MRI of Multiple Sclerosis in Thai Patients

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Objective: *Evaluate the MRI findings of multiple sclerosis (MS) in Thai patients and compare these with the McDonald criteria for dissemination in space.*
Material and Method: *A retrospective study was performed by reviewing clinical and MRI records of patients attending MS clinic at Siriraj Hospital. Only patients with complete clinical and MRI data were included in the present study.*
Results: *There were 25 patients included in the study. Twenty-four patients were females and 1 was male. The mean age was 35.24 years old (range 16-50). The disease duration was 1 month to 17 years after the onset. Twenty-three patients were diagnosed as relapsing-remitting MS, one as possible MS and one as clinical isolated syndrome. Analysis for CSF oligoclonal bands was performed in 22 cases with positive results in 6 cases (27.3%). The sites of involvement were optic neuritis (16 cases), spinal cord (14 cases), and brain (9 cases). Seventeen cases had MRI study at the early presentations, and 8 cases during subsequent relapses. In the 9 cases with brain symptoms, all had positive brain MRI. Ten cases (58.8%) had infratentorial lesions mostly found at the medulla. Most T_2 lesions were found at juxtacortical and periventricular regions. Five in 9 cases (55.6%) with periventricular lesions had lesions not less than 3 mm and at least 3 lesions were found. There were 6 cases (35.3%) with, at least, nine T_2 lesions. Most of the T2 lesions were oval shaped. Seven cases (41.2%) had black hole lesions. Three cases (17.6%) had gadolinium enhanced lesions. Thirteen of 15 available spinal MRI were abnormal. The locations of the lesions were cervical (6), thoracic (4) and cervicothoracic (3) levels. The number of T2 lesions was one in 8 cases and more than one in 5 cases. The length of each lesion varied: less than 1 vertebral segment (5 cases) and 2 or more vertebral segments (8 cases). Swelling of the cord was found in 3 cases and atrophy in 7 cases. The lesions occupied the whole cross-sectional cord in 6 cases and center of the cord in 7 cases. The gadolinium enhancement was found in 6 cases with a patchy pattern in 5 cases and mixed ring and patchy patterns in 1 case. There were totally 6 cases (24%) that fulfilled the McDonald MRI criteria for dissemination in space.*
Conclusion: *The MRI findings in Thai MS have distinct features from the Western reports. Re-evaluation of McDonald criteria for the Eastern countries is needed.*

Keywords: *Multiple sclerosis, Diagnosis, MRI*

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Multiple sclerosis (MS) in Asia has been reported significantly different from the Western countries. A joint Asian study described distinct features of MS differing in rare family histories, more frequent occurrence of acute transverse myelitis, high frequency of paroxysmal tonic spasm, less frequent involvement of cerebellum, more frequent optic-spinal recurrent form and low incidence of positive oligoclonal bands in cerebrospinal fluid (CSF)[1]. The present report also found a lower rate of abnormal brain magnetic resonance imaging (MRI), longer segment of spinal cord involvement than among Caucasian MS. In July 2000, the International Panel on the Diagnosis of MS convened in London, United Kingdom recommended a diagnosis criteria for MS, known as McDonald crite-

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ria[2]. This criteria included both clinical and paraclinical data of MRI, CSF analysis for oligoclonal IgG bands and visual evoked potentials (VEP). The diagnostic scheme divided into MS, possible MS and not MS depending on the acquired additional data. In these criteria, MRI plays an important role by demonstrating dissemination in space and time. As far as we know, there is no reported data evaluating the MRI criteria of McDonald for Asian MS. The purpose of the present study was to evaluate the MRI findings of patients diagnosed with MS in Thai people and to compare the findings with McDonald criteria for dissemination in space.

Material and Method

A retrospective study was performed by reviewing the clinical and MRI records of patients attending MS clinic at Siriraj Hospital. Only patients with complete clinical and MRI data were included in the present study. The patients who did not fulfill the diagnostic criteria of clinical definite MS (CDMS) or possible MS according to Poser's criteria were also excluded[3].

