What I tell my patients about magnetic resonance imaging

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An MRI scanner is a doughnut-shaped machine that uses radio waves and a powerful magnet to create detailed views of the body

In an era of developing technology and non-invasive investigations, there is more and more reliance on radiological investigations. Magnetic resonance imaging (MRI) is a relatively new technology that was first developed at the University of Nottingham. Increasingly, MRI is being used to establish a diagnosis. Within the field of renal medicine, there is growing use of MRI in the diagnosis of renovascular disease, renal transplantation work-up and response to treatment in autosomal dominant polycystic kidney disease.

MRI provides a better way of looking at soft tissues (like the brain, kidney, spinal cord and muscles) than CT scans. Further, MRI does not use the contrast that CT scans do, which has a risk of causing kidney damage to certain groups of patients.

What is an MRI?

An MRI machine is a doughnut-shaped scanner with a tunnel that is used to produce clear, detailed images of the body without the use of X-rays (radiation). MRI scanners use a powerful magnet and radio waves to create detailed views of the body, especially soft tissues. These pictures are then sent to a computer.

How is an MRI scan performed?

You will be placed lying flat on a movable table in a large, closed tunnel. Some patients will find this uncomfortable, especially if they are scared of confined spaces (claustrophobic). There will be a radiographer (a trained person experienced in scanning and imaging technology) in the room with you, and you will be able to communicate with them through a microphone. When scanning starts, you will hear a variety of loud banging noises

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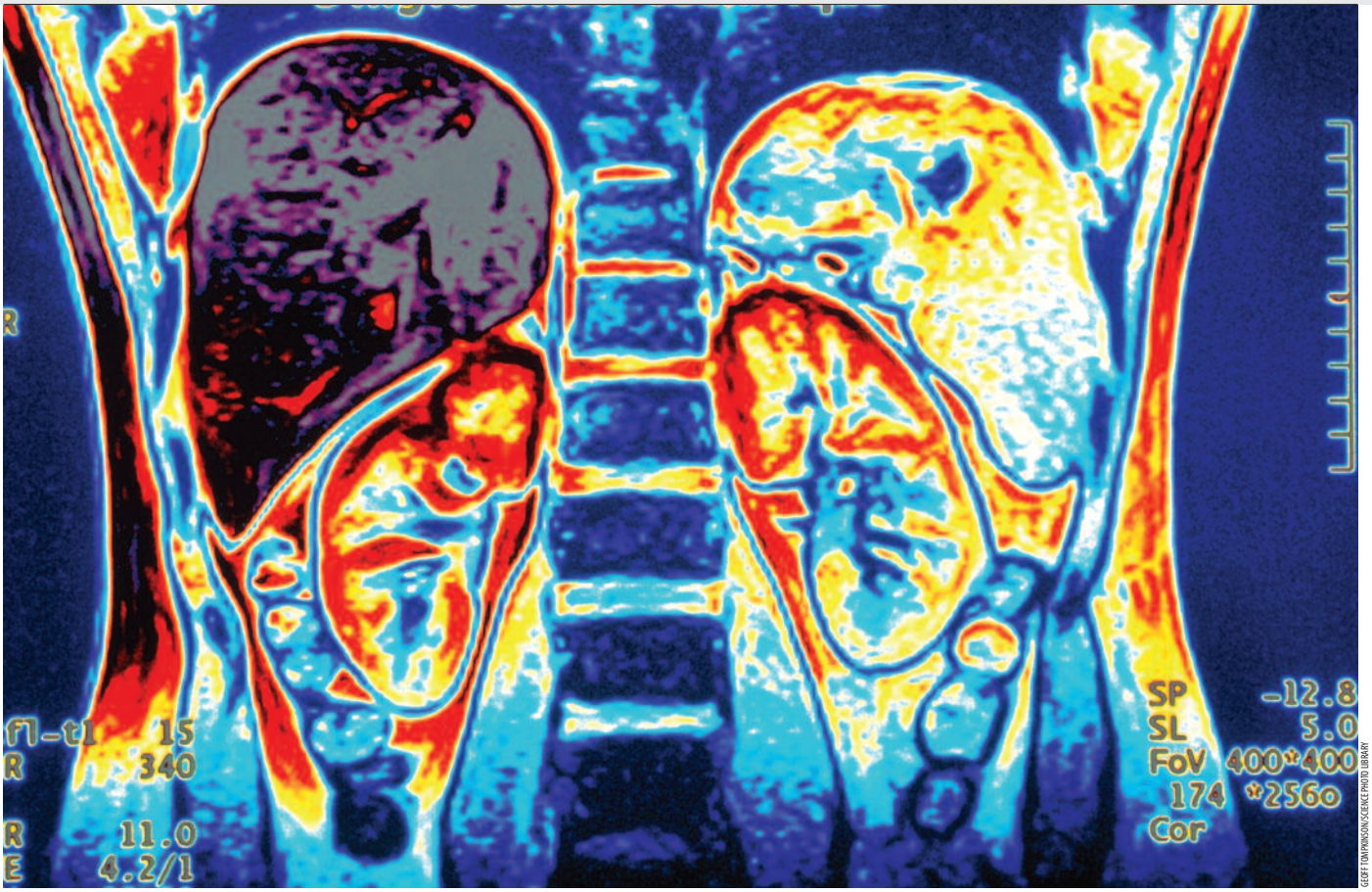

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■ MRI provides high-quality cross-sectional and three-dimensional images of the body, especially soft tissue

from the machine due to the radio wave signals. Sometimes, the radiographer will offer you earphones with some music to listen to and distract you from these noises.

