Academy of PHYSICAL MEDICINE

Transcript

Radiology
With Dr Rajesh Botchu

APM: Good evening and welcome once again to the Academy of Physical Medicine. A very warm welcome to you on this lovely spring evening. We have a fantastic evening of CPD ahead of you. It is 90 minutes of learning with others if you're a UK registered chiropractor or osteopath. If you're any other discipline or registered in a different country, it's just 90 minutes of brilliant CPD and I think this evening, we have got some truly great CPD. I'm joined by Dr. Rajesh Botchu who is a consultant radiologist from the Birmingham Royal Orthopedic Hospital. I think we can safely assume he is an expert. He's written over 50 papers in the peer reviewed journals and chapters in numerous books on the topic of radiology. His own expertise and specialty is in musculoskeletal issues but he covers the whole range of radiology. He covers CT, ultrasound, MRI, fluoroscopy and some interesting, fascinating in fact, new developments which we'll be hearing about later on but we'll talk about all those disciplines as we go through. Dr. Botchu, welcome to the studio. It's a great delight to have you with us.

RB: Thanks for the invite.

APM: What I didn't say in the introduction, of course, is that you don't just do radiology, do you? You do surgical interventions as well such as vertebroplasty. Is that normal for a radiologist?

RB: No. Most of the radiologists predominantly just look at the images and just report whereas nowadays, more and more radiologists are trying to use their expertise to do treatment as well, so ranging from injections to more or a bit more aggressive like doing vertebroplasty or kyphoplasties as well.

APM: And in vertebroplasty, what does that entail?

RB: So if somebody has a fracture, you can either manage them conservatively by giving some painkillers or you can do surgery by putting rods, but what we do

is we make small cuts, we do a scan, identify where we need to go in and put rods into the vertebral body and put some cement into the fracture to make it strong.

APM: And you didn't previously train as an orthopedic consultant or orthopedic specialist, did you?

RB: I was an orthopedic surgeon way back in India but here in England, I've trained again as a radiologist but any radiologist who is trained, musculoskeletal radiologist can do all these procedures.

APM: That makes life a bit more interesting for you, I imagine than just looking at pictures. Tell us about the spread of radiology then. I mentioned the topics that we're going to cover this evening. I get the feeling that the technology is moving on rapidly and it's very hard for anyone outside the profession, the specialty to keep pace with it.

RB: Absolutely. If you look at maybe 1970's, 1960's, radiology was always, what we say is underground. We used to be in dark…behind the screen people in order to develop films, you have to use different chemicals but now, if you see, what it is is we have state of the art. So you have music system. You can listen to music, whichever you want. You have voice recognition —

APM: Sorry. Is the music an important part of this or is that —

RB: It's just to keep you going because otherwise, we might get bored reporting on so many scans. So hence we have PACS which is an electronic way of looking at the images, the MRs and the x-rays instead of the old classic films. We use voice recognition as well.

APM: What does PACS mean?

RB: PACS is picture archiving computerized system. So all the x-rays, instead of being stored as a hard copy, now, they're more stored electronically.

APM: And is it the same software that handles the MR images as well?

RB: Yeah, it's the same. So you can see your ultrasound images, your x-ray images, your fluoroscopy images or your MR using the same system.

APM: And you talked then about voice control, meaning? What sort of control would you need with the images?

RB: No, you can have…for example, if you want to report an MR, you can just say, "The MR shows the rib fractures," and the report will just type on the system. So instead of sending the report to your secretary to type, now we have voice recognition which is great.

APM: So presumably, that's increased your productivity quite a lot.

RB: Absolutely.

APM: How many images would you say you assess in a day, typically?

RB: In a day, will report about 40 to 50 MRs. We do about 200 biofilms, about 10 to 15 ultrasounds. So that's an average day for us.

APM: See, this has always struck me because…I don't think I'm alone in the physical therapy world in wanting to look at the pictures and know what I'm looking at but it's got to be almost impossible for someone who isn't doing that volume of pictures to be able to assess these things properly, hasn't it?

RB: I agree but I always feel that all the referrers, whoever refers, should at least take the effort of looking at the images themselves rather than just relying on the report but with time…for example, if you're just looking at spines, with time, maybe a couple of years or three years down the line, you will become pretty good enough correlating the images and the report.

APM: Because we don't get them, do we? When patients come to me these days, they bring a small paper report from the radiologist that says, you know, what he's found. I don't get to see the images. They don't get…given a disc anymore with the images on.

RB: It depends where you get the scan. For example, in the NHS, if you want a disc, you have to ask and you have to pay. You just get the report but if you go to a private centre, you could ask for your CD. Many centers will give you a CD and there'll be a software. You just put it on your computer and you can look at the MR and you'll have the report as well.

APM: What software do you recommend? Because not all of them are good at handling MRs particularly, are they?

RB: There are millions of them. If you have a Mac, there's an OsiriX system. There is Horos. There are so many free software and you can use all of them.

APM: I think we use OsiriX on our Macs in the clinic but I wouldn't know what you'd use for PCs but you said Horos?

RB: Horos. Horos is a similar one to OsiriX but OsiriX is the one that our college also recommends.

APM: We talked earlier on about a friend of mine, a chap that you know, spinal consultant, Nick Birch. We've had him in on two occasions before here to talk about spinal surgery and diagnosis. Now, we're getting you in again to talk

about spondylolisthesis in response to a request from one our members but I've watched him looking at MR scans and he zooms through these things and very often picks up things that the radiologist hasn't picked up but I just…I look at them and I think, "Well, how does he know that that little white thing there isn't normal, that little white mark on the picture?" It must take…I mean you said a couple of years, you become an expert but you've still got to look at a lot of images, haven't you?

RB: Absolutely. So if you look at an MR, you're looking at over 200 images. If you're looking at a CT, you're looking at more than 1,500 images. So it's quite humanly possible to miss small findings and that's where the referrer…for example, Nick Birch is an excellent spinal surgeon. He always reviews his images. So he always picks up these additional findings. So hence, I think the referrers should make an effort of looking at the scans and try to improve their knowledge so that they can pick up these additional findings that could probably have been missed or not reported by the radiologist.

APM: Now, I was going to save this until the end of the broadcast because at the end of these broadcasts, when we post the recording, we put all the supporting information we can up for the benefit of the audience but you have a website called radiology4u.com.

RB: .co.uk.

APM: .co.uk, I beg your pardon, with the radiology4u with a figure 4 rather than the word and you've got on that the facility to look at quite a large number of images, haven't you? And test yourself on your ability to diagnose. How many images are on there?

RB: There are about 3,800 images.

APM: So would you recommend that to the average physical therapist? Because this is free. This is not charged. It's a fantastic resource.

RB: So the MSK Radiology 4 U, it's a website. It's available as an app as well and it's got the whole spectrum. So you can choose by anatomy or you can choose by pathology or you can just test yourself.

APM: Well, we'll put the details of that up on the website later because I'm sure there'll be a lot of people who would like to go into even greater depth than we can this evening but where shall we start with the different radiological protocols then? Which would you prefer to go with? Ultrasound?

RB: I think x-ray is the commonest and the cheapest. So I think if somebody comes in with a history of trauma or…then x-ray should be done because it's easily available. It's quite cheap to do and quite often, you can get a

diagnosis. For example, if you're suspecting a fracture, you can see it on x-ray and that's pretty cheap.

APM: Are there still limitations in that? I mean when I went through training, you were always told, you know…scaphoid fracture, for example, you don't x-ray for a good 10 days because you won't see anything. Are the x-ray's better now?

RB: No, x-ray is still the same. x-ray won't pick up…for example, in scaphoid fractures, you have to leave it for 10 to 14 days but if you want to pick up a fracture early, you have to do an MRI. MRI's quite sensitive. What it does is that if somebody has a bone bruise, MRI will pick it up and that's where you have special sequences like STIR sequence which will pick up the edema. So if somebody has a scratch then normally it swells up. So similarly, the bone, if it gets…there's an injury that has edema within…or fluid within the bone and they can pick it up using MRI.

