Abnormal Findings of Magnetic Resonance Imaging and Assessment of Treatment for Low Back Pain

by

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Because of the symptoms of patients with low back pain are various, assessment method of treatment for low back pain after Japanese Orthopaedic Association (JOA) score (2) is used as one of the evaluation methods. On the other hand, diagnostic usefulness of magnetic resonance imaging (MRI) for the disease with low back pain is widely recognized, and MRI examination is increasingly conducted for these patients. This time, we studied correlation of MRI findings and JOA scores in patients with low back pain.

Materials and methods

The subjects were 72 cases with low back pain (45 male cases, 27 female cases) with an average age of 42 years old. There were 40 cases of lumbar disc herniation, 14 cases of lumbar canal stenosis and 18 other cases.

Ordinary conductive or superconductive MRI with 0.5-1.5 tesla was carried out in which the lumbar vertebral sites were observed on T1 or T2 enhanced sagittal images and axial images mainly by spin-echo (SE) methods. Numbers of degenerative lesions and herniations were investigated in the lower 5 intervertebral discs on MRI, and number of compressed dural sac and degrees of compression were also investigated. Moreover, in 51 cases in which axial images were obtained, degree of compression of dural sac and displacement of epidural fat was investigated. Relationship between MRI findings and JOA score, which is composed of subjective symptoms, objective signs, ADL score and JOA total score, were studied. Reduction in the signal intensity of the intervertebral disc on T2-enhanced image was regarded to be degeneration, and number of low intensity disc on MRI with grade 2 or more, as described by Gibson (1), was investigated. In cases of degenerated intervertebral disc with deformed shape of nucleus pulposus, the number of herniated discs was counted according to the criteria described by Maravilla (3) (Fig.1). The dural sac was examined with respect to number and stage of compressed sites. For evaluate degree of compression on the dural sac, it was divided three stages, stage 1 when the remaining antero-posterior diameters of the dural sac were $\frac{2}{3}$ or more of the maximum antero-posterior diameters, stage 2 with $\frac{2}{3} \sim \frac{1}{2}$, and stage 3 with $\frac{1}{2}$ or less. Each case was graded by the highest stage.

Fig. 1 In this study, we judged the disc herniation according to the criteria described by Maravilla (1985). Protrusion of disc material must be beyond the posterior margin of the adjacent vertebral bodies. MRI signal of protruded disc material must be isointense with the involved disc intensity.

Fig. 2 In total 72 cases, number of herniated disc in the group with 16~29 points of JOA score and the group with 1~15 points was 0.97 and 1.64 in average. This relationship was statistically significant ($P < 0.01$).

Fig. 3 In total 72 cases, cases with many herniated discs tend to show lower score of objective signs and severe low back pain.

Result

The average JOA score of 72 cases was 14.6 points, and 2.5 pieces of low intensity discs and 1.2 pieces of herniated intervertebral disc were recognized in average on MRI.

MRI findings which had highest correlation with JOA total score showed -0.56 of coefficient in number of herniated intervertebral disc. Number of herniated intervertebral disc in the group with 16~29 points of JOA score and the group with 1~15 points was 0.97 and 1.64, in average,

Fig. 4 In case of lumbar disc herniation, cases with many herniated discs tend to show lower score of objective signs and more severe low back pain.

Fig. 5 In case of lumbar canal stenosis, cases with large number of low intensity disc on MRI tend to show lower score of subjective symptoms and more severe low back pain.

respectively, which was a significant difference ($P < 0.01$) (Fig. 2).

The highest correlated combination was investigated among items of subjective symptoms and objective signs in JOA score and number of low intensity disc and number of herniated intervertebral disc in MRI findings. This relationship was recognized regardless of cases of diagnosed diseases. Cases with many herniated discs tended to show lower point of JOA scores of objective signs and had marked degrees of low back pain in total cases (Fig. 3). A similar tendency was also seen in case of lumbar disc herniation (Fig. 4). Cases of lumbar canal stenosis with large number of low intensity discs on MRI tend to show lower JOA scores of subjective symptoms (Fig. 5).