The MRI were performed by 1.5 tesla machine as the authors' routine protocol. For brain MRI, the protocol included axial T_{1wi}, PD_{wi} or FLAIR, T_{2wi}, coronal T_{2wi} and sagittal T_{1wi} in pre-contrast scan and T_{1wi} in three orthogonal planes in post-contrast scan. The thickness of each slice was 7 mm with 0.7 mm gap. The spinal MRI was done in sagittal T_{1wi} and T_{2wi} and axial T_{2wi} in pre-contrast scan. The sagittal and axial T_{1wi} were performed in post-contrast scan. The thickness of spinal MRI was 4 mm for both axial and sagittal planes. The hard copies of images were evaluated by a neuroradiologist and a neurologist. The final records were met by consensus of the two readers. The data was recorded as presence or absence of T2 lesion, number of lesions, location, size of lesions, shape and pattern of enhancement. For each patient, imaging findings were also concluded to evaluate whether they met the McDonald criteria for dissemination in space or not.

Results

From 1997 to 2004, 76 patients attended Siriraj Hospital's MS clinic but only 25 patients with complete MRI data were included in the present study. There were 24 females and one male with a mean age of 35.24 years old (range 16-50 years old). The disease duration was 1 month to 17 years after the onset. Twenty-three patients were diagnosed as relapsing-remitting MS and one as possible MS. The last case was diagnosed as clinical isolated syndrome and was followed up for only one month before conclusion in the present study. This case was diagnosed as laboratory supported definite MS because of positive CSF analysis. Most patients had optic neuritis and spinal involvement as the first presenting symptoms. The details of first presenting signs and symptoms are shown in Table 1. The CSF analyses for oligoclonal IgG band were performed in 22 cases with positive results in 6 cases (27.3%).

Of the 25 cases, 17 cases had MRI study at the early course of the disease, and only 8 cases had MRI during subsequent relapses. In the 9 cases with brain symptoms, brain MRI was available in 8 cases, all were positive. The other one did not undergo brain MRI but a lesion extending to the medulla oblongata was detected on spinal MRI. In 14 cases with spinal cord involvement, 12 spinal MRI were available and 11 showed positive results. In 6 cases presenting with optic neuritis alone, brain MRI was available in 5 cases with negative results in 3 cases. The spinal MRI was available in the other one case with optic neuritis and showed negative result.

There were totally 20 brain MRI and 15 spinal MRI evaluated. The positive results were found in 17 cases of brain MRI (85%) and 13 cases of spinal MRI (86.7%). Eight cases with positive brain MRI (47.1%) had brain symptoms and 11 cases with positive spinal MRI (84.6%) had spinal cord symptoms. For the negative brain MRI, all cases had no brain symptoms. For the negative spinal MRI, one case had spinal cord symptoms and the other one had not.

Brain MRI

In evaluating T_2 lesion on brain MRI, most lesions were found at the juxtacortical and periventricular regions (70.6% and 52.9% respectively). Most of the juxtacortical lesions were larger than 3 mm with oval shape (Fig. 1). Only 5 of 9 cases (56.6%) with peri-

Table 1. First presenting signs and symptoms of 25 cases of diagnosed MS

Signs and symptoms	N (%)
Optic neuritis alone	6 (24%)
Optic neuritis with spinal involvement	7 (28%)
Optic neuritis with brain involvement	1 (4%)
Optic neuritis with brain and spinal involvement	2 (8%)
Brain involvement alone	4 (16%)
Spinal involvement alone	3 (12%)
Brain and spinal involvement	2 (8%)

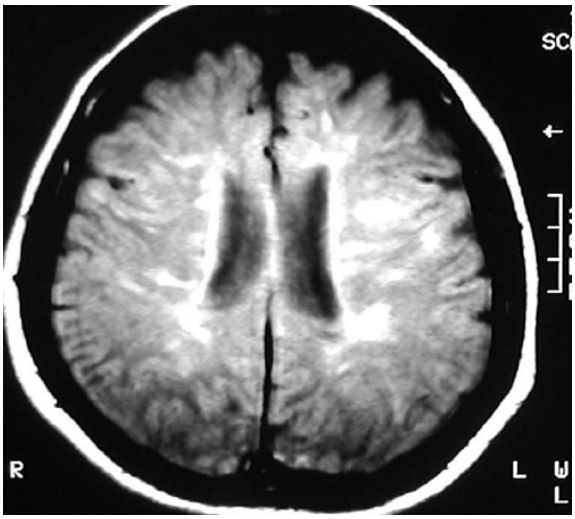

Fig. 1 Axial proton-density image of brain demonstrates multiple T2 lesion in periventricular and subcortical white matter

ventricular and/or deep white matter lesions had lesions not less than 3 mm and at least 3 lesions were found. In these, two cases showed typical perpendicular and finger-like lesions. Ten cases (58.8%) had infratentorial lesions mostly found at the medulla and not smaller than 3 mm in size with confluent (or patchy) shape. The details of number, size and shape of T_2 lesions at each location are shown on Table 2. There were 6 cases (35.3%) with 9 or more T_2 lesions.

