Kidney Health Information

Kidney Stones

Kidney stones are common, especially in men. How common they are depends on your age, diet, and where you live.

Stones usually occur between the ages of 30-60. Over a lifetime, around 12% of men and 6% of women have kidney stones at least once. Rates for males are increasing.

The pain of kidney stones can be intense

Kidney stones can cause disabling pain, bleeding and infection in the kidneys. Usually it is a very painful, but temporary problem. In extreme cases it can lead to a decrease of kidney function, even kidney failure.

Kidney stones are also known as renal stones, renal calculi, urolithiasis and nephrolithiasis. (uro- = of the ureter and nephro- = of the kidney).

Kidney stones - what are they and what are the causes?

- kidney stones range in size from microscopic to stones the size of potatoes, with a smooth or jagged texture
- they can form anywhere in the kidneys, ureters or the bladder
- 80% of kidney stones contain calcium
- some contain calcium phosphate – the material that makes bones hard
- uric acid can be present (the chemical that causes gout)
- cystine (one of the amino acids that form proteins) is a rare cause
- 'staghorn' calculi form inside the drainage canals (pelvis) of the kidney. They are composed of 'struvite', a mixture of ammonium, calcium and phosphate. This type is often caused by infection. It can cause a progressive decline in kidney function.

Usually the compounds that form kidney stones pass out in the urine without trouble, but any of the following can encourage stone growth:

- concentrated urine; perhaps not enough fluid is being taken
- substances that prevent crystal formation are present in some people, but may be reduced in others
- cysts or scars in the kidneys may encourage stone formation

- kidney stones can result from certain drugs becoming concentrated in the urine

Common Symptoms

Kidney stones can cause intense pain and blockage as they pass downwards. Any or some of the following symptoms are noticed:

- severe loin pain that comes and goes (in the back or side between the pelvis and lower rib). This is known as renal colic. The pain can move down into the groin or genitals
- nausea
- difficulty in passing urine
- any blockage could cause a loss of kidney function
- visible or microscopic traces of blood in the urine
- symptoms are not always present – staghorn stones (see above) do not always cause problems – at first
- infection of the kidneys is more likely if stones are present.

Certain groups of people are more likely to develop stones:

- more common in the white population than in UK Asians. The black population has the lowest frequency of all
- if a family member has had them
- if high blood pressure is present

- people with raised levels of calcium in their blood. An over active parathyroid gland is the most common cause. Treatment will correct the problem
- anything that increases loss of calcium from bones
- having too much calcium in the urine. Rarely due to diet – a low calcium diet may be worse! (See treatment)
- normal urine is acidic. A reduction in acidity can cause some chemicals and minerals to form stones. For example calcium phosphate stones will form if the urine is too alkaline
- certain conditions or diseases encourage the formation of kidney stones:
    - ❖ diarrhoea that is longstanding: there is a tendency to form calcium oxalate stones
    - ❖ persistent urinary infections. These seem to be ideal conditions for staghorn calculi
    - ❖ diseases of the bowel like *Crohns' disease* can lead to an increased amount of oxalate in the urine
    - ❖ *medullary sponge kidney* – tiny stones form in the kidney in this condition
    - ❖ a few people with *renal tubular acidosis* tend to form calcium phosphate stones.

Diet can encourage the formation of stones:

- by not drinking enough liquids
- not enough calcium in the diet – the best sources are milk, cheese and green leafy vegetables
- however taking calcium supplements may increase kidney stone formation
- diets that are high in protein, especially meat, and also high in sodium (table salt) encourage the formation of stones
- a few people have higher levels of oxalate in the urine (hyperoxaluria). This chemical is from the breakdown of proteins and vitamin C during digestion. The amount of oxalate absorbed in the intestines depends on how much calcium is taken in the diet. calcium oxalate stones can be formed if there is **too little** calcium in the diet
- the area of diet and how it relates to kidney stone formation is complex – certain cases will be reviewed by a dietician.

Diagnosis

Kidney stones are easy to diagnose for those with a sudden onset of pain, blood in the urine and stones that show on x-ray. For others, diagnosis is less straight forward as:

- plain x-rays do not 'see' stones not made of calcium, like those containing uric acid. Small stones and those in front of bones do not show up either

- intravenous urography (IVU) is an older test that may be used for stones that X-ray cannot show. Dye is injected into a vein and X-ray studies are taken as it passes through the kidneys. Any problems with the passage of urine out of the body also show
- CT scanning shows all stones well
- ultrasound scanning is less good at seeing stones but can show if a blockage is present. It is an option in pregnancy
- levels of calcium and uric acid in the blood will be examined
- any stone passed out of or removed from the body is analysed to identify the constituents.

