The role magnetic resonance imaging and myelogram in the cervical spondylitis radiculopathy (prospective study)

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الخلاصه:

الغرض من الدر اسه :

تقييم دور الرنين المغناطيسي في معرفه تأثير الانزلاق الغضروفي على جذور الأعصاب الخارجه من الحبل ألشوكي في في المنطقه العنقيه.

المرضى والطرق :

اجريت دراسة مقطعية لخمس وثمانين مريضاً بالم الرقبة الحاد يشتبه باصابتهم بانزلاق الفقرات، تم فحصهم بجهاز الرنين المغناطيسي واجري لهم فحص الرنين العادي وفحص المايلو كرام .

النتائج:

ودراسة نتائج الفحص اثبت الرنين المغناطيسي هن هتالك حساسية في تشخيص انزلاق الفقرات العنقية 88.9 % في تشخيص نهائي 94.5% بينما الرنين المغناطيسي للفقرات العنقية الملون يمتلك حساسية 84.4% في تشخيص نهائي 88%.

الاستنتاجات :

كل من المايلوكرام والرنين العادي معا يزيدا من حساسيه الرنين المغناطيسي في تشخيص امراض الفقرات القطنيه (الانزلاقات وتضيق جذور الاعصاب)

Abstract

objective:

The objective of this study was to prospectively evaluate the accuracy of MRI and myelogram for the demonstration of foramina nerve root impingement in cervical spondylitis radiculopathy

Patients And Methods

Between January 2012 and May 2014. Eighty five patients referred to the department of Hilla teaching hospital with. cervical spondylitis radiculopathy were imaged with conventional MM and with MR myelogram . The diagnostic accuracy of these imaging strategies for the demonstration of exit foraminal stenosis was calculated relative to a gold standard of the combination of conventional MRI and MR myelogram

Results:

Conventional MRI had a sensitivity of 88.9%, specificity of 99.1%, and diagnostic accuracy of 94.5% for the demonstration of exit foraniinal disease. MR myelography alone had a sensitivity of 84.4%, a specificity of 90.1%, and diagnostic accuracy of 88%.

Conclusion:

However, the addition of MR myelography increased the diagnostic yield of the MR examination for the detection of forantinal stenotic disease. MR myelography is a useful adjunct to conventional MN in the investigation of cervical spondylotic radiculopathy.

Introduction:

Symptomatic cervical spondylotic radiculopathy is a prevalent condition worldwide and creates an enormous burden on medical and imaging resources. An effective imaging strategy for the demonstration of clinically significant cervical degenerative disease is a fundamental requirement for the management of this condition. MRI has replaced CT myelography in many centres for the imaging of cervical spondylotic radiculopathy because of its high soft tissue discrimination and its multiplanar capability (1-4) MR is, in contrast to CT myelography, non-invasive and does not utilize ionizing radiation. As a result, CT myelography is generally reserved for the evaluation of patients who cannot undergo MR examination, and for the further elucidation

of equivocal MR findings and the delineation of osseous foraminal stenosis(5,6).

It is widely recognised, however, that the diagnostic accuracy of MRI in cervical spondylotic radiculopathy is limited, especially in the assessment of foraminal nerve root impingement (7,8) . In particular, MRI has a false negative rate for the detection of foraminal nerve root compression because of suboptimal demonstration of foraminal disc and osteophyte. CT myelography, in contrast, is highly sensitive to foraminal disease because of the superior differentiation of bone and soft tissue(9), and the thin axial sections routinely acquired using spiral CT technology allowthe clear demonstration of nerve root impingement and compression. Many centres consider MRI and CT myelography to be complementary techniques, using MRI as an initial screening technique. A previous study reported the superiority of CT myelography for the pre-operative evaluation of cervical spondylotic radiculopathy (9)over conventional MRI.

