amphotericin B
- Cephalosporins
- Colistin
- Griseofulvin
- Lithium
- Methicillin
- Nafcillin
- Kidney damaging drugs
- Oxacillin
- Penicillamine
- Penicillin G
- Phenazopyridine
- Polymyxin B
- Salicylates
- Sulfonamides
- Tolbutamide
- Viomycin
The following may also interfere with test results.

- Severe emotional stress
- Strenuous exercise
- Receiving a special dye (contrast media) for a radiology exam within 3 days before the urine test

Urine contaminated with vaginal secretions

What are the treatments?

If the amount of proteinuria is high or if the kidney function is affected it is particularly important to find out the cause. Heavy proteinuria can damage the kidney if it is present over a long period of time. The treatments may differ depending on the cause of the proteinuria - if this is known. It is essential that anyone with proteinuria is monitored over time. However for most people, who have a lower level of proteinuria, the right thing is simply to monitor urine tests, blood pressure and kidney function over a prolonged period. If things are stable this may be just once a year and these tests need not be always undertaken from hospital or by specialists. All nephrologists will recommend paying particular attention to ensuring good blood pressure control, however well the kidneys are working.

Blood Pressure and Urine Protein Levels with the Least Risk for Worsening Kidney Disease

Chronic kidney disease can cause a gradual and progressive loss of function in both kidneys. Most patients with chronic kidney disease have high blood pressure (hypertension) and high levels of protein in their urine (proteinuria). Doctors use drugs called antihypertensive agents to reduce both blood pressure and protein in urine. Some of these drugs, such as angiotensin-converting enzyme (ACE) inhibitors, clearly prevent worsening kidney function.
Guidelines recommend that doctors reduce blood pressure to less than 130/80 mm Hg in patients with kidney disease. Some recommend reducing blood pressure to even lower levels (<125/75 mm Hg) in patients who lose more than 1 gram of protein in their urine per day. A few studies, however, suggest that reducing blood pressure too much may be harmful and increase the risk for heart attacks. Whether very low blood pressure could worsen kidney function is also questioned. To determine the levels of blood pressure and protein in urine that are associated with the lowest risk for worsening kidney disease.

Higher systolic (the top number), but not diastolic (the bottom number), blood pressure was strongly related to risk for worsening kidney function. Risks for higher systolic pressure were marked in patients with urine protein levels greater than 1.0 gram daily and were not apparent in patients with urine protein levels less than 1.0 gram daily. Patients with systolic pressures of 110 to 129 mm Hg and urine protein levels of less than 1.0 gram daily had the lowest risk for worsening kidney disease. Very low systolic pressure (<110 mm Hg) was associated with increased risk for worsening kidney disease.

Systolic blood pressure of 110 to 129 mm Hg is associated with the least risk for progression of kidney disease in patients with urine protein levels greater than 1.0 gram daily.