APM: So you mentioned STIR sequence which I've just reminded myself is a short TI recovery…

RB: Inversion recovery sequence.

APM: Sequence, yeah. What does that actually…what's that mean?

RB: So basically, if you want to do an MRI, you can have different sequences. In order to look at fluid, you have to suppress everything else. So STIR is a special sequence where you suppress most of it and the fluid just jumps out. So hence, if you're suspecting a fracture or an infection, you look at the STIR and whatever is bright, that's where the problem is.

APM: And just to go over old hat probably for a lot of people, there are…the bright signal in an MR is…it can be different things, can't it? In T1 weighted, that's…it's fat, is that right? T2, it's water?

RB: Yeah. Water.

APM: And then in a STIR sequence, it is —

RB: So in T2, basically, the fat also is bright. In T1 and T2, fat is bright whereas on a T2, water and fat, both are bright. So in order to look more at the fluid, we suppress the fat and everything else —

APM: I see.

RB: So the only thing that is bright is water. So that's as simple as that.

APM: Which includes blood.

RB: Blood is also bright.

APM: Normally, when we do these things, we get a long pause in the broadcast before we get any questions come in. They all save them up until just before the end but I've had a very long one come in right away. So I'm going to read that one to you, if I may. "I'm concerned about physical practitioners' overuse of x-ray for diagnostic purposes where chiropractors and osteopaths do full spinal x-rays pre and post adjustment to show the patient changes in Cobb angles. Do you think the autonomy of a lone worker puts patients at a higher risk of over radiation where there's less monitoring? From my experience, things such as IEMER regulations are much more respected than an MDT approach such as within the NHS. Is a full spine x-ray justifiable just to demonstrate to the patient a marked improvement?" And the viewer has acknowledged that this is a bit of a rant but thank you for that. I mean we like questions and we like observations as well.

RB: No, that's a brilliant question and he has pointed out about the IRMER which is IRMER regulation. Full spine x-rays, there's a lot of radiation. For example, if you want to do a lumbar x-ray, that is equal to 30 chest x-rays. So you have to carefully consider if somebody's requesting for a full spine x-ray. I would strongly recommend not doing a full spine x-ray before and after treatment. The only indication for doing a full spine x-ray would be to assess scoliosis but also for surgical planning and follow up but not what you…that also, we normally do once a year or maybe twice a year. That's a max because of the effect of radiation.

APM: I'm sure that most of my colleagues out there…we don't do x-rays at our own clinic but I'm sure that those who have their own x-ray equipment, they must be well informed about all the safety regulations. What is the guideline? I mean you mentioned that the chest x-ray is 1/30 of the volume of a lumbar x-ray. What's the safe level?

RB: There's nothing as safe as…there's no safe level. As a rule, 1 in 4 of us will get cancer. So because of radiation…there are different effects but the most important effect that we are concerned is cancer. So 1 in 4, whatever you do will get cancer but the radiation will increase the relative proportion of the risk of having cancer. If you have repeated CTs…for example, a CT abdomen and pelvis is equal to a thousand chest x-rays.

APM: That seems a lot.

RB: It's quite a lot. So that's —

APM: How does that compare to background radiation?

RB: Background radiation, as I say, is not a lot. So that, I would say…if you have one CT, chest, abdomen and pelvis, that might be equal to a few years of background radiation. It's quite a lot whereas MR, there's no radiation. So you have to carefully consider when you do CT or x-rays in kids and pregnant ladies, especially whereas MR, it's OK but there's a risk with MR as well. If you've ever been in an MR machine, there's a lot of sound. There's a lot of noise. So if you do an MR in a pregnant patient…anybody who has an MR will have earplugs but obviously, if you're pregnant, you can't put earplugs on the baby. So there is a risk of deafness for the baby.

APM: Really?

RB: Hence, you should not do MR in the first trimester of pregnancy.

APM: That first trimester gets a lot of bad press, doesn't it?

RB: Because all the organs are formed during the first trimester. So if somebody comes in and asks for an MR during the first trimester, we say it's better to avoid during the first trimester because everything is formed during that time. So hence, you should be very, very careful when you do MR during the first trimester.

APM: Is that based on evidence or is that just based on finger in the wind, saying, "Well, let's just be on the safe side"?

RB: No, that's all based upon evidence and guidelines, based upon what is published in the literature, the guidelines and the guidelines clearly say that if you want to do an MR in the first trimester, there's a slightly higher risk of deafness for the baby, hence, you have to make sure that the mother is educated and she knows…she gets the relevant information.

APM: One of our audience has asked whether STIR is a T1 or T2 weighted MR.

RB: It's a T2 weighted sequence.

APM: Because if it were T1 —

RB: If it's a T1, the fluid will be dark.

APM: So getting back to x-rays, I mean I think everybody knows that x-rays are great for spotting fractures. What else can we use them for? When else should we be referring people considering trying to get a referral?

RB: Stress fractures, infection and tumors.

APM: Infection?

RB: Infection, so if somebody has an infection of the bone, osteomyelitis, you do an x-ray. You can see cortical thickening. You can see the abscesses. You can see lucency. You lose the normal architecture of the bone. And then you obviously do a secondary examination like an MR or a CT, depending on what you're looking for. So it's always…and if you want to pick up early fractures which are not evident on an x-ray then you do MR. So if you have a runner or if you have a bowler or a cricketer and he gets back pain, you're looking for this pars fracture, so pars edema, x-rays would be normal but MR will pick it up.

APM: What would your suggestion be to our physical therapists who are trying to get a patient referred for an x-ray through their GP, for example? Is there a good way of going about it? I'm always slightly worried that GPs are going to be resistant to getting any requests from osteopaths and chiropractors because we're all quacks in their opinion when we want somebody to get x-rayed.

RB: If somebody comes in with back pain but he has got leg pain, there's no indication to do x-rays because you're looking for small discs or nerve root compression and x-ray won't pick it up. One of the only indications for x-ray is trauma. If somebody has trauma, then yes but if you're suspecting…if the patient has back pain and leg pain then MR is better.

APM: Let's have a chat perhaps a bit about CT scanning then because I must admit I was a bit in the dark about CT scanning until a recent broadcast where an orthopedic consultant showed us the construction of the pelvis or the reconstruction of a pelvis which had been done through a combination of CT scan and manipulation of the images. That's a CT machine that you've put up on the slides there and it looks very much like an MR machine to me.

RB: Absolutely. To put it into perspective, a CT of the chest, abdomen, pelvis will take about less than a minute but as an MR of the whole body takes one hour. The way we do a CT is you take multiple x-rays and because they're done at thin slices, you can reconstruct in which ever plane you want and that helps us to identify the orientation of the fracture or…for example, if you're suspecting a small pars defect, you can clearly see it by zooming it in and by rotating or rendering.

APM: So once again, the indication for CT is going to be trauma.

RB: Yes.

APM: Any other uses?

RB: To guide the intervention. For example, if somebody has a back pain and they have…normally, if it's a young person, a young boy, for example, a 16-year-old, they can have special tumors, what we call …. tumors and in order to

burn them, we do it under CT guidance to make sure the electric…the RF pulse is directed just at that. So it helps us in intervention.

APM: You're not CT scanning while you're intervening —

RB: We are.

APM: You are because that sounds like there's an awful lot of radiation.

RB: So we scan the patient, just a bit. Not the whole thing and then we put the needle in and scan again, make sure it's in the right place. Advance a bit further, scan again but every time when we do intervention, you're just scanning a small bit, not the whole thing so that. And we use low dose radiation because it's just to look at the needle, not to look at the bone architecture or anything else.

APM: From what you've said then, there's limited reason for a physical therapist to refer for a CT.

