The diagnostic yield of magnetic resonance imaging (MRI) of the brain and spine requested by general practitioners: comparison with hospital clinicians

DONALD A COLLIE

ROBIN J SELLAR

JOHN P STEYN

ROGER E CULL

SUMMARY

The rate of diagnosis of radiologically significant abnormalities in outpatients following requests of magnetic resonance imaging (MRI) of the brain and spine by general practitioners was compared with the rate following MRI scan requests by hospital clinicians. A similar rate of significant pathology was diagnosed in both groups in both the brain and the spine. Under carefully controlled conditions, open-access MRI scanning of the brain and spine can contribute to effective patient management.

Keywords: magnetic resonance imaging; open-access; general practice.

Introduction

THE Royal College of Radiologists and the Royal College of General Practitioners have stated that the rights of general practitioners (GPs) to request radiological examinations should be similar to those enjoyed by hospital consultants.[1] There is an increasing body of evidence that GPs are as effective as hospital specialists at requesting many non-invasive imaging techniques. Magnetic resonance imaging (MRI) is widely recognized as the preferred first-line investigation of choice in the majority of diseases of the brain and spine,[2] and is superior to computerized tomography (CT) in the great majority of non-emergency neurological conditions.[3] This study aimed to assess whether there was a difference in the incidence of diagnosis of abnormalities following MRI scans of the neuraxis when requested by either GPs or hospital clinicians.

Method

A pilot open-access service for MRI scanning of the brain, skull, and spine was provided to a number of fundholding general medical practices across Lothian, using additional MRI scanning time (to avoid affecting existing services) made available each week. Guidelines on MRI scanning of the neuraxis, based on those of the Royal College of Radiologists, were drawn up, and discussion with both local hospital neurosciences specialists and GPs (Table 1) and a GP workshop on MRI preceded initiation of the service. All requests were reviewed by a consultant neuroradiologist to confirm the appropriateness of referral.

The indications and radiological findings of the first 100 GP referrals for MRI of the neuraxis were compared with 100 sequential outpatient hospital clinician neuroradiological referrals. Only scans requested for new neurological symptoms were included. All scans were reported by consultant neuroradiologists. Imaging results were divided into two groups: normal scans or scans where any abnormalities seen were not expected to alter the patient's management (negative scan), and abnormal scans with radiological findings that were likely to lead to a direct change in patient management or intervention (positive scan). The demographic features and radiological diagnoses of the scans for the GP and hospital groups were compared.

Results

Forty-four GPs referred patients from 23 different practices. There were 36 requests for brain MRI and 64 requests for spine MRI. Overall, 35% of scans demonstrated abnormalities that were considered radiologically significant and likely to lead to changes in patient management (Table 2). Forty-four per cent of spinal MRI scans and 19% of head MRI scans showed a radiologically significant abnormality.

Of the 100 consecutive outpatient MRI scans there were 61 requests for brain MRI and 39 requests for spine MRI. Overall, 32% of scans demonstrated abnormalities considered radiologically significant (Table 2). Forty-one per cent of spine MRI scans and 25% of brain MRI scans demonstrated radiologically significant abnormalities (Table 2).

There was no significant difference between the rate of positive scans requested by GPs and hospital clinicians for either brain or spine.

Discussion

This pilot study was stimulated by interest from local GPs in a direct-access MRI service, and has shown a similar rate of positive diagnoses following MRI in outpatients referred by GPs and those requested by hospital clinicians. This is contrary to the perceptions of many hospital clinicians.

Two previous studies have shown similar rates of spinal pathology in GP- and hospital-referred outpatients following both CT[4] and MRI,[5] with the GP group scoring slightly higher with non-specific spondylotic changes. However, the diagnostic yield of brain MRI requested by GPs has not been previously reported. The only previous study detailing open-access brain imaging was based on a comparative audit of brain CT scans in a district general hospital, where the rate of diagnosis of abnormalities in GP-referred patients was only 10%.[4] Our study has demonstrated that the rate of diagnosis of significant abnormalities in brains following GP-requested MRI scans was 19% higher than with CT scans. This is likely to be due to the higher sensi-

D A Collie, MA, MRCP, DMRD, FRCR, consultant neuroradiologist; R J Sellar, DMRD, FRCP, FRCR, consultant neuroradiologist; and R E Cull, FRCPE, consultant neurologist, Western General Hospital, Edinburgh. J P Steyn, FRCGP, general practitioner, Blackhall Medical Centre, Edinburgh.
Submitted: 30 April 1998; final acceptance: 10 March 1999.

Table 1. Guidelines for GPs for the use of CT and MRI scans as the primary investigation of symptoms of the brain and spine.