Cases with large numbers, or with marked degree of compression of the dural sac in MRI findings tend to show lower JOA scores, although no strong correlation with specific items in JOA scores was recognized. The percentages of cases in which compression of dural sac and displacement of epidural fat were seen on MRI axial image were 88% and 78% out of all the

cases, respectively. Cases of lumbar disc herniation showed high probability of both above findings. Especially, displacement of the epidural fat was seen with specifically high proportion in case of lumbar disc herniation or lumbar canal stenosis, although it was rarely seen in case of the other disease. Cases with compression of the dural sac, or displacement of epidural fat on MRI axial images, tend to show lower JOA scores of subjective symptoms, ADL scores and JOA total scores. However, significant difference of JOA score was not recognized between the cases with compression of dural sac or displacement of epidural fat and the cases without those findings on MRI axial image.

Discussion

Degeneration of the intervertebral disc and compression of the dural sac can be understood fairly accurately by MRI without invasion. Influence of degeneration of the intervertebral disc and compression of the dural sac on low back pain were investigated using the assessment of treatment of low back pain by Japanese Orthopaedic Association (JOA) score. The results demonstrated that higher degree of degeneration of the intervertebral disc and compression of the dural sac tended to show marked low back pain. Degeneration of disc should be understood as reduction of signal intensity on T2 enhanced image, and deformation in shape of nucleus pulposus on MRI image (1). When the degeneration of the intervertebral disc was observed with respect to change of signal intensity of nucleus pulposus on MRI, increase the number of low intensity disc led to stronger subjective symptoms. Strong subjective symptoms without objective signs have been likely to be regarded doubtful or not be reasonable. But in such cases, large number of low intensity disc may be found on MRI. Actually, in our study cases with strong subjective symptoms tend to have many low intensity discs on T2 enhanced image. There may be a possibility that functional reduction of a degenerated intervertebral disc may be involved, whether the disc is herniated or not. Cases with many herniated disc observed on MRI may possibly cause direct compression of the nerve root and the cauda equina. Those cases may be more likely to present objective signs as well as subjective symptoms due to the degenerated intervertebral discs. Among all MRI findings, numbers of herniated disc were most correlated with JOA total score. This relationship is statistically significant, so that cases with large number of herniated disc had severe low back pain. Although presence of many non-responsible herniated discs are well known on MRI, existence of herniated intervertebral disc should be thought most significant in low back pain.

Compression of dural sac tended to lead to severe degree of low back pain. On MRI axial image, the displacement of epidural fat was recognized with high percentage in case of lumbar disc herniation (97%) and in case of lumbar canal stenosis (91%), however it was only 10% in cases with other diseases. Therefore, the finding of displacement of epidural fat was considered to be useful in diagnosis of both the diseases.

Summary

We studied the correlation between MRI findings of the patients with low back pain and the assessment score after Japanese Orthopaedic Association.

There were significant correlation among number of degenerated disc, herniated disc and dis-

placement of epidural fat on MRI and the score.

References

- (1) Gibson. M. J, et al.: Magnetic resonance imaging and discography in the diagnosis of disc degeneration. J. Bone Joint Surg., 68-B : 369-373, 1986.
- (2) Japanese Orthopaedic Association: Assesment of treatment for low back pain. J. Jpn. Orthop. Ass., 60 : 107-108, 1986.
- (3) Maravilla. K. R., et al.: Magnetic resonance imaging of the lumbar spine with CT correlation. AJNR, 6 : 237-245, 1985.

腰痛患者のMRI所見と、日整会腰痛治療成績判定基準について

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腰痛を主訴とする患者の症状は多彩であり、評価法として日整会腰痛治療成績判定基準がよく用いられている。今回、私達は、腰痛患者のMRI所見と日整会腰痛点数につき検討した。対象：腰痛を主訴とする72例、男性45例、女性27例、平均年齢約42歳、椎間板ヘルニア40例、脊柱管狭窄症14例、その他18例を対象とした。方法：0.5～1.5 tesla MRIにてT₁及びT₂強調像のSagittal, Axial群で腰椎部を観察

し、椎間板変性、硬膜管圧迫所見と日整会腰痛点数を比較した。結果：MRIで椎間板性変や硬膜管圧迫が高度に認められる症例では日整会腰痛点数が低い傾向がみられた。腰痛と最も相関の高いMRI所見は椎間板ヘルニア個数であった。日整会腰痛点数の自覚症状、他覚所見に対しMRI所見では変性椎間板数、ヘルニア個数がそれぞれ高い相関を示す傾向が診断名にかかわらず常に認められた。