Cystinuria
– information for patients

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What is cystinuria?

Cystinuria is a rare condition that causes kidney stones. It affects approximately 1 in 7000 people and affects men and women equally. Symptoms usually occur between 10 and 30 years of age.

The kidney contains millions of tiny filters called nephrons that make urine and help control the level of salts and minerals within our body. A normal kidney will filter everything, except for blood and protein, into the tubule (small tube) of the nephron. The tubules then take back everything the body needs to function properly but disposes of the things it does not.

In cystinuria a part of the tubule does not work properly (please see diagram) and is unable to reabsorb the amino acids; cystine, lysine, ornithine and arginine. This results in high levels of these amino acids in the urine. The only one of the amino acids that causes a problem is cystine, as it does not dissolve very well in the urine. Therefore it is able to form crystals which then grow into cystine stones.

Patients are usually unaware they have cystinuria until they develop their first kidney stone. Renal colic (severe pain in the back, side and groin area) is often the first sign.

However not all stones cause renal colic. Some stones are small enough to pass without causing any pain.
How is cystinuria diagnosed?

**Spot urine tests**

A spot urine sample can be performed at any time of day and only requires a small amount of urine. This type of test can be useful for initial screening. However further tests are usually required to confirm diagnosis.

**24 hour urine tests**

Diagnosis can be made by requesting specialist urine tests to see what is in your urine. You may be required to do a 24 hour collection which requires you to collect all the urine you pass over 24 hours into a container. To obtain an accurately timed specimen you should begin and end the collection period with an empty bladder. For example:

Day 1, 08:00 – Void and discard first urine of the day. Collect all following urine for next 24 hours.

Day 2, 08:00 – Void and collect first urine of the day and add to previously collected urine. Stop collecting urine from this point.

**Stone analysis**

Kidney stone analysis is a test done on a kidney stone that has been passed in the urine or removed surgically. Kidney stones can be made up of different chemicals depending on the condition. Patients with cystinuria make stones purely made of cystine.

**Genetic testing**

A genetic blood test can look for changes in your DNA that indicate a diagnosis of cystinuria.
What effect will cystinuria have on me?

There is no cure for cystinuria, however with treatment and monitoring the outlook for patients with cystinuria is good. You should be able to work and take part in daily activities as normal. You may need to take time off work or college to attend clinic appointments, and should be allowed unrestricted access to toileting facilities. If you are being denied either of these please let your doctor or nurse know.

Despite the general outlook being positive, there are some complications that patients with cystinuria should be aware of, these are as follows;

• **Renal colic:**

Renal colic is when you experience moderate to severe pain caused by a stone travelling down the ureter (the small tube that takes urine away from the kidney). The pain is noticeable in the lower back, the side, and moving into the groin.

• **Kidney/urine infections:**

Patients with cystinuria are at an increased risk of developing kidney infections. The symptoms include pain on passing urine, and increased frequency or urge to pass urine.
• **Hydronephrosis:**
This is when the ureter becomes blocked and urine starts to backfill into the kidney. The kidney becomes enlarged and unable to function properly. The still urine within the kidney can also cause a very serious infection. It is important that this is treated as soon as possible to prevent further complications.

[Diagram showing normal kidney and hydronephrosis]

• **Kidney damage:**
Your kidneys can temporarily stop working when they are blocked but function can recover when the blockage is removed. However, rarely the kidney might become permanently damaged, caused by repeated infections, blockages, and scaring from surgery. Your kidney function will be regularly checked to monitor any kidney damage.
Who will look after me?

You will need to be managed by a specialist team of clinicians that may include the following:

- **Nephrologist**: A doctor who specialises in the kidneys who will monitor your kidney function and guide management to prevent new kidney stones forming

- **Urologist**: A doctor/surgeon who specialises in the urinary tract who will intervene and treat any cystine stones that have formed

- **Nurse Specialists**: Senior specialised nurses will help coordinate your care and monitor your progress if your condition is stable

What treatment is available?