Indication	Recommended investigation (alternative)	Notes
Head MRI		
Headache	CT (MRI)	Recommended where new daily, morning, or persistent headache, or focal symptoms or signs occur. Patients with suspected subarachnoid haemorrhage, papilloedema, or suspected intracranial mass require urgent neurosurgical or neurological referral.
Seizures	MRI (CT)	Recommended where focal features, temporal lobe epilepsy, late onset, or drug resistance occur.
Dementia and memory problems	CT (MRI)	Recommended if early, rapid onset, or unusual features occur, to exclude tumour, hydrocephalus, or other intracranial mass.
Stroke or multiple TIA	CT (MRI)	Recommended to exclude haemorrhage or mass lesion prior to aspirin treatment. CT scans should be within 2–3 days of onset of symptoms as haemorrhage may be resorbed. Consider MRI if delay is >2 weeks from symptom onset, if patient is under 50 years old, and/or there are brainstem or cerebellar features. Imaging should not delay specialist referral if appropriate.
Suspected multiple sclerosis (MS)	MRI	MRI is commonly the first and most useful of several tests leading to the diagnosis of MS. MRI changes become less specific with increasing age, and a normal scan does not categorically exclude the diagnosis.
Acute confusional state	CT	Neuroradiological assessment should follow exclusion of extracranial causes.
Sensorineural deafness	MRI	Recommended to exclude acoustic neuroma or demyelination. Unilateral hearing loss is usually best imaged following assessment by an ENT specialist.
Visual symptoms suggestive of compressive lesion of anterior visual pathways	MRI (CT)	Recommended if there is suspected compressive lesion in the orbit or suprasellar region. Imaging should not delay urgent specialist referral if deterioration is rapid.
Spine MRI		
Neck pain/brachialgia	MRI	Recommended if pain is significantly affecting lifestyle, or if there are focal neurological signs and the patient is suitable for active treatment.
Sciatica with no adverse features	MRI (CT)	Conservative treatment for six weeks is indicated before investigation.
Back pain and/or sciatica with adverse features	MRI (CT)	Recommended if there is an acute history. Adverse features include those associated with gait or sphincter disturbance, saddle anaesthesia, severe or progressive motor loss, known malignancy, and HIV. Imaging should not delay urgent specialist referral.
Progressive back/radicular pain (especially thoracic) with suspected bony metastatic disease, cord compression	MRI	Early detection and treatment may prevent cord compression and paraplegia. Imaging should not delay urgent specialist referral.

Table 2. Radiologically significant findings in 100 GP- and hospital clinician-requested outpatient MRI scans.

Radiological diagnosis	GP-referred patients	Hospital-referred patients
Disc prolapse and neural compression	19	11
Malignant cord compression	–	1
Spinal stenosis	8	3
Bony spinal metastases	1	1
Intrinsic cord lesion (myelopathy, syrinx)	–	1
Primary intracranial tumour (benign and malignant)	1	2
Cerebral aneurysm	1	–
Intracranial tumour recurrence	2	4
Multiple sclerosis	1	8
Acute cerebral infarct	2	–
Heterotopic grey matter	–	1
Total	35	32

tivity of MRI to brain pathology, particularly white matter disease.

Although the incidence of positive studies has been emphasized in this study, the value of a negative scan should not be underestimated. A negative MRI lumbar spine scan may alter planned management of a patient with back pain, from orthopaedic to physiotherapy or chiropractor referral. Open-access MRI has been shown to have considerable impact on the pattern of outpatient clinic referrals, with a reduction in referrals of up to 41%, and another 24% of patients referred to more appropriate clinics than those originally planned before the MRI.[6]

In summary, GP-requested MRI scans of the brain and spine demonstrate a similar frequency of radiologically significant changes to hospital clinician-requested outpatient scans. For certain clear-cut neurological symptoms where MRI is likely to be

requested by a hospital clinician, direct access to a neuroradiological opinion and MRI may be appropriate. Further follow-up studies are required to establish whether this form of open-access MRI service is cost-effective.

References

1. The Royal College of Radiologists and the Royal College of General Practitioners. *Radiology and the patients of GPs*. London: RCR/RCGP, 1993.
2. Edelman RR, Warach S. Magnetic resonance imaging. *N Engl J Med* 1993; **328:** 708-716.
3. Bradley WG, Waluch V, Yadley RA, Wycoff RR. Comparison of CT and MRI in 400 patients with suspected disease of the brain and spinal cord. *Radiology* 1984; **152:** 695-702.
4. Kearney SE, Loughran CF. Direct access to CT screening. *Br J Gen Pract* 1996; **46:** 320.
5. Chawda SJ, Watura R, Lloyd DCF. Magnetic resonance imaging of the lumbar spine: direct access for general practitioners. *Br J Gen Pract* 1997; **47:** 575-576.
6. Apthorp LA, Daly CA, Morrison ID, Field S. Direct access MRI for general practitioners - influence on patient management. *Clin Rad* 1998; **53:** 58-60.

Address for correspondence

Dr D A Collie, Department of Neuroradiology, Western General Hospital, Crewe Road South, Edinburgh EH4 2XU.