MR myelography is an imaging technique which utilizes heavily T2 weighted sequences to produce high signal from fluid (including cerebrospinal fluid (CSF)) (10,1 1) This results in highly contrasted images that are similar in appearance to conventional myelograms. This technique has been applied to the imaging of lumbar degenerative disease and several authors have reported it to be a valuable supplement for the demonstration of the lumbar thecal sac and dural sleeves (12,15).

We are not aware that there has been a previous prospective study of the efficacy of MR myelography in the setting of degenerative cervical radiculopathy. The objective of this study was to prospectively evaluate the diagnostic effectiveness of MR myelography forthe demonstration of foraminal nerve root impingement in cervical spondylotic radiculopathy
(16-19).

Patient and Methods:

85 patients:(47 female, 38 male, age range 28—76 years, average age 48 years) with a diagnosis of cervical spondyloticradiculopathy were included in the study. Clinical criteria for inclusion included bachalgia, upper limb motor weakness or sensory dysfunction, in the absence of signs of myelopathy and without suspicion of alternative diagnoses (such as demyelination), in association with evidence of corroborative degenerative change on plain cervical radiographs. Patients with a history of previous cervical surgery or with evidence of myelopathy were excluded from the study.

MRI was performed on a 1,5 T Intera seamier (Philips Medical Systems, Best, Netherlands) using a phased array spine coil. Each patient was prospectively imaged using the following MR protocol: sagittal turbo spin echo (TSE) T1 weighted images (repetition time (TR) 397 ms, echo time (TE) 14 ms, TSE factor 3, acquisition time 4:09); sagittal TSE T2 weighted images (TR 2498 ms, TE 110 ms, TSE factor 16, acquisition time 4:02); axial T2 weighted images (Driven equilibrium spinecho, TR 1200 ms, TE 120 ms, TSE factor 34, acquisition time 6:20, slice thickness 1.7 mm) from C3 to TI; MR myelography (single shot TSE, TR 8000 ms, TE 1000 ms, TSE factor 256, acquisition time 3:36). MR myelographic images were automatically reconstructed as maximum intensity projections and presented as 9 consecutive images at 22.5° intervals, extending from a right lateral to a left lateral projection. This process did not significantly add to the examination duration.

The films were reviewed by experienced neuroradiologists (DB and KH), without knowledge of the clinical presentation. A consensus opinion was reached regarding the presence or absence of foraminal compressive disease, which was diagnosed in the presence of nerve root compression. In each case, the left and right exit foramina at all levels from C3/4 to C7/Tl were assessed, resulting in 10 separate observations.

The combinatiop of conventional MRI (sagittal Ti and sagittal and axial T2 images)

and MR myelography was considered as a gold standard for the purposes of this study. The relative sensitivity, specificity and diagnostic accuracy of conventional MRI and of MR myelography when examined in isolation was analysed using contingency tables and the chi-squared statistic. Positive and negative predictive values were also calculated.

Results

Eighty five patients presented in Hilla teaching hospital of having different presentation table (1) show clinical presentation of each patient ,age of patients included in this study range from a 28—76 years, average age 48 years table(2) show age of patients ,then underwent MRI examination in department of radiology in Hilla teaching hospital.

The sensitivity of conventional MRI relative to the chosen standard was calculated at 88.9%, with a specificity of 99.1%. The positive predictive value of conventional MRI was 98.8% and the negative predictive value was 91.6%, relative to the standard. The diagnostic accuracy was calculated at 94.5%.

The sensitivity of MR myelography relative to the chosen standard was calculated at 84.4%, with a specificity of 90.1%. The positive predictive value of MR myelography was 88.4% and the negative predictive value was 87.7%, relative to the standard. The diagnostic accuracy was calculated at 88%. The chi-squared statistic was 115 on I degree of freedom and the p value was <0.001.

Discussion:

The criterion of neck pain was also different, as the participants with cervical symptoms had been suffering from pain for a minimum of 6 months before referral for discography. The classification of abnormalities of cervical spine was analyzed dichotomously as morphologically normal/abnormal.