Cystinuria is a lifelong condition and there is currently no cure available. However there are treatments, and ways of managing the condition, that can reduce the amount of cystine stones your body makes. The following methods and medications are used to manage cystinuria:

**High fluid intake**

Patients with cystinuria are encouraged to drink high amounts of fluid. This will ensure that your urine is diluted which will decrease the concentration of cystine in the urine. A lower concentration of cystine reduces the chance of forming a cystine kidney stone. The urine becomes more concentrated at night time and therefore we particularly encourage drinking extra before going to bed. The aim is to pass approximately 3 litres of urine a day, which may require drinking between 3.5–5 litres of fluid a day.

**Alkaline urine:**

Urine can be acidic or alkaline depending on what you drink and eat. Patients with cystinuria should have alkaline urine. This is because alkaline urine allows more cystine to dissolve in the urine, therefore leaving a lesser amount of available cystine to form a stone. The common medications used to make urine more alkaline are:
• **Potassium citrate**  
  – Liquid solution that needs to be diluted.

• **Effercitrate**  
  – Fizzy tablet which needs to be dissolved in water.

• **Sodium bicarbonate**  
  – Comes in tablet form; however the sodium load in the tablet can actually increase the risk of other types of stones. This is only used if patients are unable to tolerate other medications.

**Chelation therapy:**

A high fluid intake and alkaline urine is sometimes effective enough to reduce cystine in your urine to a safe level. However if cystine levels still remain too high you may be prescribed chelation medication. Chelating medicines breaks up the cystine molecule and then binds to the molecules preventing the molecules from sticking back together and forming a stone. Chelating medicines used to treat cystinuria are as follows:

• **Penicillamine**

• **Tiopronin (not licensed in UK)**

• **Captopril**

Most medicines are associated with having side effects, it is important that you report any suspected side effects to a health care professional. Penicillamine and tiopronin can potentially have serious side effects, it is therefore essential that you are monitored by a specialist team whilst taking these types of medication. If you experience a significant increase in mouth ulcers, joint pain, or develop a rash you should stop taking the medication and contact your specialist team. If you are planning pregnancy you should not take this medication as the effect of the medication on the foetus is unknown.
What happens if I make a new stone?

Some stones may not require immediate attention, and may even pass on their own if small enough. If the cystine stone is causing a blockage, causing pain, or is too big then you may require intervention. Your options for stone removal should be discussed with your urologist.

Will cystinuria affect my family?

Cystinuria is inherited in an autosomal recessive pattern. This means that a person must inherit two changed copies of the same gene in order to have cystinuria. If a person inherits one changed gene and one normal gene, then that person will be a healthy carrier. If both parents are carriers of the same changed gene, they may pass on either their normal gene or their changed gene to their child.

Each child of parents who both carry the cystinuria gene has a 25 % chance of inheriting a changed gene from both parents and being affected by cystinuria.

There is a 50 % chance that the child will inherit just one copy of the cystinuria gene. This means they will be healthy carriers like their parents. There is a 25 % chance that the child will inherit both normal copies of the gene and will therefore not have cystinuria or be a carrier of cystinuria. The chance remains the same in every pregnancy and is the same for boys and girls. Patients with cystinuria are advised to discuss any plans for pregnancy with their specialist team.

Autosomal recessive inheritance: both parents carriers

![Autosomal recessive inheritance diagram]

- **Parents**: Carrier, Carrier
- **Offspring**: Unaffected, Carrier, Carrier, Affected
Common investigations

Ultrasound scan
• An ultrasound scan can be requested to check for cystine stones within the kidney, or can be used to monitor existing cystine stones. The procedure is safe and painless. You’ll lie down and a probe will be placed on your skin. The probe sends out pulses of ultrasound which will detect your kidneys and any cystine stones.

X–Ray
• An X–ray is safe and painless, and is able to produce images of the entire urinary tract. However cystine stones can be difficult to see on X–ray as the X–ray energy passes through the stone.

CT scan
• A CT scan uses a series of X–rays taken at different angles to build a detailed picture of inside the body. They involve a significant dose of radiation and are therefore not used for routine monitoring.

