

### **What is renal artery stenosis?**

Renal artery stenosis (RAS) is a narrowing of the main artery supplying the kidney. The narrowing can result in a reduction of blood flow to the kidney(s) and therefore a decline in the kidney function.

### **What are the causes of renal artery stenosis?**

The main cause of renal artery stenosis is atheromatous disease, or furring up of the arteries by cholesterol and calcium plaques, this can occur in exactly the same way that coronary arteries can become narrowed, although whilst coronary artery disease causes chest pain it is rare for renal artery stenosis to cause kidney pain (unless the artery becomes blocked suddenly).

### **What are the risk factors?**

The risk factors for renal artery stenosis are: increasing age; male gender; history of smoking; history of arterial disease affecting other areas and high cholesterol.

### **What are the symptoms of RAS?**

Renal artery stenosis can be entirely asymptomatic. In some people renal artery stenosis results in hypertension (high blood pressure) and fluid retention (swollen ankles, breathlessness due to fluid in the lungs). If the artery occludes suddenly this can result in loin pain but this is rare and RAS does not usually cause pain. Renal artery stenosis can result in a decline in the kidney function (Raised creatinine, or decreased eGFR) and this deterioration in kidney function can be caused by the addition (or increase in dose of) certain blood pressure tablets, such as ACE inhibitors (e.g. ramipril) or Angiotensin receptor blockers (ARBs e.g. Losartan). Whilst ACEi and ARBs are thought of as drugs which protect the kidneys they work by dilating the blood vessel going away from the filters in the kidneys, in the presence of a narrowing to the arteries feeding the kidneys this can result in too little blood flow through the filters and a consequent reduction in kidney function.

### **How is it diagnosed?**

Renal artery stenosis is diagnosed by talking to an examining the patient in order to determine the likelihood of arterial disease. The urine dipstick is usually unremarkable (i.e. no blood and no protein). A renal ultrasound may be normal, or may show slightly small or shrunken kidneys, or classically 'renal asymmetry' which is where one kidney is smaller than the other (The smaller kidney having been more affected by the renal artery stenosis).

It is possible to do a 'doppler' ultrasound of the renal arteries to try to detect changes in blood flow resulting from a narrowing but this test is highly specialised and dependent on the expertise of the sonographer and should probably only be used, if at all, as a guide.

A magnetic resonance angiogram (MRA) or a CT renal angiogram (CTRA) are the best non-invasive tests to look for renal artery stenosis although may over estimate the extent of any narrowing. Each test has its pros and cons. Both are relatively expensive tests. The MRA may not be appropriate for those who suffer from claustrophobia and the CT involves a dose of X-rays and usually requires an injection of iodinated contrast (the contrast can cause concern where renal function is poor).

An angiogram (direct visualisation of the artery by injecting contrast dye directly in to the aorta just above the renal arteries) is the definitive test for renal artery stenosis. An angiogram is, of course, an invasive test, and the operator needs to be an experienced interventional radiologist. Another

advantage of an angiogram is that it is possible to do 'pressure wire studies' in order to prove that any narrowing seen is indeed causing a reduction in blood flow to the kidneys.

### **How is RAS treated?**

Another advantage of direct renal angiograms is that if found renal artery stenosis may be treated at the same time without the need for any further tests, alternatively it may be necessary for the radiologist and the nephrologist to discuss the case and agree on the best course of action (which would mean coming back another day for definitive treatment).

Renal artery stenosis is treated by using a balloon, and usually a stent, to open up the artery, in exactly the same way that cardiologists have treated chest pain for years. Unfortunately the evidence for benefit is less clear. In cardiology if you have chest pain, undergo an angiogram and the chest pain improves then you have direct evidence of benefit. In renal artery stenosis it is less clear. Two small trials, called CORAL and ASTRAL (both of which recruited fewer than 1000 patients) failed to show clinical benefit. Some people use this as an excuse not to treat renal artery stenosis with intervention but it is quite clear that some patients, especially those with a significant narrowing to the early part of the renal artery can benefit, and especially when it is to a single functioning kidney of preserved size (as in the case where the renal artery stenosis has caused one kidney to shrink already and the remaining, functioning kidney, is at imminent risk). An experienced nephrologist working with an equally experienced radiologist is best placed to present the available options to people with renal artery stenosis.

It is rare for a renal artery angioplasty (usually combined with stenting) to result in an improvement in kidney function (although I have certainly encountered this); usually we hope to reduce the rate of decline of kidney function; and sometimes improve blood pressure and symptoms of salt and water retention.

Medical management of renal artery stenosis includes: reducing, or stopping, ACEi and ARBs; giving low dose aspirin and high dose statins.