RB: The role for CT for a musculoskeletal person, osteopath or a chiropractor is quite limited, I agree.

APM: So we're going to say, "It's trauma therefore we want x-ray," and presumably, once they get to the radiology department, somebody will say, "Well, maybe we ought to go one stage further."

RB: The role for CT in trauma is only to plan the surgical…for surgical planning.

APM: When people present for, let's say, an x-ray, obviously, the first person who looks at this is the radiographer who's now had it beaten into him or her that they mustn't tell the patient anything about the pictures because patients will go away with the wrong impression. There could be a long period of time between that radiographer…in a standard NHS hospital, between that radiographer seeing the pictures or producing the pictures and the radiologist actually seeing it.

RB: Yes.

APM: That seems to me that…there's a big problem there, isn't it? Because if you then say, "Well, these images aren't quite what I need. I need something else," then you've got to get the patient back in which is another delay.

RB: Most of the times, recalls are quite less in x-ray when compared to other specialties and the reason is because most of the x-rays are done by protocol and there are standard protocols. The reason the radiographer is not allowed is because not all radiographers can read the x-rays. If you want to read the x-rays, then you have to go on special courses and then you're a reporting

radiographers and if you give a wrong report to the patient or to whoever has had an x-ray and the radiologist thinks otherwise then there is a bit of a conflict. So there are only certain reporting radiographers who have the qualification to read the x-rays who can give the report. So hence —

APM: So those x-rays would never get to you then. They'd stop with the reporting radiologist…radiographer.

RB: Some of them. Some of the NHS trusts have reporting radiographers and they report it and send it back but some, like our trust, we don't have it. We don't have reporting radiographers. So all the x-rays, MR, CTs are reported by consultant radiologists. With the current NHS, the number of reporting radiographers is increasing.

APM: Which presumably means that you've got more time on your hands for the more skilled and difficult stuff.

RB: Doing CTs and MRs.

APM: You said that x-rays are relatively cheap to produce. Does that mean that GPs are much more willing to refer for x-rays than —

RB: Absolutely because x-rays are quite cheap. To put into perspective, I can't quote the NHS rates but just random rates in the private sector, if you want to have an x-ray, it costs anywhere between £75 to £100. If you want to have a CT scan, on an average, it ranges from £500 to £600. I'm talking about one part. If you want to have an MRI, depending on what quality MRI you want, you're looking at £600 to £700 and if you want to have an ultrasound, it's £200. So when you request, you have to consider what you want to do and what the patient can afford and what the question is, not asking everything else.

APM: And going back to the x-ray equipment that's available in, you know, the standard physical therapist clinic. I've always been very skeptical that, you know, a domiciliary x-ray can compete in any way, whatsoever, with a standard equipment available even the bog standard NHS hospital. I mean the technology is quite phenomenal in these hospitals, isn't it?

RB: Technology is quite phenomenal because you can do all sorts of x-ray. For example, every x-ray machine can do a full length extra limb length discrepancy, if you want, looking for limb leg discrepancy. There are only certain trusts which will do it or full spine x-rays. Not every x-ray machine will do but technology has moved on and now, we have portable MRs as well. So you have MRs which are just like a small box. So x-ray's also the same but there are limitations depending on what you want it for. There are limitations, what you can do with small x-rays and small MRs.

APM: I came very close recently, a couple of years ago, to buying a clinical ultrasound imaging machine and the thing that finally dissuaded me of getting this ultrasound kit was I thought…I've watched the guy in a hospital. I actually went on…I went to a breast screening unit and I saw him using this thing and I couldn't make head or tail of the image of static that I saw on the screen and a slight variation in the angle of the head changed everything. Is ultrasound as difficult as I think it is to read?

RB: No, it's like driving a car.

APM: It's just me, is it?

RB: It's like driving a car. If I'm driving a car for the first time, I don't know where is the brake, where is the accelerator but once you know how to drive a car, it's so easy. Ultrasound is the same. If you have had the training and if you have had a nice supervisor, then there's no…I can't see any reason why you can't use it. It's as easy as you think. You just need to know what you're looking for. As long as you know the anatomy, as long as you know what the process…what you're looking for, it's easy.

APM: Admittedly, I only looked at it a couple of times. So I just thought I'm going to see whatever it is I think I'm looking for in the ultrasound. Have you come across these small clinical machines, about £5,000 each I think, for ultrasound scanning?

RB: It all depends upon which machine you're talking…the portable machines are about £15,000 but the new machines, the new…because technology has moved on. If you have a smartphone, you can…there's a new kit that has come out. It's just like a smartphone and you use the ultrasound and it goes to your iPad. As simple as that. This is the latest and you can Google quite a few companies which are selling it and the picture resolution, everything is pretty good.

APM: So good enough for use in a —

RB: To use a diagnostic but most important thing is not only in diagnostic but if you want to do any intervention. For example, if you want to guide an injection, an ultrasound is good because you can just target it and just…you inject it exactly where the problem is.

APM: You're about to show us some ultrasound things on your —

RB: I'm just looking to see if I have any ultrasounds. So that's a typical ultrasound machine.

APM: But you said that's £15,000.

RB: This is costly. This is about £50,000 but you can have a portable ultrasound which is much cheaper, in the range of £20,000.

APM: Well, we certainly have been offered them at £5,000. I can't remember the name of the company and I don't know the quality of the machine. I'm guessing if you're saying £20,000 then it's going to be considerably lower quality than that but I don't know what we would lose if I can also get an ultrasound picture off an iPhone and an iPad.

RB: With the latest technology, it's so easy because you just need to buy the transducer and the transducer, different companies sell but some are £3,000 to £4,000 and you just need the app and that's it. You're up and running but depending on what you want; you have different transducers. For example, for MSK, musculoskeletal ultrasound, you need a couple of transducers. So you can be up and running with around £15,000, £10,000, £15,000.

APM: We've had another question come in from somebody who apologizes if they've missed the answer to this question which I think they have. Are there any health risks at all, other than you mentioned with fetus, from MRI scanning?

RB: No. MRI is pretty safe but the only thing is you have to make sure that the patient doesn't have any metalwork, any pacemaker. It's like putting somebody in the magnet. So you have to be sure that the patient is metal proof. So if you go to US, there was a guy who took a gun inside.

APM: What?

RB: Yeah, he didn't tell anybody and the next thing they knew, that gun had gone and then it was too late or if you see the latest one that happened in India…unfortunately, the problem is the MR machine is never switched off. The MR machine is always on.

APM: But that's because it takes so long to restart it I gather.

RB: Yes, but once the hospital closes or the MR machine is…department is closed, the cleaners go in. They don't have a clue what's happening. So they took the hospital bed without the patient, thankfully. They put it in, open the door. The next thing they knew, the porter, the MR technician and the bed is plastered against the MR machine. So you should be very, very careful what you take in. So the only contraindication is metalwork.

APM: What about metal implants?

RB: Most of the metal implants…the recent implants over the 10, 15 years are all compatible, the titanium implants but you have to be very careful if

somebody has had a surgery 20 years ago. Then you should always check what implants they have had to make sure they are MR compatible.

APM: What about teeth fillings?

RB: Teeth fillings are fine.

APM: That's fine, OK. It's quite scary though, isn't it? I think I'm more scared about the idea that someone would take a gun into a hospital, let alone into an MR machine.

RB: So that's why most of the MR machines will have the handheld metal detector as well but it all depends. You have to be careful.

APM: So there we are, there's no hazards to that. Do you want to start us off then about MR? I know you've got lots of images on your list of slides here.

RB: So I'm just going to show you some images. So this is a case. I'm just going to show you what we look at on MR. On MR, you get different sequences. You get…in different planes most of the time. So you get it in sagittal which is straight upright and then axial images and what you're basically looking for is you're looking for the nerve roots and where there's compression. For example, in this case, you can clearly see that there is a disc which is pressing on the nerve roots on the left. So this patient has got left leg pain. If you do an x-ray on this case, it'll be normal and then the patient would've had radiation whereas with MR, you can see what the problem is.

