such sheaths are found; peritendinitis crepitans occurs well above the upper limit of the tendon sheaths in the muscles and musculotendinous junctions of the forearm.

The treatment of true tenosynovitis is well described in most standard texts.¹⁰ Once infection has been excluded, non-steroidal anti-inflammatory drugs, local injections of steroids, and plaster splintage are effective in most cases.¹¹ If conservative treatment fails or if the carpal tunnel syndrome develops then surgical release may become necessary. A few patients fail to respond to an operation and are then permanently incapacitated for repetitive work, but this is unusual.¹²

At one time rigid immobilisation was also advocated for peritendinitis crepitans,⁶ but this is now thought to be unnecessary as most cases either rapidly improve spontaneously⁵ or respond to ultrasound treatment.⁴ Most patients can resume work after four or five days.

The nature of many jobs predisposes workers to tenosynovitis or peritendinitis crepitans, and methods of prevention must be explored. Several factors seem to be important: badly designed tools,⁸ awkward working positions,⁹ lack of job variation, inadequate rest breaks, and bonuses for a high work rate or overtime.¹² Mechanisation might be expected to reduce physical work, but many industries are in a semimechanised phase in which people have to undertake repetitive work at a rate over which they have little or no control.⁹

The trade unions in Britain, taking a lead from the Australian unions,¹² have now begun to encourage their members to claim compensation from their employers for

tenosynovitis. A recent trade union publication presents "teno" as an intractable problem that typically causes long term pain and disability.¹³ This is an alarmist view, particularly as the definition of tenosynovitis used is broad and covers other less serious problems including peritendinitis crepitans. Trade union pressure might lead to industry being unfairly penalised with the costs of compensation for minor or even naturally occurring disorders.² Nevertheless, industrialists should take note of the rising tide of public opinion on this issue and take effective steps to prevent these conditions arising.

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Regular Review

Nuclear magnetic resonance imaging

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The first clinical reports on using magnetic resonance imaging were published more than five years ago.¹⁻⁵ Much experience has accumulated and there are now probably over 600 magnetic resonance whole body scanners operating throughout the world.

Magnetic resonance imaging does not use ionising radiation but strong magnetic fields and radiofrequency pulses. The hydrogen protons of water and fat are imaged, and their concentration determines the contrast in the images. The technique is non-invasive, well tolerated by patients, and seems to be harmless.⁶ The crucial question is whether magnetic resonance imaging is of greater diagnostic value than established non-invasive techniques, such as computed tomography, ultrasonography, and isotope imaging.

The soft tissue contrast and spatial resolution with magnetic resonance imaging are often better than with computed tomography, but in some parts of the body where motion is an important problem—for example, in the thorax and abdomen—the spatial resolution of computed tomography is

still better.⁷⁻⁹ This is largely because of the faster image acquisition time of computed tomography. The specificity of both magnetic resonance imaging and computed tomography remains limited, although great efforts are being made to improve it.^{10,11} The multiplanar facility of magnetic resonance imaging is an advantage over computed tomography, which can achieve multiplanar images only by image reconstruction. The diagnostic advantages of a three dimensional facility have been shown in investigating the midline structures of the brain, the craniocervical junction, the neural canal,¹²⁻¹⁴ the mediastinum,^{15,16} the heart and great vessels,^{17,18} and some abdominal and pelvic organs.¹⁹⁻²¹

Investigating the central nervous system

Magnetic resonance imaging has several advantages over computed tomography for studying the central nervous system. The high degree of contrast between grey and white

matter is particularly helpful in diagnosing the disease of white matter. The lack of bone artefact is important when imaging the posterior fossa, the craniocervical junction, or the neural canal. The variety of imaging options provides scope for diagnosing many clinical problems and makes the technique sensitive to pathological change. The lack of known side effects is particularly important in investigating neurological disorders in infants and children²² and also allows regular monitoring of disease progress and treatment.

In some types of diseases of the central nervous system magnetic resonance imaging has its limitations—for example, in cerebral infarction and haemorrhage. Our understanding of the appearances on magnetic resonance imaging of acute, subacute, and chronic cerebral haemorrhage has, however, advanced greatly in the past two years. Two groups of workers have established fairly characteristic patterns that vary depending on the time after the original cerebral bleed.²³⁻²⁴ Both computed tomography and magnetic resonance imaging show benign and malignant cerebral tumours well,²⁵⁻²⁸ but the tumour mass may be difficult to separate from surrounding oedema with magnetic resonance imaging. Paramagnetic contrast medium has to some degree overcome this problem: gadolinium-DTPA can cross the blood brain barrier in the presence of some diseases and can highlight a tumour and separate it from the unaffected oedema.²⁷⁻²⁹ Technical development of closely fitting radiofrequency receiver coils and surface coils has also improved the value of magnetic resonance imaging in diagnosing, for example, acoustic nerve tumours,²⁶ and disease of the orbits³⁰ and spinal canal.³¹

Good images of the spinal cord can be obtained that allow the doctor to distinguish intra-axial from extra-axial disease, and gadolinium-DTPA helps to highlight tumours.³¹ Certain imaging sequences will also allow investigation of other types of disease such as bone and soft tissue infection and disc herniation.³²⁻³⁵ Myelography may well become avoidable in some groups of patients.

