

Kidney damage during and after septicaemia

This factsheet explains how damage to the kidneys can occur in severe cases of septicaemia and how this might affect your child's recovery.

It is important to note that only a small proportion of children who experience kidney damage during their initial illness (acute kidney injury) will go on to have long term kidney damage (chronic kidney disease). Additionally, long term kidney damage can vary widely in severity so all of the information in this factsheet may not be relevant to your child.

Having a child hospitalised with such a severe life threatening illness is a very frightening time for the whole family. **It is important to remember that you are not alone.** Specialist staff at the hospital can provide information and support for you and your child. The meningitis charities can also help and can put you in touch with other families who have been through a similar experience.

What do the kidneys do?

The kidneys are an important part of the urinary system. The urinary system gets rid of waste that the body does not need, so that we can stay healthy and grow.

The kidneys filter blood and remove extra water and waste to produce urine. The kidneys also help regulate blood pressure, red blood cell production, levels of calcium and other minerals in the blood and perform important functions for a child's growth.

The urine produced by the kidneys is carried to the bladder via the ureters, where it is stored until we are ready to urinate through the urethra.

What is septicaemia?

Septicaemia is blood poisoning caused by large numbers of bacteria multiplying in the blood. The body has to try to fight the growing number of bacteria and at the same time fight the toxins that the bacteria release which make the person feel so ill.

Why might septicaemia damage the kidneys?

When the bacteria that cause meningitis and septicaemia invade the bloodstream they produce toxins that make the person feel ill and feverish. The bacterial toxins attack the lining of blood vessels and they start to leak, causing the rash of septicaemia. At the same time blood clots form making it difficult for blood to carry oxygen to all areas of the body.

The combination of reduced blood supply and high levels of bacterial toxins in the body can stop the kidneys working so that they are not able to filter the blood properly and get rid of extra water and waste from the body.

If the kidneys stop working correctly for a short period of time -- a few days or weeks, it is referred to as Acute Kidney Injury (AKI) or sometimes Acute Kidney Failure or Acute Renal Failure.

How is it AKI diagnosed and treated?

Children with septicaemia who are ill enough to need treatment in a paediatric intensive care unit (PICU) quite often have AKI, but with the right treatment it gets better in most cases.

The medical team will monitor your child for signs of kidney injury. They will measure how much urine your child produces and the amount of urea and creatinine in the blood. Urea and Creatinine are chemical waste products that healthy kidneys filter out, so high levels in the blood are an indicator of poor kidney function.

If kidney function does not get better, your child may need specific treatment while in PICU. This may include haemofiltration or **dialysis**, which uses special machines to help do the job of healthy kidneys by filtering the blood and removing waste products.

Will my child make a full recovery after AKI?

After AKI your child should have blood and urine tests to make sure that their kidneys are functioning properly. If kidney function recovers and stays normal for a period of time that satisfies the doctors that there is no lasting damage, these tests may no longer be necessary. If kidney function does not improve, then long term monitoring as an outpatient in a renal clinic may be necessary.

Research shows that around 80% of children with AKI as a result of meningococcal septicaemia regain full kidney function once they have recovered from the illness¹⁻², but the kidneys can be permanently damaged after AKI³⁻⁴. One study found that approximately 1% of patients were left with permanent kidney damage⁵. Permanent damage to the kidneys is called chronic kidney disease (CKD).

PLEASE NOTE: Information beyond this point is only relevant to children who have been diagnosed with permanent damage to their kidneys (CKD).

What is chronic kidney disease (CKD)?

Chronic Kidney Disease (CKD) is a very general term used to describe kidneys that do not work properly in the long term. CKD can vary in severity depending on how much kidney function has been lost. Poorly functioning kidneys cannot filter blood as efficiently as healthy kidneys, leading to a slow build up of waste products and sometimes fluid in the body. Protein in the urine is also an indicator of kidney disease.

Children with mild to moderate CKD (also described as stage 1-3 kidney disease) often have no obvious symptoms and the aim of treatment is to prevent further deterioration in kidney function. In more severe cases, there is an increased build up of waste products in the body (stage 4 – 5 kidney disease) and symptoms such as tiredness, loss of appetite, itchy skin, headaches, swelling in the legs or the need to urinate frequently may appear. Severe cases must be treated to keep the body working properly.

More information about the different stages of CKD is available from

<https://www.kidney.org/atoz/content/gfr>

How is CKD treated?

Your child will regularly attend a nephrology outpatient clinic. At the clinic, height, weight and blood pressure will be checked and your child will see a special doctor called a nephrologist. The nephrologist uses these results along with urine and blood and sometimes other tests to see how the kidneys are working. More information about the sort of tests that can be done to help diagnose problems with kidney function is available from <http://www.infokid.org.uk/tests-and-diagnosis>

It is not possible to repair damage which has already been done to your child's kidneys, but if your child has stage 1 - 3 kidney disease, treatment will focus on preventing further deterioration of the kidneys by using medication, controlling blood pressure and controlling diet. A child with stage 1 - 3 kidney disease will not necessarily progress to the more severe stages of kidney disease.