APM: But the sagittal image really gives you an idea. It doesn't give you any detail, does it?

RB: No, it gives you detail. It shows you the vertebral body, it shows you the disc, it shows you the cord as well. So that's what we record because more often than not, sometimes the spine will be normal but there will be a problem in the cord, for example, in patients with multiple sclerosis and you'll be the first person to pick it up.

APM: So having seen that sagittal image where there is clearly an indentation in the cord, you can't tell which side that disc is bulging at the moment. How do you then find the relevant image from that huge, massive images on the other side?

RB: We have what we call—

APM: … Of the film.

RB: --as cross registration. So we have a cross registration bar and then we have…as you move the axial the corresponding bar moves on the sagittal. So it's just a cross reference.

APM: So more to the point…from our perspective as physical therapists, if we're using, in my case, say, OsiriX and I am looking at that sagittal image, will I get the same…will it also do the same thing?

RB: Yes. On OsiriX also you can cross reference it by using two windows. You can put the sagittal on one side, axial on the other side and it'll cross reference. So similarly, you can see another case here. Same thing again and this case, it's more on the right. Patient coming in with right leg pain. You can see the disc pressing on the nerve or in this case…so it's a larger disc, more on the left. So it's quite easy and if you go to the cervical spine…for example, patient coming in with neck pain, there are different causes whereas when you do MRI, you can see if there's a problem with the vertebral body or the cord and you can see a massive disc pressing on the cord and causing cord compression.

APM: And how often are you going to see something like this incidentally which has no bearing in any of the symptoms that the patient presents with?

RB: Not very uncommonly. It all depends what the patient symptoms are. Sometimes you can have a big disc on the left but the patient has symptoms on the right. It's not very uncommon to see. So you should not treat the MR images. You should treat the patient. So that is the most important thing. Don't treat the MR. If you do MR, you'll pick up some things which are irrelevant. So technology's good but you should use it with caution.

APM: How often would you say that…you're not an average radiologist, clearly but an average radiologist is going to miss important findings on MR?

RB: On an average, I would say you should try and keep your discrepancy rate less than 3% to 4%. If your discrepancy rate…if you miss more than 3% to 4%, that is a problem.

APM: What sort of things are going to be missed? What you've shown us here are fairly glaring images, aren't they? But what are the sort of things that go missed?

RB: So the things that can be missed is…if somebody comes in with leg pain, you pick up the disc which is causing the leg pain but…on the image here, for example, you can see the other structures in front of the neck whereas the patient has got neck pain. So you might miss a big tumor within the chest.

APM: Because you're focused on the disc.

RB: Yes, or you can miss a big tumor within the thyroid gland or if you go back to this, the patient coming in with back pain, obviously, you can see the disc whereas…I'm just going to show you one but we have the aorta in front. So here, for example, this patient came in with back pain and if you look at the spine, the spine is pretty normal. So you know that that is not the cause but when you look at the big structure in front of it, that is the aorta, this patient has got a whopping big aneurysm which is a dilatation of the aorta which is causing the back pain but if you miss, this is a bundle case whereas patient coming in with back pain, if you concentrate on the spine, you will say, "Everything is normal," but you missed the structure which are outside the spine.

APM: And so would you say that MR is the examination of choice for looking for AAA?

RB: No, CT is.

APM: CT.

RB: CT is the modality of choice but you have done the lumbar spine. You can't exclude the aorta. Aorta is just sitting in front. So what you have to do is when you look at the MR, you have to look at all the structures around as well and that's why people miss things. So you will be concentrating on the spine. You will be looking for a disc, obviously, the discs that are no discs and you'll send the patient home but what you missed is a big aneurysm or lymph nodes, tumors. On the axial images, sometimes you can see the kidneys and the kidney tumor can also present with back pain. So those structures, you're not imaging but they are there on the system.

APM: With this particular case, the image you put up on the screen here, you then send that patient for a CT.

RB: Send them for CT, urgent CT and A and E because if the size is more than 5.5, they have to have surgery because it can just blow up and the patient will be dead.

APM: That's size 5.5 longitudinally along the length…

RB: 5.5, yeah, diameter.

APM: Diameter, right.

RB: Diameter.

APM: I'm intrigued by this. I've got a particular interest. I sent a patient back to the GP recently just to query AAA, possible AAA and I have no…I tried to phone today to find out what the result of that visit to the GP had been but it will be

interesting for me to find out whether she actually had a CT scan or whether they sent her off and telling her she had wind for the last three months.

RB: You can do ultrasound as well. With ultrasound, also, you can see whether the patient has AAA or not but if somebody has AAA then you do a CT to plan because what you can do nowadays is you can just put stents from the groin. Not a major surgery. Patient is awake. You put the stents in and then it's sorted.

APM: So stents within the artery rather than cage around —

RB: Within the aorta.

APM: I thought they're caged around the outside of the aorta.

RB: No, within the aorta. So through the groins, you put it into the arteries and you put it within it.

APM: Presumably extending how far above and below?

RB: It'll be above the aneurysm.

APM: How much?

RB: We have to decide based upon where the renal arteries come off because you don't want to block the renal arteries.

APM: Another question, "Again, sorry if I missed this but I lost the stream," thanks. "When are CT scans indicated over x-ray or MRI? And I think I caught the end of the discussion not something a physical therapist would request." So yeah, we have discussed that but just to run through it again, CTs are —

RB: The role of CT in musculoskeletal is quite limited. The only indication is trauma for planning, surgical planning and the other thing is if there's a high end athlete, to look for subtle pars defects and to grade whether there is sclerosis of a small fracture.

APM: And that would be decided by whom then?

RB: That would be decided by whoever is referring. For example, if you have an English cricketer and he has got back pain, x-rays will be normal. He can do MRI and that might show edema but in order to see the fracture, you have to do focal CT of that because accordingly, the period of rest will change.

APM: In our clinics, there will be some people treating elite athletes, I'm sure but in our clinics then, if we've got somebody who…where we suspect a fracture, we're probably going to say, "Go for x-ray," aren't we?

RB: Yeah but for pars defect, it's a bit tricky unlike a normal one. If it's a chronic pars then you can see it on x-rays but if you want to grade the pars and if you want to see the sclerosis then CT will help. Obviously, MR is the modality of choice. MR is the modality of choice because you can see the edema, early parts and all.

APM: Where I'm going with this is I still fear that if we get too precise with the GP and say, "Oh, I want a CT scan. I want to look for possible pars defects," they're going to turn around and say, "Well, it's not your job sonny boy. I'm not referring this person at all. They've had an x-ray and it didn't show anything."

RB: I think the way to go around would be if somebody comes in with back pain and it's a young person without any major problems, no leg pain and is fit and well, athlete or cricketer or footballer then you should ask for an MRI and based upon MRI, the radiologist will obviously refer if he's suspecting that there could be subtle fracture. Otherwise, accordingly, you can assess if there is nothing there or in order to assess whether there a clear cut pars fracture. You can request.

APM: One of our viewers has asked if they could see that aorta again. Could you just indicate on the screen the boundary of the aorta there?

RB: So this big pipe of plumbing in front is the aorta and this is a sagittal plane and the same thing, you can see it on axial as well and you can see that this aorta here is normal whereas here, it's bulged and it's quite big.

APM: And there's a particularly dark oval in the middle of the aorta where your cursor —

RB: That's called thrombus and calcification. So because this is an elderly gentleman, so he's got thrombus calcification all within the aorta. So don't forget that back pain has got a number of causes.

APM: Of course, yeah. And I was looking at the sort of L4-5 area of the spine there and there are some little indentations into the cord, aren't there? But those are within normal bounds, I take it.

RB: Within normal limits. Obviously, you are to look at the axial and all but it does not look very exciting.