Where people repeatedly form stones there will be:

- a full metabolic evaluation and measurement of certain substances in the urine and blood
- a dietary assessment.

Treatments - aim to relieve symptoms, deal with complications and prevent the formation of more stones.

- management of pain
- medication to relieve any nausea
- intravenous fluids may be given if needed
- the diagnosis will be confirmed using the tests detailed above

- small stones (smaller than 5mm) usually pass by themselves within 72 hours. Any stones should be kept for analysis
- tests are repeated to confirm that the stone has passed out of the body.

Stones of up to 9mm in size may pass, but those larger will not and more active treatment is needed. This is urgent if a blockage occurs.

- extracorporeal shockwave lithotripsy (ESWL) – often used when stones are in the kidney or upper ureter. The 'shock' waves are aimed towards the stone from a probe placed outside the body. The stone breaks into small pieces and leaves the body naturally
- if necessary, stones can be removed using the techniques of 'keyhole' surgery. This procedure is known as 'nephrolithotomy'
- staghorn calculi or other very large stones may require conventional surgery.

Prevention

Studies have shown that 15% of those with a stone develop another within a year and 33% within 5 years. These rates can be halved by drinking more that 2 litres of fluid each day.

For those who form more than one or two stones, an examination of metabolism should find any underlying causes. Treatments can be taken from the following options:

- a dietician who can help with dietary changes
- drug medication can also be used
- treatment with 'thiazide' diuretics to reduce the amount of calcium lost in the urine. This discourages the formation of calcium stones
- treatment with allopurinol reduces production of uric acid in the body.

The acidic and alkaline balance in the urine can be adjusted if necessary – for example:

- potassium citrate can be given.

Finding out more:

Kidney stones information from EdREN:
http://renux.dmed.ed.ac.uk/EdREN/EdRenINFObits/KidStonesLong.html

Kidney stone information from the National Institute of Diabetes and Digestive and Kidney Disorders (USA):
http://kidney.niddk.nih.gov/kudiseases/pubs/stonesadults/index.htm

Information on obstruction from EdREN:
http://renux.dmed.ed.ac.uk/EdREN/EdRenINFObits/Obstruction.html

Below is some information into our recent projects into kidney stones:

2004 Dr Michael Stechman. A genetic mouse model for renal stone disease. Almost half of patients will have a genetic tendency to form kidney stones and an ongoing study funded by Kidney Research UK aims to identify and understand the causes. For more information, please go to: http://www.kidneyresearchuk.org/images/pdfs/research/stechman.pdf

2003 Dr J Kavanagh. Stone growth and crystallisation inhibitors. Another of our current funded studies considers prevention of kidney stones by

- Controlling the diet
- Citrate therapy

For more information please go to :http://www.kidneyresearchuk.org/images/pdfs/research/kavanagh.pdf

2002 Dr J A Sayer. What causes kidney stones? This studies the formation of kidney stones, from their initial formation as tiny crystals, in solution. Next the problem of why the crystal grows into stones inside the renal system, instead of being passed out in the urine was considered. For more information please go to: http://www.kidneyresearchuk.org/images/pdfs2/research/sayerresults.pdf

2001 Dr J Kavanagh. The Stone Farm. A system designed to imitate the formation of kidney stones and any factors that would slow or inhibit their growth. For more information, please go to:
http://www.kidneyresearchuk.org/images/pdfs2/research/kavanaghresults.pdf

2000 Professor R V Thakker. Kidney stones affect 12% of men and 5% of women by 70 years of age. This disorder may be genetically related in 45% of cases, suggesting a genetic link. This study aims to test that possibility. For more information, please go to:
http://www.kidneyresearchuk.org/images/pdfs2/research/thakkerresults.pdf

2000 Professor Whittaker. Influence of the chemistry of chlorides in the urine and the formation of stones. This study aims to see whether the removal of certain stone forming elements and the addition of other inhibiting elements in the urine will prevent renal stone formation in healthy people. For more information, please go to:
http://www.kidneyresearchuk.org/images/pdfs2/research/whittakerresults.pdf

Illustration produced by Beth Shortt (www.bethshortt.com)

Kidney Research UK, Kings Chambers, Priestgate, Peterborough PE1 1FG
Kidney Health Information telephone number: 0845 300 1499
Or email: kidneyhealth@kidneyresearchuk.org
If you would like to make a donation please call free on 0800 783 2973

Registered Charity Number: 252892 VG11/06