

# Glomerulonephritis

Glomeruli are the filters of our kidneys. We should have about a million in each kidney. They are tiny - you can fit 10 side by side on the head of a pin. A tube (tubule) leading out of each is actually a processing device from which 99% of the filtered fluid is reprocessed back into the blood, leaving waste products, excess salt and so on to flow out into urine.

So glomeruli filter over 150 litres of blood each day into the tubules, but only 1-2 litres of this remains at the end of all the nephrons to make urine.

## What happens when glomeruli go wrong?

Three types of problem:

### 1. They leak protein or blood:

- **Proteinuria** is when protein leaks into the urine; (detailed info about [proteinuria](#)). The main protein is albumin; so proteinuria may be called albuminuria. When the leak is very severe it causes [nephrotic syndrome](#). This is when the leak is so large that the levels of protein in the blood fall. This leads to the kidneys retaining salt and fluid, and the excess fluid collects as swelling (oedema) of the ankles and legs, or of the face and abdomen (these last two especially in children).
- **Haematuria** means blood in the urine; (detailed info on [haematuria](#)). Red blood cells should normally be kept in the blood stream at the filters (glomeruli). When the glomeruli develop big holes, for instance caused by inflammation, they can leak blood. If the blood is visible to the naked eye it is called macroscopic haematuria. Usually it is much less than you can see and is only detected by a urine dipstick test - this is called microscopic haematuria.

### 2. High blood pressure:

[High blood pressure](#) occurs in most kinds of glomerulonephritis, and can lead to further kidney damage.

### 3. Loss of filtering power:

If you lose a few glomeruli, the others can compensate. But if you lose a lot you lose filtering capacity, so your kidneys don't work properly, and waste products

build up in the blood. Filtering capacity is called Glomerular Filtration Rate, GFR. You can lose 75% of filtering capacity before you start to feel unwell from it. A sudden severe reduction in GFR is [acute kidney injury \(AKI or ARF\)](#). Long-term reduced GFR is known as [CKD \(chronic kidney damage\)](#).

### What can damage glomeruli?

- A congenital or inherited problem with some part of the glomeruli. The most common example is [Alport's syndrome](#). There are others, usually rare diseases.
- Inflammation - either the kidneys alone or as part of a disease affecting other organs too. See the causes in the next section.
- Other problems can disturb some of the very special cells in the glomerulus so that they leak protein.
- In diabetes extra material can be deposited in the glomerulus and it doesn't work properly.
- Different causes of damage cause different types of glomerulonephritis.

### What are the common kinds of glomerulonephritis?

The table shows some of the more common causes of glomerulonephritis (GN). There are some rare kinds too though.

	<b>Proteinuria</b>	<b>Haematuria</b>
<b><a href="#">Minimal change</a></b> - Causes most cases of nephrotic syndrome in children but some in adults too. Unlikely to cause renal failure.	++++	-
<b><a href="#">Focal and segmental glomerulosclerosis (FSGS)</a></b> - Can cause nephrotic syndrome in adults. Those with other types of FSGS can progress to renal failure.	++++	-

<p><b><u>Membranous nephropathy</u></b> - Causes proteinuria or nephrotic syndrome. Cause is usually unknown, but sometimes drugs, other diseases or cancer can cause it. Some cases get better; others deteriorate.</p>	+++	-
<p><b><u>Diabetes</u></b> - After many years of diabetes the kidneys may start to leak protein. This is more likely to happen if the blood sugar or blood pressure are poorly controlled.</p>	+++	-
<p><b>Amyloid</b> - Special protein deposited in the kidney. Can cause <u>nephrotic syndrome</u> and renal failure.</p>	++++	-
<p><b><u>Lupus</u></b> - A common cause of glomerulonephritis in young women. Can cause different types of glomerulonephritis. The worst ones need powerful treatment to prevent irreversible kidney damage.</p>	++++	+ to +++
<p><b>Mesangio-capillary GN (MCGN) or Mesangio proliferative GN, (MGPN)</b>- Can be caused by persistent infections (e.g. endocarditis, hepatitis B or C), other diseases, or can occur alone.</p>	++	++
<p><b><u>IgA</u></b> - Most common cause worldwide (see later text)</p>	+/-	++

<p><b>Post-infectious</b> - Less c</p> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;"> <p><b>Crescentic nephritis</b> - Also known as rapidly progressive GN. A severe and usually very acute type of kidney inflammation that can cause loss of kidney function within days to weeks. It can be caused by several conditions on this list, and a few more.</p> </div> <p>ommon now than in the past. Occurs after an infection, often Streptococcal throat or skin infection. Causes with haematuria, proteinuria, high blood pressure, fluid retention, reduced GFR. Usually gets better if the infection clears up.</p>	+	+++
<p><b>Vasculitis</b> - Inflammation of small blood vessels in the glomerulus. Often caused by diseases that affect other organs too e.g. Microscopic polyangiitis, Wegener's disease. If severe, can cause crescentic nephritis (see text).</p>	+	++++

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## How do you make the diagnosis?

Sometimes the diagnosis is obvious from blood and urine tests. However other times a kidney biopsy is necessary to take a closer look at the kidney under a microscope. A scanner is used to find the kidney first, then under local anaesthetic a needle is placed into the kidney through the back. A very small sample of the kidney is taken.

## Can glomerulonephritis be treated?

Some types of glomerulonephritis can be cured, others can be stopped, and most can at least be slowed down. Here are some examples, but click on the links in the table above for more information.

- Minimal change disease does not cause permanent kidney failure but needs treatment to stop the protein leak. Most types of post-infectious glomerulonephritis get better if the infection does.
- Membranous nephropathy can either get better or worse, but can be treated if it gets worse.
- Crescentic glomerulonephritis can result in kidney failure very quickly, but this can often be stopped or even reversed by prompt treatment.
- Others (see table) can progress over different periods of time. Dialysis or kidney transplantation may eventually be required for some.

## Glomerulonephritis can be treated in two ways:

### General treatments - for all types

Blood pressure is often high in patients with kidney disease, and can worsen kidney damage so it is important to treat it. A type of blood pressure drug known as an ACE inhibitor has been proven to be particularly good at protecting kidney function and reducing the amount of protein in the urine, even if blood pressure is not high. Blood pressure should be 130/75 mmHg or ideally less. Blood pressure may need to be controlled using more than one type of medicine. More info on [blood pressure treatment](#) in kidney disease.

### Disease-modifying treatments - for some types

Because many types of glomerulonephritis are due to our immune system, treatments can involve drugs that dampen down the immune system and reduce

inflammation in the kidney (immunosuppressants). For example, steroids (e.g. prednisolone), cyclophosphamide, azathioprine, ciclosporin and mycophenolate mofetil (MMF). These are strong drugs which can have serious side-effects but which can rescue kidney function in some severe types of glomerulonephritis (e.g. crescentic nephritis). Because of this they are often only used for those patients with severe disease or rapidly worsening kidney function. However steroids alone are used frequently for treatment of minimal change disease as it usually responds fully to treatment (although it may relapse and need re-treatment). More info on [immune-suppressing drugs and the kidney](#).

## **Further info**

[Glomerulonephritis teaching](#) (edrep textbook)

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