APM: We don't want to get too obsessed with aortas but one question that's come in is do radiologists always check for AAA if you're looking at that part of the body?

RB: Absolutely. You have to look at AAA, you have to look for the nodes because lymphoma, tumors…it can pick up gyne tumors because when you do the lumbar spine, you can see the pelvis. You can pick up gyne tumors and you'll be the first person to pick it up and you might save the patient.

APM: Is that fairly common?

RB: On an average, I would presume…because I work at a tertiary referral center so we see quite a few but on an average, I would say you would see at least 2 or 3 tumors picked up incidentally when the patient has had a scan elsewhere or for something else.

APM: You said you work in a tertiary referral center. What does that mean physically?

RB: Tertiary referral center is where…for example, I work at the bone tumor center. So all the bone tumors from all of the United Kingdom come to two centers, either to our Royal Orthopedic Hospital in Birmingham or to the Royal Orthopedic Hospital in Stanmore. What we mean is that any bone tumor seen anywhere will automatically be shipped to us or to London.

APM: So tertiary because they're being referred to you by a consultant elsewhere.

RB: By a university hospital or a consultant elsewhere, for example, Manchester, Wales.

APM: We talked about ultrasound a little while ago. One of the questions that's come in is whether ultrasound is better for diagnosing, for example, rotator cuff tears. Would it be your choice there?

RB: For rotator cuff, ultrasound is very good. It can pick up tears easily. The most important thing is that most of the request cards, the history is illegible whereas with ultrasound, the patient is there. You can ask what the problem is. You can do a static as well as a dynamic examination. It helps us to get more history as well. And the other thing is that you can identify the tear. If there is no tear, if there's bursitis then you can do the injection at the same time as well and it's quicker. An ultrasound, on an average, will take about five minutes.

APM: Is that common though? I mean I was under the impression that if you refer somebody for an ultrasound, they'll go then someone will send you a report and then if there's an intervention required, you send them back for their guided injections.

RB: It depends upon the local arrangements. For example, if you are in some hospitals, that's what they do whereas other hospitals, they put ultrasound

plus or minus injection as appropriate in order to save the second appointment.

APM: So in terms of that referral process then, if for whatever reason I want to refer someone for MR, the processing…I'm going to have to send them to their GP and the GP is then going to decide whether or not I've got a valid case and then he's going to refer them to the local NHS hospital and that whole process is going to take, what, 6 weeks, 2 months?

RB: If you get an MR within six weeks, you're lucky because he has to go to GP and all. It all depends. If the patient is self-referred then there are several centers which will accept referrals from chiropractors, osteopaths, physios, sports therapists. As long as it's a valid referral, it's done. If you go through a GP, it just takes a bit longer. Depends what the problem is.

APM: Your center accepts referrals, does it not?

RB: Yeah.

APM: From physios and chiros and osteopaths.

RB: So we have a center in Knowle which is a Heath Lodge or CMC imaging where anybody can refer as long as they are qualified chiropractor, osteopath, doctor, physician and then what we do is…they offer ultrasound, x-rays, MRs.

APM: What's the mechanism for the referral? Is it an email or a letter or do you have to give special forms?

RB: No, you can do an email, you can do a letter or fill in the online form as well and the rates are pretty competitive. For example, if you want to get an MR done in a private sector, it's about £600 whereas here, it's £240.

APM: Now, we talked about this earlier on and it took me awhile to get used to this because actually, it's cost effective for somebody in Spain to fly to Birmingham for an MR rather than to go to any other conventional centers and pay 700 quid for their imaging, isn't it? Because —

RB: Absolutely. I think it makes sense because 245, you come, you have the MR, you have the report, do a bit of shopping at Bullring in Birmingham and then fly out. Cheaper —

APM: And as always, you know, these broadcasts, these CPD sessions are not meant to be sales productions for anybody who comes on as one of our guest and I only discovered this this evening but that's something that's seriously worth bearing in mind. If you've got a long waiting list in your area or you've got expensive private referral system, to get someone to Birmingham for an MR, it's a day out, it's a relatively small train or flight, very small expense,

well worth considering and we will put the details up, as I say, on the website afterwards. Some questions, what would be the current guidelines on monitoring a juvenile scoliosis?

RB: It depends upon what type of scoliosis it is. For example, at the Royal Orthopedic Hospital, we have a pediatric scoliosis service. It depends upon the extent of scoliosis. If it's mild scoliosis then they have yearly x-rays whereas if they decide on intervention then they might end up having a CT scan, depending upon the curvature but on an average, I would say —

APM: And the CT scan is designed to determine how they can intervene.

RB: Look at the pedicles…yeah, to aim…so that they can plan what type of screws to put, what type of implant to use but on an average, give or take, I would say yearly.

APM: Are upright seated MRI scans more diagnostic for prolapsed discs than non-weight bearing scans?

RB: Upright MRI is now in fashion. There are two upright scanners…there are upright scanners everywhere. There are two upright scanners in Birmingham. We have always believed that if somebody has back pain while sitting or standing then you should scan them like that, not lying down but there's a trade off. If you want to have an upright MRI scanner, you can obviously pick up additional findings but the quality of the images, you have to bear in mind.

APM: Because they're not as static as they are when they're —

RB: No. The power of the magnet, for example, on a standard MR is 1.5 tesla whereas if you want to have an upright, it's an open MR just like what we are doing, just sitting and we have a scan but the quality of the images is proportional to the power of the magnet and the upright MR magnets are 0.4 or 0.5. So accordingly, they may just…image quality would not be as great as the 1.5 or a 3 tesla but obviously, it can pick up some additional findings if the normal MR is normal.

APM: This might be a stupid question. Why can't you just turn a normal MR scanner on its end and stand while the machine does its business?

RB: It's a few tons.

APM: I know. You have to bolt it to the floor and the walls, I know but —

RB: But you can't stand because the patient has to get in, be able to scan, the magnet, the helium.. It's not possible.

APM: It's not possible.

RB: …but it's just like if somebody's claustrophobic then upright MRI is better.

APM: And certainly whenever I've been to talk to Nick Birch, the spinal consultant that I talked about earlier on, I mean he's always emphasizing the value of upright MRI, standing MRI for, you know, looking at back pain but again, is that something you would expect the referring osteopath, chiropractor to say or do we just say, "I want this person scanned for low back pain," and you would determine or the clinic would determine the type of MRI to be conducted?

RB: In my personal view, if somebody has back pain then it's better to have a traditional MR first to make sure there's nothing wrong and if the traditional MR is normal then I would suggest…and if the patient has dynamic back pain then you can scan the patient in that particular position.

APM: And if they come to your clinic, would you do that in the same day?

RB: In some clinics, yes.

APM: Because obviously, if someone's flown down to Birmingham and they do the normal MR first of all and they fly home again then we —

RB: It all depends what the question is.

APM: You were talking to me earlier on about some interesting developments in magnetic resonance.

RB: So, I don't know, everybody as a kid would have burned the paper using a lens. So the new technology that's coming up is what we call as MR guided focused ultrasound. So if somebody has a tumor or fibroids or brain tumor, the patient lies on an MR scanner, you scan, identify where the problem is and the table has in-built lens or ultrasound fit in. So what you'd basically do is do an MR, identify where the tumor is and then you focus the waves on that. There are no cuts, there's no surgery and then you burn the tumor and the tumor is gone. So that's the future at Royal Orthopedic. We're just about to start the trial for recurrent tumors on that.

APM: So you're about to start trial. The machine has been through trials. So it's safe to use. It's been proven. There's one other in the country, in London which is in use already?

RB: Yes.

APM: And this is called MR…?

RB: MR guided focused ultrasound.

APM: MR guided focused ultrasound.

RB: Focused ultrasound.

APM: But if you look…we didn't get a copy of the video because I didn't even find out about this until earlier this evening but if you look up on YouTube, MRgFUS, M-R-G-F-U-S, and look for MR guided—

RB: Focused ultrasound.