Is it painful?

No, an MRI scan is not painful.

How long does it take?

Usually, MRI scans take about 30 minutes or so, but this is dependent on which part of the body is being scanned. Sometimes the images taken may not be clear (which is why it is important to lie still), and the scan may be repeated if there is a lot of movement.

What preparation do I need to make?

No preparation is necessary for an MRI scan. Normally, you do not need to fast for most types of MRI scans. You will be given clear instructions with your appointment. You will also be asked to remove all metals, including any body piercings and bras, and change into the hospital gown provided.

Why does my doctor want to carry out an MRI?

Your doctor may want to do an MRI of your kidney or abdomen for a number of reasons, as shown in Box 1.

What if I am scared of confined spaces?

Some hospitals have an open MRI scanner. This is like a CT scanner; it is not closed like a traditional MRI machine. Sometimes your doctor may give you a medication to relax – for example, a sedative.

If you really cannot undergo an MRI scan, then there are other alternative scans or investigations that can be carried out.

Box 1. Reasons for having an MRI scan

- Assessing the blood supply to the kidney (renal artery stenosis)
- Work-up for kidney donation (to look at the blood vessels to the kidney)
- Work-up for kidney transplantation (to look for hardening of the blood vessels and assess the circulation of the pelvic blood vessels)
- There has been an increase in the use of MRI for assessing the size of kidney cysts in autosomal dominant polycystic kidney disease and its response to treatment with newer agents

In renal patients, there are other parts of the body that may also require an MRI scan:

- Patients with heart problems – cardiac MRI is becoming more popular
- Patients who have hip pain and are on steroids – they may need an MRI scan of the hip to look for signs of avascular necrosis of the femur (painful hip caused by reduced blood supply, as a result of long-term steroid use)

What are the alternatives to MRI?

Depending on what your doctor is looking for, the options include a CT scan, with or without contrast. If

they are looking for renovascular disease, then your doctor may decide to proceed straight to renal angiography without doing the CT scan.

Not everyone can have an MRI scan (see Box 2). Patients with coronary artery stents can have an MRI scan, but usually only after two months have passed since their operation.

You will find that the technician will go through a checklist to ensure you are suitable for MRI, and that they will make sure they are thorough in their questioning.

Is any contrast agent involved?

Yes. A radiographer will put a cannula into your veins, either at the elbow joint or at the back of your hand. They will check to see if you have any allergies before injecting the contrast agent. This contrast agent (gadolinium) is different from the contrast agent used in CT scans – it does not cause kidney damage and is less likely to cause an allergic reaction.

What happens after your MRI?

You may go home immediately after the scan, unless you were given a sedative medication. If you received a sedative, you must have a responsible person to take you home and stay with you for a few hours after the scan.

What about my test results?

Your doctor will usually get the MRI results within a week, and they will have made a follow-up appointment with you after the scan. Depending on the reason for the MRI, they will decide how soon to see you for the follow-up appointment.

Is it safe to have an MRI scan?

Like all radiological investigations, there has to be a valid reason for performing the test. However, MRI is a very safe investigation if all the precautions are taken.

What are the disadvantages of MRI?

MRI scanners are more expensive than CT scanners. Because of this, some of the smaller hospitals do not have MRI scanners, and so the prodecure is not as readily available as a CT scan.

What complications can occur?

An allergic reaction to the contrast agent can happen, but this is rare compared with the contrast agent used in CT scans; only between two and ten patients per 10,000 MRI scans will suffer a reaction. In the event that this happens, the radiographer is trained to deal with this and will have all the necessary equipment available to treat you. Allergic reactions usually happen within the first ten minutes of the contrast being administered.

Another very rare complication associated with gadolinium contrast in patients with advanced kidney disease is the condition nephrogenic systemic fibrosis.

Box 2. Who cannot have an MRI scan?

- Pregnant women
- Patients who cannot lie flat, for whatever reason
- Patients with pacemakers, defibrillators and ear (cochlear) implants
- Patients with certain types of cerebral aneurysm clips and vascular stents; however, metals used in orthopaedic surgery (screws/nails/plates) are safe.

What is nephrogenic systemic fibrosis?