Compared with computed tomography magnetic resonance imaging has some disadvantages for investigating some neurological disorders. Calcification is not shown by magnetic resonance imaging and can only be inferred. Patient throughput is slower than with computed tomography, and the patient on a life support system presents an important problem. Nevertheless, one centre in Glasgow has reported encouraging results in diagnosing cerebral haemorrhage in patients with acute head injuries (D M Hadley *et al*, Society of Magnetic Resonance in Medicine, 1985). Lastly, magnetic resonance imaging equipment has high capital and running costs.³⁶⁻³⁷ It is therefore not suitable as a general screening technique for neurological disorders and should be reserved for patients with conditions in which the diagnostic advantage has been fully established.

Imaging the rest of the body

The indications and usefulness of magnetic resonance imaging in the rest of the body have not yet been as well worked out as for the central nervous system. The most important problems are motion artefacts caused by the heart beat and respiration. To overcome the effects of cardiac motion electrocardiographic gating has been developed with considerable improvement to image quality of the heart and great vessels,¹⁶⁻¹⁸ but artefacts caused by respiratory motion have not been totally eradicated. One method called

“respiratory phase encoding” has to some extent overcome the problem.³⁸ An alternative approach is fast imaging,³⁹⁻⁴² but many technical problems are still unresolved. The image quality of magnetic resonance imaging is still inferior and of less diagnostic value than that obtained by other non-invasive techniques.

Satisfactory images can be obtained of mediastinal structures and the lung hila,¹⁵⁻¹⁶ but they do not add much to information already obtained by computed tomography. Adequate images of the heart can also be produced, showing conditions such as infarcts, aneurysms, various types of myopathies, congenital abnormalities, and pericardial disease.^{17-18 43-44} These images are better than those obtainable by standard computed tomography, but whether they provide more detailed information than ultrasonography or rapid scanning computed tomography is uncertain.⁴⁵⁻⁴⁶ Vascular studies, including flow measurements within large vessels and cardiac chambers, are possible and important developments are taking place.⁴⁷⁻⁵² This particular aspect of magnetic resonance imaging can be applied to functional and physiological studies of the circulation, an important development.

Magnetic resonance image quality of the liver, the kidneys, and other retroperitoneal structures has improved appreciably in the past two years, mainly because of technical developments. Different types of focal liver lesions can be shown satisfactorily, but this is not possible for diffuse disease.^{7-9 53-54} Whether or not these images provide additional or better information than those obtained by computed tomography or ultrasonography is still uncertain. Using gadolinium-DTPA in abdominal organs has not added much to the diagnostic advantage of magnetic resonance imaging over other techniques.⁵⁵⁻⁵⁶

The quality of images produced by magnetic resonance imaging of the pelvis, limbs, and large joints is encouraging, because of the lack of motion artefact in these sites. In some forms of pelvic disease magnetic resonance imaging is at least equal if not already superior to computed tomography and ultrasonography—for example, in disorders of the prostate or bladder,⁵⁷⁻⁵⁹ and in the normal⁶⁰ and abnormal uterus.⁶¹⁻⁶² Recent studies of the pregnant uterus, imaging the placenta and tumours, show great promise.⁶³⁻⁶⁴

In musculoskeletal disease the ability of magnetic resonance imaging to produce detailed soft tissue images is an important advance—for example, articular cartilage and the ligaments and menisci of the knee joint are all well seen.⁶⁵⁻⁶⁶ Since bone disease often expresses itself in soft tissue abnormalities tumour spread into soft tissue or within bone, particularly bone marrow, is better shown by magnetic resonance imaging than by other techniques.⁶⁷⁻⁶⁹ But, in contrast to computed tomography, bone itself is not shown.

The future

It is difficult to predict how fast body imaging will develop and whether it will reach the high standard achieved in the central nervous system. Once the quality of body images has reached the standard of images of the central nervous system magnetic resonance imaging will replace some of the other non-invasive methods of diagnosis in some diseases. A further consideration must be its cost effectiveness compared with computed tomography and ultrasonography.³⁶ Magnetic resonance imaging is still expensive, particularly when high field magnets of 1.5-2.0 Tesla are used, but for imaging alone low field systems of 0.1-0.5 Tesla provide

satisfactory results. The cost of low fields systems may come down, and rapid imaging should improve patient throughput and so cost effectiveness.

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