APM: --focused ultrasound, there is a superb marketing video, a superb video demonstrating how this works and just to recap on that, the MR images are going to show you precisely where the tumor is and the extent of the tumor. You're then…within the machine—

RB: Use the ultrasound.

APM: --there's a focused series of ultrasound waves which independently, wouldn't do anything but when they concentrate at the site, they will burn that tumor away and this is useful for…?

RB: For fibroids.

APM: Fibroids, yeah.

RB: For tumors, for essential tremors. In Germany, they use it for facet joint as well. So if somebody has facet joint, they just ablate and burn the nerves around on the facet joints and for tumors, for like metastasis also.

APM: And I think on that marketing video, they show a gentleman being wheeled into the MR with a tremor—

RB: Tremor.

APM: --when he goes in and that tremor is gone when he comes out of the MR. So it's done without anesthetic.

RB: It depends upon what it's required for but most of these patients are anesthetized because you are to ensure that the patient doesn't move when the ultrasound is…beams are put on because if the patient moves then you might burn the other part. That's —

APM: So they faked that image then when he came out of the MR and was tremor free.

RB: No because that is after the procedure and the patient is awake and then…

APM: What sort of temperatures are we talking about?

RB: It depends what you do, what type of tissue you're burning but you can range from 40, 60, depending on what you're burning. You change the temperature accordingly.

APM: And you were saying this is a bit like using a computer game, sort of an Xbox or something —

RB: Absolutely, like an Xbox remote. If somebody uses Xbox remote, it's quite easy.

APM: So we've got robotic surgery in the conventional sense. We've now got Xbox radiography because it's a radiographer who will be doing this.

RB: Absolutely.

APM: Not an orthopedic surgeon or whatever.

RB: No, yeah.

APM: These machines are going to be overwhelmed, aren't they? There's only two of them in the country and…

RB: But we feel that there's a potential that this would definitely take off because there are only two machines now but the procedure now takes a bit longer than what you will expect. For example, it takes a few hours but with time, it'll definitely take off.

APM: It's certainly well worth keeping an eye on, isn't it? I can see all sorts of people hoping to be first in the queue for your trial. What's your trial going to demonstrate?

RB: If somebody has had a tumor and they have taken the tumor off but there's a small tumor left behind or there's a small tumor which has come back then in order to burn the residual tumor, the patient should have surgery but instead, we can use this and burn it.

APM: And is this a trial in the formal sense of the word trial in that it'll be reported as such for one or other of the journals?

RB: Yeah.

APM: And the outcome measure is no recurrence over what period?

RB: So what we do is we do a scan straight away to make sure it's all necrotic, the tumor is dead and we do a scan every three months. And then there's a protocol. So you do 3 months, 6 months.

APM: At what period do you judge it to have been a success?

RB: If there's no recurrence by a year then it should be fine.

APM: That sounds fascinating. We'll keep an eye open on that because yeah, I should imagine that…I haven't heard anything about that in the TV or radio news and this amazes me.

RB: There was one in BBC about brain tumors but…

APM: I've got a few other things that I was going to ask you about MR scanning. I mean the term spin echo came up when I was looking up this…researching for this interview. What's spin-echo all about in MR?

RB: It's all to do with the protons. So for example, every structure, every cell in the body has water and the protons, normally, they spin within a magnet. So spin echo is this…there are two types of images. You have a spin and gradient. Spin echo is the traditional one and based upon the spinning of the protons, you get the images. So it's a technique of developing images. Depending on what you want, you either have a spin echo or a gradient echo.

APM: I'm almost sorry I asked the question, to be honest, because I'm not sure I still…I'm not sure yet I understand the answer.

RB: Basically, it's a technique of creating images.

APM: And again, not something we would concern ourselves with, you decide that in the —

RB: No. So we decide. For example, if you're asking for blood, if you're suspecting some hemorrhage then we do gradient echo but apart from that, if you ask for a normal MR, you'll get a spin echo.

APM: One thing always puzzled me in college when they used to throw up x-rays at us in the very limited period of training that we had on radiography, you would see all sorts of little dark bubbles and things which could be gas or could be tumor in the abdomen, for example. How do you tell the difference?

RB: Sometimes it's tricky.

APM: Good, it's not just me.

RB: But you need to know your anatomy. So once you know your anatomy then you can decide but if there's any query then we do further imaging. Sometimes it's tricky but sometimes you have to consider doing a CT or an MR depending on what it is and where it is.

APM: So let's get back to that education thing though. We talked about your website. Is it MSK Radiology 4U?

RB: Radiology 4U.

APM: If one of our audience were to go to your website, would they have a relatively comprehensive self-education package on reading all these different types of —

RB: Yeah. It's free. You can access it and it's got photos and cases. So for example, if you want to look at infections of the calcaneum, you can just Google it and you'll see all the calcaneal infections or if you want to look at discs, different type of discs, you can just Google it, you can just search it. It's quite easy to do and you can test yourself. Otherwise, we'll tell you the answer and you can see it on iPad as well, iPhone, Android.

APM: And three times a year, you're doing live webinars yourself on this I think.

RB: Yeah —

APM: Did you say March, June and…?

RB: March, June and December.

APM: And December. For a very nominal fee and what's the purpose of those webinars?

RB: It's just for educational purposes. We are just doing…to educate and the first webinar that we did in December was on soft tissue tumors. The webinar that we just did was on bone tumors part one.

APM: Are there recordings available of those?

RB: The recordings are available. Yeah, it'll be going live in the next few days, the recordings. The next webinar is in June and that's on bone tumors as well.

APM: Talk to me about fluoroscopy then.

RB: Fluoroscopy is nothing but like light x-rays. You can either increase the radiation dose or decrease the radiation dose but fluoroscopy's important in a way in…to target your intervention, to guide your intervention. If you're doing a nerve root block or a facet or you want to fix a fracture then

fluoroscopy is useful in that way. For example, here you can see the patient has…in this case, you can see that the patient has got multiple fractures in the lower thoracic and upper lumbar spine. So what you can do is…if I can get…so this is a fluoroscopic image. So what I have done is I have put in rods into the vertebral body and I put the cement in. So this is vertebroplasty. So it's quite easy to do. With the fluoroscopy, we can guide the needles accordingly.

APM: So those rods aren't needles.

RB: The rods are needles to deliver the cement and once the cement is put in, as in this case, we take the needles out and the fractures are as strong as it can be and the pain is instantly gone.

APM: Really? Out of curiosity, do you remember what caused those fractures? Are they crushed —

RB: All osteoporotic. These are all osteoporotic fractures because on the MR, we could see…you can see the fracture line and you can see the edema. This is just because of osteoporosis.

APM: And is that a common intervention with osteoporotic fractures then to cement the vertebral bodies?

RB: No, not common, depending on where you are. Normally, osteoporotic fractures are managed conservatively but if the patient continues to have persistent pain, maybe…or fail conservative treatment after 4 to 6 weeks then we do vertebroplasty and the main thing is to…so that they can get up and do their normal work.

APM: But isn't there a danger…I mean if you've got an elderly patient who's severely osteoporotic and they've got very wedged vertebrae, if one…if there is a fracture there, isn't there a huge value in actually supporting that vertebra straight away? I mean conservative management means it's going to get more wedged and worse, isn't it?

RB: On that side, your ideal solution…for example, if you're in Germany, if you have a fracture today, you'll be fixed tomorrow whereas with the NHS and the current resources, it's not possible. So hence, we have a rough guideline of six weeks but there's no strict guideline. You can do it straight away. Patient's symptoms will go straight away but in the UK, we normally tend to leave it for 6 to 8 weeks and then the patient…the symptoms don't improve then we intervene.

APM: Is there no preemptive treatment for osteoporosis then as you see a patient gradually becoming more and more kyphotic, you know?