It is likely that your child will see a specialist dietician and you may be asked to keep a detailed diary of your child's food intake for a period of time. Diet can play a very important part in the management of CKD at every stage but the way in which it needs to be controlled will be individual to each patient. More information about how controlling your child's diet can help is available from <http://www.edren.org/pages/edreninfo/diet-in-renal-disease.php>

If your child has severe CKD such as stage 4 - 5 kidney disease this means that the kidneys are no longer able to keep the body working. At this stage, treatments such as dialysis – where the blood is filtered to rid the body of harmful waste, extra salt and water – may be necessary and eventually a kidney transplant may be needed. After a successful **kidney transplant**, children can live full and healthy lives, but will need to take medicines to look after the new kidney.

PLEASE NOTE: A child with stage 1 - 3 kidney disease will not necessarily progress to the more severe stages of kidney disease. Information beyond this point is only relevant to children who have been diagnosed with stage 4 – 5 kidney disease.

What is dialysis?

Dialysis is a treatment which artificially performs the main functions of the kidney. There are two main types - Peritoneal dialysis and Haemodialysis:

Peritoneal dialysis uses the body's own membrane, called the peritoneal membrane, which surrounds the abdominal cavity to filter fluid and waste products from the blood. It works by inserting a catheter into the abdomen (tummy) into which dialysis fluid, consisting of sterile water, salts and glucose, can be pumped. Because the fluid contains a different concentration of salts and glucose compared to the blood, excess water and waste products contained in the blood are transferred across the peritoneal membrane into the dialysis fluid. After a certain amount of time, the fluid containing the waste products is drained away and the procedure is repeated. This type of dialysis can be carried out at home.

Haemodialysis is where blood is pumped through a machine which acts as an artificial kidney filtering waste products and excess fluid from the blood. The cleaned blood is then returned to the body. This type of dialysis takes three to four hours several times a week and is usually performed in a hospital.

Your child's doctors will discuss with you which type of dialysis would be best for your child and the reasons for this.

More detailed information about the different types of dialysis and treatments such as kidney transplantation are available from <http://www.infokid.org.uk/treatment>.

How else can CKD affect my child?

Some children with late stage CKD may have some of the following complications:

Anaemia

Anaemia happens as a result of too few red blood cells and haemoglobin in the blood, which help to transport oxygen around the body. The main symptoms of anaemia are abnormally pale skin and fatigue.

Healthy kidneys produce a hormone* called erythropoietin (EPO) which helps the body to produce red blood cells, but children with chronic kidney disease may not be able to make sufficient EPO.

Anaemia can be treated with iron supplements which can be given orally or through the veins. Some children will also need EPO treatment, which is given as a small injection, just under the skin.

*Hormones are chemical messengers that target distant parts of the body, regulating and controlling certain bodily functions and processes.

Growth problems

Several different things can cause growth problems in children with CKD. The nephrology clinic treating your child will closely monitor your child's growth over time⁶ so that any problems can be identified and treated early. They will also regularly check the levels of hormones important for growth.

Some of the reasons for poor growth as a result of CKD are:

Poor nutrition - Children with late stage CKD may have a poor appetite and not be able to eat as much, which can lead to growth problems. Your child will see a paediatric dietician who will formulate a diet especially to address your child's nutritional needs. Part of this diet may include nutritional supplements. Some children may need a feeding device where liquid nutrients can be given through a tube if they are unable eat and drink all they need to for growth.

Anaemia - Anaemia can cause growth problems so it is important to treat this.

Hormone imbalances - Your child may be referred to a **paediatric endocrinologist**, a doctor who specialises in treating children with hormone problems. They can examine your child and may need to arrange tests to find out more.

- Imbalances in chemicals such as calcium and phosphate in the blood can cause increases in certain hormones such as parathyroid hormone. High levels of this hormone can strip the bones of calcium causing abnormal growth. This condition is known as renal bone disease which can be treated with medication.
- Hormones called growth factors help the body to grow, but children with CKD may not respond very well to normal levels of growth hormone. Some children with severe CKD may require extra growth hormone. If this is the case, growth hormone can be given as a daily injection under the skin that children can learn to administer themselves.

Acidosis - Normally, the kidneys remove excess acid from blood, but if function is impaired too much acid can build up in the blood and cause problems, which can include problems with growth.

Polyuria - Some children with CKD make an abnormally large amount of urine, which disrupts the body's fluid balance and causes minerals to be lost in urine. The body slows growth to make up for the lost fluid and minerals.

Further sources of information and support

The **British Kidney Patient Association (BKPA)** provides support and advice to kidney patients and their patients including financial assistance and help with getting a holiday.

Website: www.britishkidney-pa.co.uk

Email: info@britishkidney-pa.co.uk

Tel: 01420 541424

The **National Kidney Federation (NKF)** is run by Kidney Patients for Kidney Patients. They provide support and information to individuals affected by kidney diseases and information specifically for children affected and their families.

Website: www.kidney.org.uk

Helpline: 0845 6010209

The **Kidney Patient Guide** is a website that provides information for renal patients, their partners and families and offers patients and their families the opportunity to share experiences and points of view www.kidneypatientguide.org.uk.

infoKID is an online information resource for parents and carers about kidney conditions in infants, children and young people. The information covers a range of conditions, symptoms, causes, diagnosis, treatment and management. www.infokid.org.uk.

The **Renal Association** is a professional body for UK nephrologists (renal physicians, or kidney doctors) and renal scientists. They have a useful page on their website which lists clinical standards in nephrology. Clinical standards can help you identify whether your child is getting the best standard of care. See <http://www.renal.org/bapn/bapn-clincical/clinical-standards-in-paediatric-nephrology#sthash.wnFIZRRc.dpbs>.

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