

Background information

The Kidneys: Versatile Organs with Multiple Functions

The kidneys are high-performance organs. They come as a pair and are located just below the diaphragm, to the left and right of the vertebral column near the bottom edge of the ribcage. Although the kidneys are provided as a pair, it is also possible for a single one to perform the necessary functions on its own – which means that we can also live with just one kidney!

Blood is filtered in the minute capillaries of the glomeruli. Urinary waste products in blood are filtered out, along with water molecules, via the glomeruli. This 'primary urine' – almost 180 litres of it a day! – is then concentrated. About 99% of the originally filtered fluid is returned to the body, the remaining urine (about 1.5 litres per day) being collecting in the urinary bladder and excreted via the urethra. This detoxification process is vital for survival. When the kidneys no longer function, the first signs of poisoning are manifested within a short space of time.

Important hormones are also synthesised in the kidneys: renin, for example, is involved in the regulation of blood pressure, erythropoietin is a hormone that stimulates the production of red blood cells, and calcitriol (activated vitamin D3) plays a crucial role in bone metabolism. The kidneys also perform a key function as a 'measuring station and regulation system' – they maintain acid-base homeostasis, which is fundamental for the body's metabolism, and plasma osmolality, which is the body's electrolyte-water balance.

These vital functions give an idea of what happens when kidneys fail. Kidney diseases never affect just the kidneys themselves, but have impacts on the entire organism. Even slight limitations of kidney function will significantly increase the risk of cardiovascular disease. Without medical intervention, complete failure of the kidneys would inevitably result in death.

Chronic Kidney Disease (CKD): Early Detection

The prevalence of chronic kidney disease is often underestimated. It frequently occurs in the second half of people's lives, so the number of dialysis patients has also risen as a result of demographic change. However, when diabetes mellitus, high blood pressure, obesity or smoking cause damage to blood vessels, kidney function can start to decline even at a younger age.

When a patient suffers from CKD, the kidneys lose their function only slowly, and in steps. In the early stage, when the disease's progress could still be stopped or at least slowed down significantly, kidney diseases are relatively symptom-free. One consequence is that many people with CKD do not go to a doctor until it is far too late. Severe symptoms, such as high blood pressure, fluid retention in the legs and lungs, bone disorders, muscle weakness or anaemia (deficiency of red blood cells), do not arise until the disease has reached an advanced stage.

Early detection is therefore important – the simplest way to test kidney function is a quick urine test. A dipstick can be used to check the level of protein in urine, for example. This test can provide a first indication of kidney disease. The filter tissue in a healthy kidney is so dense, that a maximum of 20 mg of protein per day is secreted in urine. If the urine more than that, the condition is called microalbuminuria, and if the level exceeds 200 mg protein per day, it is called 'proteinuria'. If the urine test produces critical values, it is imperative to analyze kidney functions more precisely with a blood test. Blood levels of creatinine and urea, for example, are used as indicators of kidney function. These levels are inversely proportional to kidney function, i.e. the higher the level of creatinine and/or urea that is measured in the blood, the weaker the filtration function of the kidneys. The normal range for creatinine is 0.8 – 1.2 mg/dl, and the normal range for urea concentration in blood is between 20 and 45 mg/dl.

High Blood Pressure as a Risk Factor

Hypertension is a very prevalent condition, estimated as affecting one in three people aged 50 or more and one in two of those aged 60 or more. High blood pressure is therefore a widespread disease, and one major problem is that many cases still go unreported, even today. Many people do not notice that their blood pressure is too high, and many who know about it do not take the disease seriously. They do not go to the doctor or take their antihypertensive medicines, because they dismiss hypertension as 'indisposition', rather than classify it as what it is, namely a serious ailment that can have severe consequences, such as kidney failure, heart attacks or strokes.

Kidney disease and high blood pressure have reciprocal effects and are often mutually reinforcing. Routine measurements of blood pressure are therefore an active form of kidney protection. Blood pressure should be kept below 140/90 mm Hg, as far as possible.

For kidney patients, reducing hypertension is an important way of delaying further progression of the disease and therefore for postponing the need for dialysis. Many studies have shown that certain anti-hypertensive drugs, namely inhibitors of the renin-angiotensin system (primarily ACE inhibitors, but also angiotensin receptor blockers), also have a specific, protective effect on kidney function over and beyond the reduction of blood pressure. They are therefore used or combined, also in high dosages, as a basic therapy in difficult situations.

Summary: Hypertensive patients are a high-risk group for kidney failure. They should therefore have their kidney function checked every year by their general practitioner.

Diabetes as a Risk Factor

Diabetes mellitus is a widespread disease in Europe. According to the WHO, there are about 60 million people with diabetes in the European Region, or about 10.3% of men and 9.6% of women aged 25 years and over. The prevalence of diabetes is increasing among all age groups in the European Region, mostly due to increases in overweight and obesity, unhealthy diet and physical inactivity.

If blood sugar is permanently elevated, the risk of developing CKD is rising. That risk must not be underestimated – one in four dialysis patients suffers diabetes, but not every diabetics develops kidney disease. Nine out of ten cases involve 'type 2' diabetes. The primary cause is lifestyle: at the onset of disease, 80% of type 2 diabetics could reduce their blood sugar level to within the normal range by reaching normal body weight and increasing their physical activity. Drugs would no longer be needed to treat their diabetes mellitus.

The frequency of kidney damage depends on the duration and control of diabetes: the longer a person has had diabetes mellitus and the less well the blood sugar level is managed, the higher the risk of the kidneys being affected (diabetic nephropathy). A urine test conducted by a general practitioner and measuring the concentration of protein particles in urine (albuminuria test) can detect whether the kidneys have already been damaged. Diabetes mellitus damages the vascular system and makes the walls of renal blood vessels more permeable. Small particles of protein, such as albumin, 'slip through' the vascular walls and are excreted in urine. An elevated albumin level in urine is the first alarm signal indicating kidney damage caused by diabetes. If that is the case, the patient should be referred to a nephrologist, who will prescribe medication to stop any further loss of kidney function.

Summary: Diabetes is the main cause of incident ESRD. They should therefore have their kidney function checked every year by their general practitioner.

Obesity as a Risk Factor

Obesity impacts kidney function via hypertension and diabetes. These diseases strike obese people more often than others and harm the kidneys, especially, if they are not treated sufficiently.

But there are also direct effects of obesity on kidney function: In obese people the production of certain hormones, adiponectin, leptin, and resistin, is higher than in people of normal weight. The higher hormone levels go along with inflammation, oxidative stress, abnormal lipid metabolism, activation of the renin-angiotensin-aldosterone system, and increased production of insulin and insulin resistance. These various effects result in pathologic changes in the kidneys.

Summary: Obese patients are a high-risk group for kidney failure. They should therefore have their kidney function checked every year by their general practitioner.

About ERA-EDTA

With more than 7,000 active members, the ERA-EDTA is one of the biggest nephrology associations worldwide leading European nephrology and one of the most important European Medical Associations. It organises annual congresses and a Scientific Education Interactive Day (SEID), it produces guidelines, it collects data and performs epidemiological studies through its Registry. It supports fellowships and research projects. Its publications are NDT and CKJ (this last journal is Open Access). The ERA-EDTA also has an online Educational platform: the European Nephrology Portal (ENP) which includes NDT-Educational@ENP. The 2020 Congress will be held June 6-9 in Milan (Italy). Visit the booth to receive more information!

Web site: www.era-edta.org