RB: No, there's no indication as it is but only if there is fractures and if there is fluid on the STIR sequence, that is the only indication to do and at one sitting, you can only do three but obviously, the patients can have calcium supplementation and other supplementation to prevent or strengthen their bones.

APM: There was a radio…there was a lot of publicity recently, wasn't there? About the effect of various drugs in aggravating osteoporosis. Have you been involved in that? Are you aware of the detail behind that?

RB: Normally, all those are dealt by a metabolic physician or orthopedic surgeon. It's beyond our expertise.

APM: Do you get a lot of osteoporosis in your —

RB: Yes, we do because there are very few centers who do the vertebroplasty. For example, in the Midlands, so we are the only one. Otherwise, you have to go to Oxford and we do quite a few.

APM: You had some graphic images on your presentation earlier on which I must say…I don't know what they are but they intrigued me. If you go off a little bit further, I think you had some…

RB: Yeah.

APM: Well, there's a CT image there, isn't there? Which —

RB: So this is the 3D volume rendering. This is what I was talking to you about. If somebody has…you're suspecting a pars defect, you can do an x-ray and if it's clear on x-ray, that's fine but if not, then you can do a CT and you can see the defect clearly or you can do fancy 3D rendering and it can show the defect. It just helps to do…to plan —

APM: That first slide you showed then, that is also a CT.

RB: This is a CT.

APM: I must admit, I looked at it and thought it's just an x-ray and that the CT was the 3D rendering that…which came afterwards.

RB: But you can do a 3D rendering on a CT.

APM: If we looked at that on an x-ray, we wouldn't see the fracture.

RB: This one, you might. You might be in a position to see but if you're looking for subtle ones…for example this one, this one you can but this one, I'll be really surprised if you can.

APM: So the left-hand one is —

RB: The left-hand one, you can't whereas on CT, you can clearly see and that would significantly change the management.

APM: I always assume that on x-ray, if there was a fracture then the fracture line would show up as a bright signal on the films.

RB: It depends upon what…how you are taking the x-rays. For example, if the fracture…if you're suspecting a pars, if you do an AP, you can't see it but if you do an oblique view on the lateral, you might but if there's a subtle fracture like that, it's quite tricky.

APM: And again, I suppose I have asked this question a couple of times but if we're sending people in, hoping to get an x-ray or CT, how much detail do we need to specify? If we say that, "Well, we want an oblique x-ray because we're looking for," whatever, should we just say what the condition is we suspect and then leave it to the radiographer or whoever to —

RB: Absolutely. Just right out what you're suspecting and accordingly, that will protocol by the radiographer or the radiologist. It will be accordingly protocol

APM: Any tips for us when we get the reports back on what we should be looking for to make sure that the right things have been done and the right things included or excluded?

RB: As a routine, if you look at the report…if you're suspecting trauma, infection or tumor, make sure you have a STIR sequence.

APM: Will they say that on the report?

RB: Yes, they should say the technique and most of the centers will try and avoid it because it takes an extra few minute. In order to cut time, they normally would do only T1 and T2 but if you're suspecting infection, inflammation, tumor then ensure that there's a STIR sequence. If there's no STIR sequence, it's a bit tricky. You will miss…for example, in this case, you can see a patient with back pain. So you can see on the STIR, it's quite evident. It's quite bright whereas on the T1s, it's very tricky. The second thing is make sure that the question is answered. If the question is not answered then it's better to look at the images yourself or ask somebody to just have a look.

APM: So if we've sent in an image suggesting that…I don't know, we're looking for a pars defect and they haven't come back with that information —

RB: Yeah then —

APM: I can't imagine that happening. Does it happen often?

RB: Yes. You'll be really surprised because if you're suspecting pars defect, they tend to have an MR and the traditional teaching is in order to look at pars defect, you have to do a CT whereas now, with the current MRs, you can see the pars defect even on MR but many of the radiologists tend not to look at it. So hence, if you have a question like query pars defect, back pain, and query pars defect then you have to ensure that the question is answered. If the question is not answered then it might be worth asking somebody else to have a look at it.

APM: We've had a question in about…another question about training in reading images. We've already talked about your website and the facilities that you've made available on that. Are there courses available for physical therapists or non-experts? If so, how long are they? If not, should there be?

RB: I'm not aware of any courses but internet has got a lot of material. There are several websites which will show you what MR should look like with axial, coronal and sagittal plane and with time, you can improve your knowledge by looking at them and correlating with the MR and the other thing is by looking at pathologies. So if you get the report of the patient with fractures, make sure you look at the corresponding MR or if the patient comes with infection then look at the corresponding MR and with time, you'll improve.

APM: It's going to take us two years, you said. So we just need to make sure we look at a lot of images over that time.

RB: Absolutely.

APM: But we can use your site for that, of course. Other than the technology you've already mentioned, where is technology now going in radiology? What other advances do we expect to see?

RB: So normally, nowadays, we do what we call as PET-CT. PET-CT is nothing but…where you give the dye in and then you do a scan. It's a radioactive dye. For example, any place which uses small glucose, the drug is taken up and when you do a scan, it just becomes hot. For example, if you have…in musculoskeletal, if you're suspecting a subtle pars defect…let me find the image for you, pars defect. So this is a traditional bone scan. This is what was done before but it's like unclear medicine. You don't know where the uptake is but in order to show exactly where the uptake is, you copy it and plaster a CT on it so that you can see more details.

APM: Are these still done —

RB: this is a bone scan.

APM: Are these —

RB: They're still done in order to look at distant meds for example, if somebody comes in with infection or tumor somewhere, in order to look at the whole body, you do a bone scan and it shows a bit of uptake but if you don't know exactly where it is…so you have to do an x-ray or a CT to correlate them for sure

APM: So what's the mechanism used for that?

RB: So you give a dye to the patient. For a bone scan, you give a dye which is taken up by bones and then put them in a special scanner and they scan them again and you get these images.

APM: The only time I've come across bone scanning in the past is assessing bone density for osteoporotic patients.

RB: That is DEXA scan. That's a different scan. That's DEXA scan.

APM: Which doesn't involve dye.

RB: Yeah, does not involve dye.

APM: Do you get involve in DEXA scanning?

RB: DEXA scanning is just normal scanning where you just do special x-rays and then accordingly, you will get a different score, TNZ score and then you can say that the patient is osteopenic, osteoporotic or normal.

APM: So with this one, we've injected dye into the patient. They've gone to a special scanner —

RB: It's a radioactive dye. So you are to ensure that all the radioactive protection is done and then they go in a special scanner and then you take those images and you get these images.

APM: And what we're seeing on here…what's significant on the image that's on the screen at the moment?

RB: Whatever is black, that means all the dye is being taken up. That means there is increased bone turnover for example, if there's a stress fracture, if there is infection, if there is tumor, the dye will be taken up and it'll turn out as black

APM: So if you don't see anything at all, that's normal on this particular scan?

RB: Yeah or if there's degenerative then it'll also be black.

APM: With DEXA scanning, now we're turning to a different type of scanning, DEXA scanning, we're looking for people at risk of osteopenia, osteoporosis. There are various scanners out there. Which are the reliable ones? Or which is the reliable area to scan? What's the —

RB: Either you do a wrist, femoral neck or the spine, depending on what you have. All the three are considered standard

APM: And they're equally reliable.

RB: Yeah.

APM: And presumably, you know, the ones, again, available in clinic are going to be down at the bottom end of the financial spectrum. Does that mean that they are less capable than what you might get in a hospital or as reliable in —

RB: No, most of them will either do one of the three areas and the results are pretty competitive, I think.

APM: Now, just a minute ago, above that CT image on here, you had some plain graphics, just…not images, just…another one. There, those four images there, what are they showing?

RB: It is just to show the anatomy, what we are looking for

APM: So you've got a normal disc there.