Blood and urine tests
• You will have frequent blood tests to monitor your kidney function, and to monitor the level of waste products and minerals within your blood.
• You will have frequent urine tests to monitor for signs of infection. Increased levels of blood or protein in your urine may be an early indication of a stone being formed.

What should I do if I get renal colic?
Renal colic can be extremely painful and distressing. Small stones can often be passed (up to approximately 5mm) but can still be incredibly painful, although this is different for each patient. You can try and encourage the stone to be passed more quickly by increasing your fluid intake. Painkillers may help take away, or reduce, the amount of pain. Some people find that applying heat to the area can help (warm baths, heat pads etc.). If the stone has not passed within a few days you should contact your hospital team.
If you are having pain when passing urine you should have your urine checked for infection. Sometimes urine infections can cause pain in the same areas as renal colic.

You should seek medical advice if you have any of the following symptoms alongside renal colic:

- Fever, nausea, and vomiting
- No longer passing any urine
- Severe pain in the lower back or abdomen that can not be controlled with medication
- Single functioning kidney

**What can I do to help?**

The single most important thing patients can do to help themselves is to drink a lot of fluids (3.5–4 litres a day). The fluid does not need to be made up of entirely water. Fruit juices, tea and coffee, etc. all count towards fluid intake. Citrus fruit juices have the additional benefit of alkalinising (reducing acid) the urine (patients should be aware of the sugar content).

Patients should try to reduce the amount of salt in their diet. Research has shown that salt can increase the amount of cystine in the urine and therefore increase the risk of forming a stone. Patients should try not to eat more than 6g salt a day (about the size of a small teaspoon). Speak to your nurse, doctor, or dietitian if you would like further information on how to reduce salt in your diet.

Cystine comes from an amino acid call methionine which can be found in animal protein. Dairy products, fish, and meat can be high in methionine. The effect of restricting dietary methionine on the level of cystine in your urine is yet to be proven. Patients should therefore try to maintain a healthy balanced diet but try not to consume animal protein in excessive amounts.
Further information and support groups

www.rarerenal.org
www.cystinuriauk.co.uk
www.cystinuria.com
www.rarekidneystones.org

Alternative names to Cystinuria

• CSNU
• Cystine Stones
• Cystinuria–Lysinuria
• Aminoaciduria
• Cystinuria with Dibasic–Aminoaciduria

Tips for clinic

There is a specialist kidney clinic for patients with cystinuria where you will be seen by a doctor or specialist nurse knowledgeable in the condition. Below are a few tips you can follow to make the most of your appointment:

• Write down any questions you may have because it can be easy to forget when you enter the busy clinic environment
• Write down any symptoms you may have experienced since your last clinic appointment. Make sure you include when the symptoms started and what makes them worse or better
• Never be afraid to double check and ask for things to be explained if you do not understand
• Ask for any words you do not understand to be written down and explained
• Write down a summary of any plans that have been made or any tests that have been booked
• Ask when your next clinic appointment will be
MyHealth@QEHB

MyHealth@QEHB is a secure internet based programme that allows you to view blood results, clinic letters, and much more. Speak to your nurse or doctor if you would like to find out more.

Help with health care costs

Information can be found in the leaflet HC11, “Are you entitled to help with health costs?” available from the cashiers office in the Queen Elizabeth Hospital, Birmingham.

Or visit www.nhs.uk/healthcosts

Useful contacts

Renal Metabolic Disease Nurse Specialist
Mobile: 07810 654 864
Office: 0121 371 8708

Renal Outpatients
Nurses: 0121 371 5635 or 0121 371 5633
Appointments: 0121 371 4447 or 0121 371 4446

The Trust provides free monthly health talks on a variety of medical conditions and treatments. For more information visit www.uhb.nhs.uk/health-talks.htm

Renal Outpatients Department
Queen Elizabeth Hospital Birmingham
Mindelsohn Way, Edgbaston, Birmingham B15 2GW
Telephone: 0121 627 2000