Nephrogenic systemic fibrosis is a rare, but serious, debilitating complication seen in patients with advanced kidney disease who receive contrast that contains gadolinium. Gadolinium is a contrast agent used to enhance abnormal tissue in the body when performing MRI scans. Nephrogenic systemic fibrosis starts off as a painful swelling of the leg and then later progresses to thickening and tightening of the skin. When this happens over the joints, it reduces movement in the joint and causes contractures. The thickening (known as fibrosis) can also affect other organs in the body.

Thankfully, it is very rare and only 600 confirmed cases have been reported so far.

Am I at risk of developing nephrogenic systemic fibrosis by having an MRI scan?

No – if you do not have any kidney problems, you are not at risk of developing nephrogenic systemic fibrosis. Very little is known about nephrogenic systemic fibrosis, but all reported cases so far have been in patients with significant kidney disease – that is, patients who are already on dialysis, or patients who are likely to need dialysis in the near future.

If you have kidney problems, there is a small risk, but this is dependent on the stage and severity of your kidney disease. Your doctor will discuss this with you. If you have significant kidney disease (that is, with a glomerular filtration rate of <30 ml/min), then your doctor will decide if you need the MRI or if other alternative investigations can be done.

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If you do need the MRI scan, your doctor will discuss the risk of nephrogenic systemic fibrosis with you before proceeding.

What precautions are being taken to reduce the risk of nephrogenic systemic fibrosis in renal patients undergoing an MRI scan?

There is some emerging evidence that certain types of gadolinium-containing contrasts are associated more with nephrogenic systemic fibrosis than others.[1–3] Most hospitals are moving towards using the gadolinium-based contrast with the least risk of nephrogenic systemic fibrosis in patients with kidney disease. The dose of gadolinium contrast is also minimised. If a patient needs a repeat scan for any reason, this should be delayed for at least five days.

In those patients already on dialysis who need an MRI scan, dialysis treatment is carried out as soon as possible after the MRI (within 24 hours) to reduce the risk of developing nephrogenic systemic fibrosis.

What treatment options are available for nephrogenic systemic fibrosis?

Sadly, there is no proven successful treatment for the debilitating condition that is nephrogenic systemic fibrosis; therefore, avoidance is the main aim ■

Declaration of interest
None declared.

References
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2. Altun E, Martin DR, Wertman R *et al.* Nephrogenic systemic fibrosis: change in incidence following a switch in gadolinium agents and adoption of a gadolinium policy--report from two U.S. universities. *Radiology* 2009; **253:** 689–696.
3. www.fda.gov/Drugs/DrugSafety/ucm223966.htm (last accessed 21/02/12)

Key points

- A magnetic resonance imaging (MRI) scan is a useful diagnostic method to visualise soft tissues and does not involve radiation.
- An MRI scan is safe to use in the majority of patients, and can be used to evaluate a number of conditions.
- Patients with pacemakers and certain other metal objects (such as vascular stents or cochlear implants) cannot have an MRI scan, but those with metal plates, nails or screws from orthopaedic surgery are suitable for MRI.
- Nephrogenic systemic fibrosis is a rare condition associated with gadolinium-based MRI scan in patients with significant kidney disease – most patients without kidney disease are not at risk.

BritishRenalSociety

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Congratulations to those authors who successfully submitted abstracts for the 2012 BRS Conference, due to be held in Manchester Central from 1–3 May. Under the direction of Maarten Taal (Consultant Nephrologist, Royal Derby Hospital) and Sue Cox (Consultant Nurse, Guy's and St Thomas' Hospitals), the programme will be showcasing several new features. We are particularly pleased to be offering two inaugural 'named' lectures: Sir Netar will deliver 'The Mallick Lecture', and Joseph Chilcot, Lecturer in Health Psychology at King's College, is honoured to be giving 'The Donna Lamping MDT Researcher Lecture'. We are privileged to have such an expert faculty of speakers at our conference and look forward to welcoming them.

To celebrate, we are initiating a virtual membership database on the BRS website. Those registering for the conference will automatically be enrolled; membership gives you access to a restricted part of the BRS website where you will be able to listen to guest speakers' talks and view their slides. We are grateful to our affiliates who have helped to develop their own sessions within the conference, and we invite members to join with us to support these important opportunities to learn from one another.

Last year, BRS Research for Renal was in the fortunate position (in collaboration with the British Kidney Patients Association) to be able to award six grants at a total of £185,492. Research projects include studies investigating physical activity in chronic kidney disease; a new care bundle to lower salt; bone alkaline phosphatase in haemodialysis patients; increasing organ donation in the Asian community; alternative methods of scaling dialysis dose; and a qualitative study exploring the benefits of a new, joint-specialty renal/genetic clinic. Well done to all recipients and a big thank you to the BKPA, without whose generous support this would not have been possible.

To support all those researchers who are having trouble knowing how to start or getting funding, the BRS will be holding a Research for Renal clinic during the conference, with 15-minute appointments available for one-to-one advice and feedback. Full details are available on the BRS website at www.britishrenal.org ■

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