RB: Normal disc, annulus fibrosis and a normal disc and sometimes you can have extra pieces of bone and depending upon which angle they go in, they are claw osteophyte or syndesmophytes and the same here on the axial here, you can clearly see the disc and the disc can sometimes come out and cause pressing of the nerve it's just an animation of the same

APM: And the yellow dots in the canal there?

RB: These are the nerve roots, the nerve roots in the canal and this is the exiting nerve root that comes out of the neural foramen

APM: And the purple ovals?

RB: These are the facets. so don't forget that if there's a hypertrophic facets or there's a sign of a cyst it can also pop in into the canal and cause compression of the nerve.

APM: I remember from talking to Nick Birch on one of these broadcasts that he was saying that a lot of spinal decompression are a big part of the process and actually removing ligamentum flavum and not other material

RB: For example, here, you can clearly see that at this level, the central canal is quite narrowed. To put into perspective how it should look like, look at this level. This level is pretty normal whereas if you look at here, in this case, this is now the same on this

APM: There were two levels on that slide you just showed which I think you were…were they both circled?

RB: Yeah so here, you can see narrowing at this level whereas here, you can see a cyst. So that's how you see a facet joint cyst.

APM: That's the small white quite distinct—

RB: On the top, yeah, this one.

APM: --signal there. Yeah, OK. And going further down, you've got a —

RB: So here, at this level, you can see that the center canal is quite narrowed because of facet joint ligamentum flavum as well as a disc. So this patient has got full-fledged serious spinal canal stenosis. And this is the same cyst that I was talking to you about, the white thing that you can see here. So there's a facet joint cyst as well, in this case, causing spinal canal stenosis.

APM: Fascinating stuff. Have you covered, do you think, the full range of limitations of radiography, radiology as we've got at the moment? I mean are there, you know…the things that we should be considering not to refer for that are commonly sent to your department?

RB: The most important thing I think is if you're suspecting…for example, knee pain in a patient who is more than 60, don't refer for an MR unless you have an x-ray. That's the first thing because you can pick up osteoarthritis on x-ray. You don't need MR. So that's the first thing. Second thing is if somebody comes in with back pain, with leg pain then MR is better, not x-rays. So these are the two common things I think

APM: What about patient education? Because most patients coming to our clinics these days expect to get an MRI or an MR scan because they believe that that's what they need to diagnose all their ills.

RB: You have to be very careful about over investigation. You might pick up things which are irrelevant. For example, you might get a patient who has got back pain, complaining of back pain whereas clinically, he doesn't have anything and you scan and unfortunately, you would've picked up a kidney tumor.

APM: A patient would say that is good because you found a tumor.

RB: It's good —

APM: And on your new machine, you can get rid of that tumor almost instantaneously with the —

RB: Absolutely but you have to think how it was before. You have to understand that we have what we call as incidental lesions and most of these lesions, if left alone, they won't do anything. So some of them will change, some of the renal tumors will increase rapidly but quite a few will just stay static. Similarly, if you pick up some incidental lymph nodes, they might be irrelevant but that will increase the anxiety of the patient. So I think if you want to investigate something, you have to have a clear guideline or clear question rather than just asking MR or CT just for the sake.

APM: If you do find one of those incidental lesions, is that something you would then say, "OK, there's no clinical signs of this but we do need to keep monitoring it. We need to get you back —"

RB: Absolutely. Then, for example, if you have a renal tumor in a patient with lumbar spine, they need to have a full staging CT just up to the pelvis referred as a two-week wait. See a urologist within two weeks and decide about what it is, have a biopsy or have surgery.

APM: Do you think there's any effect on the growth or otherwise of the tumor on the patient's overall health or the concern that they would feel as a result of that incidental finding?

RB: Absolutely, it'll increase the anxiety and all and that's a common…that's a well known fact. You do a scan for something else and you pick something else. It might be relevant, it might not be relevant. So you should only request scans which are relevant. So if somebody comes in with back pain, has got leg pain and is not improving, yes, consider but just with back pain, I don't think you should do it because you're looking for facets or something which you can treat.

APM: Well, before we wind up this evening, I mean are there any other things that you feel we should cover before we move on? What are the great treats that you've got that you haven't disclosed so far?

RB: Just going to show you some cases of…so just remember one thing. If somebody comes in with back pain, they can have disc, they can fractures, they can have infection. Don't forget tumors. As in this case, patients come in with back pain, everything is inside. You can see a big tumor. Same again here, a patient coming in with nerve pain and you can see a big tumor here. The last thing I wanted to show you was the infection. Infection is a big mimic of… For example, this one came in with back pain and what you can see, he's

got…this is STIR sequence showing abnormality within the thoracic spine and also in the lower lumbar spine. Big abscess. This is —

APM: And the abnormality that you're seeing there is the increase…the light signal, the bright signal.

RB: Increased signal and increased soft tissue around. The same thing here, you can see this, all the soft tissue around. Big abscess.

APM: And this is a STIR sequence. So —

RB: This is a STIR sequence.

APM: Fat has been taken out.

RB: Fat has been taken out. You can see that under the fat, there's no fat. The fat within the vertebral body has been suppressed and what you can see is just a bright thing which is the infection or the abscess. You can see the urine in the bladder which is bright and these are the T2 sequences. This is T2 sequence. You can see the fluid is bright, big abscess. This is TB. You don't need anything. This is florid TB. So remember that infection is a great mimic for back pain. Young person coming with back pain, infection.

APM: Are you seeing more TB these days than before?

RB: Absolutely. There is a resurgence of TB and it's florid everywhere. So always, TB should be in your differential.

APM: When we talked to Alexander Montgomery in London, I don't know if you know him, he talked to us about MRI some time ago. He was saying that the population at particular risk was the very high Bangladeshi population in London and is that the case here or is it now widespread throughout all —

RB: I published a paper which showed resurgence of TB in West London. In Birmingham area, we have a lot of ethnically mixed community as well. There is rampant TB and the same…depending on which locality you live but even if you are not living in an ethnically mixed community, if you have contact with any of these, there's a chance that it could be TB. So don't try to bias yourself depending on where you live but think TB.

APM: And what's the process for somebody who has TB? I mean TB can be asymptomatic, can't it?

RB: Absolutely.

APM: Latent TB. So this could be an incidental finding on your —

RB: The patient would have had weight loss or patient would have had imaging for some non-specific back pain and then when you see MR, the imaging features will be…may be disproportionate to what his clinical symptoms are and that's classic of TB whereas with bacterial…with normal bacterial spondylodiscitis, the patient would've been in agony whereas TB, symptoms would be disproportionate to what the imaging findings are and it can be multiple levels. As in this case, you can see it's multiple levels.

APM: And what's going to happen to this patient next?

RB: Well, unfortunately in this case, patient has got a bit of cord compression but if the patient has normal neurology then it can just be treated conservatively with ATT whereas if the patient has neurology, they have to try and decompress the cord and fix it.

APM: And ATT is relatively successful?

RB: Yeah.

APM: ATT stands for?

RB: Anti-tuberculosis treatment.

APM: It was a nice, easy one, wasn't it? their I was thinking you would come up with some great Latin name of a drug. Anti-tuberculosis treatment. Who are most at risk before we have to do any sort of screening differentiation in our patients? Immunocompromised I'm lead to believe are —

RB: Immunocompromised, ethnically mixed community, Asians or Bangladeshis, Africans and if somebody else had any contact or any recent travel, so you have to think about TB.

APM: Dr. Botchu, that's been a great romp through radiology and hopefully it's been a great value to our audience here. I mean it's a lot to cover, various different disciplines. I hope people are more confident as a result of what you've said this evening about how they can refer and now of course of a relatively cheap mechanism for referring for MRs, presuming of course that they're referring for the right reason. We will put up the details of your website and obviously, make people aware of the contact details for your department. So if they want to make use of you they can but actually, that's been great. Thank you very much for coming in. It's been a great pleasure talking to you and I hope in the future we can get you back—

VVV