Cervical spondylotic radiculopathy is a common condition and creates an enormous demand on spinal and'medical imaging services. In the past, CT myelography has been considered the gold standard for the demonstration of foraminal nerve root impingement, with excellent bone and soft tissue contrast and high spatial resolution. However, MRI has generally replaced CT myelography as the primary diagnostic tool in this condition, primarily because as a technique it is non-invasive and less time- and resource-intensive and because there is no exposure to ionizing radiation (1-4). However, it is recognised that although MR provides superior diagnostic information regarding the spinal cord and spinal canal, the relatively poor contrast observed between bone, disc material and the normal contents of the cervical exit foramina results in suboptimal delineation of foraminal pathology and a significant false negative rate (5-8). Conversely, the susceptibil-ity artefacts at soft tissue—bone interfaces that may be observed with gradient echo imaging are associated with a tendency to overestimate foraminal stenosis in a proportion of patients(16)

Several papers have correlated MR appearances with surgical findings in patients with compressive cervical spondylotic radiculopathy. and have reported diagnostic accuracy close to 90% (1-6). However, other groups have reported considerably lower diagnostic sensitivity for MR, with several studies confirming that CT myelography has greater sensitivity for the demonstration of foraminal entrapment. For example, Modic et al demonstrated that MRI corresponded to surgical findings in a patient group with cervical spondylotic radiculopathy in only 74% of cases, whereas CT myelography correctly predicted the surgical findings in 85%(7). In this report, a combination of MRI and CT myelography increased the diagnostic accuracy to over 90%. It has been suggested that use of thin section three-dimensional sequences on high performance scanners may increase the diagnostic sensitivity of MR. Bartlett et al report a diagnostic accuracy of 89% when comparing three-dimensional "2 weighted images with CT myelography for the detection of foraminal nerve root compression (17).

However3 Yousem et al reported a diagnostic accuracy rate ranging from 73% to 82%, despite using three-dimensional axial T2 imaging and 1.5 mm sections(18).

As a consequence, CT myelography is used as a complimentary investigation in many centres, and is used in a significant proportion of patients in whom diagnostic uncertainty remains after MRI (5,6). Indeed, a recent review of trends in imaging of the spine in the USA demonstrated that there has been an increase in the use of myelography by over 50% in the years between 1993 and 1998 (19). CT myelography is, however, invasive and is often poorly tolerated, and there is therefore a continuing effort to improve the diagnostic accuracy of MRI for this patient group in order to reduce the necessity for subsequent CT myelography. This is a particularly important factor in those countries in which managed systems of healthcare promote the use of more streamlined diagnostic pathways.

MR myelography represents a relatively recent development in MRI (10,11)and has theoretical advantages in the visualization of the nerve roots within the entrance and proximal canal of the exit foramina. Several papers have described the use of MR myelography in the investigation of lumbar degenerative disease (12,15). The diagnostic accuracy of MR myelography is reported to be insufficient to justify its use as an independent diagnostic technique. Furthermore, the addition of MR myelography to conventional MRI does not significantly improve the diagnostic accuracy of MR in the investigation of lumbar degenerative disease. The limited diagnostic efficacy of the technique has been attributed to inconsistent definition of nerve roots and to the observation that lumbar disc protrusions may .

displace only the epidural fat and not the thecal sac (1 2).However, when used as an adjunct to conventional MRI, MR myelography has been shown to be useful for the further characterization of equivocal findings in a proportion of cases and to increase the diagnostic confidence in.this setting(12,15). Otherwise, there is little evidence to support the use of MR myelography in the routine imaging of lumbar degenerative disease.

In this study, MR myelography altered the interpretation of the conventional MR images in 22 of 400 exit foramina (5.5%) when viewed in combination, The addition of MR myelography to conventional MRI of cervical spondylotic radiculopathy increased the number of compressive foraminal stenoses positively identified, This generally occurred with the presence of a soft lateral or foraminal disc protrusion, the suboptimal contrast with the normal foraminal contents being insufficient to allow its ready detection, as demonstrated in Figure 3. Although the most radiologically obvious foraminal stenoses were identifiable on conventional MRT in all cases, the addition of MR myelography improved the detection of concomitant foraminal stenoses in multilevel disease. (16)

However, when the MR images were reviewed with the relevant clinical details, conventional MRI detected the most radiologically significant abnormalities in all 40 patients.

MR myelography helped in the detection of foraminal disease in two ways. First, the heavily T2 weighted nature of the technique resulted in high contrast between the CSF and all other soft tissue structures, including disc material. As a consequence, this technique allowed the demonstration of foraminal disc protrusions that would otherwise have been less easily detected on conventional axial “2 weighted images. Second, any possible abnormality seen on MR myelography prompted a re-evaluation of the relevant axial and sagittal sequences and produced an increased rate of detection of foraminal compression as a result of this review process (17).

MR myelogra,phy when viewed in isolation had an insufficient diagnostic accuracy to justify its use as an independent imaging technique for the evaluation of cervical foraminal disease, MR myelography had a greater tendency to underestimate, rather than overestimate, the severity of foraminal disease. This is attributed to a lack of

sensitivity to foraminal compression in the more lateral aspects of the exit foramen, where the dural sleeve narrows and where the amount of epidural fat increases (18).

It should be noted that the diagnostic accuracies quoted in this paper are relative to a gold standard of the combination of conventional imaging and MR myelography. It is well established that MRI has a suboptimal diagnostic accuracy when compared with surgical findings or with CT myelography, and no such standard has been applied in this study. CT myelography is not routinely performed at our institution and its use in this study was not justified ethically or clinically. As a result, it is not possible to comment on the true diagnostic accuracy of the various MR techniques. This does not, however, detract from the validity of observing the effect of including MR myelographic sequences in the interpretation of the MR examination. Similarly, the observations were made by two experienced observers in conjunction and as such no evaluation of observer variability was made. It is likely that the subjective nature of the observations will introduce a degree of observer variability and this is currently under evaluation at our institution (19).

In conclusion, this study suggests that MR myelography may be a useful adjunct to conventiontl axial and sagittal imaging in the investigation of cervical spondylotic radiculopa4hy. The use of MR mydography increased the number of compressive foraminal stenoses positively identified and it has the potential to reduce the need for subsequent CT myelographic examination in a proportion of this patient group. Further study is required to define the diagnostic accuracy of this technique by comparison with conventional CT myelography. However, MR niyelography is a robust sequence and adds only a short time to the overall examination, and it is arguable that routine use should be made of MR myelography in the imaging of patients with cervical spondylotic disease

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Table 1.clinical presentation of patients

Clinical feature	No.
Bachalgia	52(62%)
upper limb motor weakness	16(19%)
sensory dysfunction	10 (12%)
Shoulder pain	7 (7%)
total	85(100%)

Table 2. :Distribution of cervical spondyloticradiculopathy in relation to age of patients .

Age	Number
28-38 years	9 (11.25 %)
38-48 years	34 (40%)
48-58 years	12 (15%)
58-68 years	21(17.75%)
68-78 years	14 (16%)
total	85 (100%)

Table 3 Subjects with abnormal magnetic resonance imaging (MRI) findings in the normal melogram group and abnormal myelogram.

abnormal	NEMG subjectsN =35	AEMGsubjectsN=5O
Disc degeneration	7	10
Annular tear	9	10
Disc bulging	5	9
Disc protrusion	10	14
Disc protrusion	-	11
No finding	4	10

Table 4. Proportions of abnormal disc findings on MRI in the normal myelogram and abnormalmyelogram.

abnormalities	Normal myel. N = 219	Abnormai myel N = 301	Total = 520
Disc degeneration	59	72	**131**
Degree I	14	17	
Degree II	25	31	
Degree III	20	24	
Anular tear	43	64	**107**
Disc bulging	53	70	**123**
Disc protrusion	**64**	**85**	**149**

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