On T_{1wi}, 7 cases (41.2%) showed black hole lesions and 14 cases (82.4%) showed hypointensity lesions. Only 3 cases (17.6%) had gadolinium enhanced lesions.

Spinal MRI

In 13 cases of positive spinal MRI, most of the lesions involved the cervical cord. The number of lesions varied from 1-9 lesions. The length of the lesions varied from 1 to 10 vertebral body segments. Eight cases (61.5%) had lesions involving more than 2 vertebral body segments (Fig. 2). The details of location, number and length of lesions are shown in Table 3.

Swelling of the cord was found in 3 cases (23.1%), atrophy in 7 cases (53.8%), and 3 cases (23.1%) showed normal. The lesions occupied the whole cross-sectional cord in 6 cases (46.2%) and only center of the cord in 7 cases (53.8%). There were 6 cases (46.2%) with patchy appearance of the lesions.

The T_{1wi} showed black hole in 1 case (7.7%), hypointensity in 5 cases (38.4%) and mixed black hole and hypointensity in 4 cases (30.8%). (Fig. 3A) No abnormal signal intensity could be detected on T_{1wi} in 5 cases. The gadolinium enhanced scans were available in 14 cases. Of 11 cases with T_2 lesions, 6 cases (55%) showed enhancement with patchy pattern in 5 cases and mixed ring and patchy pattern in 1 case (Fig. 3B).

Table 3. Findings on spinal MRI in 13 positive cases

I. Number of lesions	
1 lesion	= 8 (61.6%)
≥2 lesions	= 5 (38.4%)
II. Location	
Cervical	= 6 (46.2%)
Thoracic	= 4 (30.7%)
Cervicothoracic	= 3 (23.1%)
III. Length of lesion	
≤2 vertebra	= 5 (38.5%)
>2 vertebra	= 8 (61.5%)

Table 2. Number (%) of cases with T_2 lesions

Location (cases)	Size of T_2 lesions		Number of T_2 lesions		Shape of T_2 lesion		
	<3 mm	≥3 mm	<3 lesions	≥3 lesions	Oval	Confluent	Mixed
PVWM (9)	2 (22.2%)	9 (100%)	3 (33.3%)	6 (66.7%)	3 (33.3%)	1 (11.1%)	3 (33.3%)
Juxtacort (12)	5 (41.6%)	10 (83.3%)	6 (50%)	6 (50%)	5 (41.6%)	0	0
Corpus (2)	0	2 (100%)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	0
Cerebellum (3)	0	3 (100%)	2 (66.7%)	1 (33.3%)	2 (66.6%)	1 (33.3%)	0
Pons (2)	1 (50%)	1 (50%)	1 (50%)	1 (50%)	0	1 (50%)	0
Medulla (5)	0	5 (100%)	5 (100%)	0	0	4 (80%)	0
Peduncle (3)	0	3 (100%)	3 (100%)	0	1 (33.3%)	2 (66.7%)	0

PVWM = Periventricular white matter, Juxtacort = juxtacortical white matter

Fig. 2 Sagittal T2wi of cervical spine demonstrates high intensity lesion extending from C2 through C7 levels

Dissemination in space

Ten cases had both brain and spinal MRI available. Eleven cases had only brain MRI and four cases only spinal MRI. Most cases (16 = 64%) had 1 or 2 abnormal MRI criteria. Only 6 cases (24%) fulfilled the McDonald MRI criteria for dissemination in space. Of these six cases, 4 were diagnosed with both brain and spinal MRI available and 2 with only brain MRI. The detail of imaging availability is shown in Table 4. The details of number of abnormal MRI criteria are shown in Table 5.

Discussion

The present study confirmed some distinct features of MRI findings in Asian MS compared with the Caucasian MS. First, the spinal involvement was common in the presented cases. Most of the presented cases (61.6%) had one lesion. This differed from Western countries where multiple lesions have commonly been reported (65%)[4]. The cervical cord involvement was also common in the presented cases. More than half of the cases had lesions extending to more than 2 vertebral body segments, which is not characteristic of the Caucasian MS[4]. Swelling of the cord and involvement of the entire cord were common in the present study.

Second, T2 lesions in the presented cases had distinct features from typical T2 lesions described in Caucasian MS. In Thai MS, typical finger-like or perpendicular T2 lesion is rarely found. Most of the

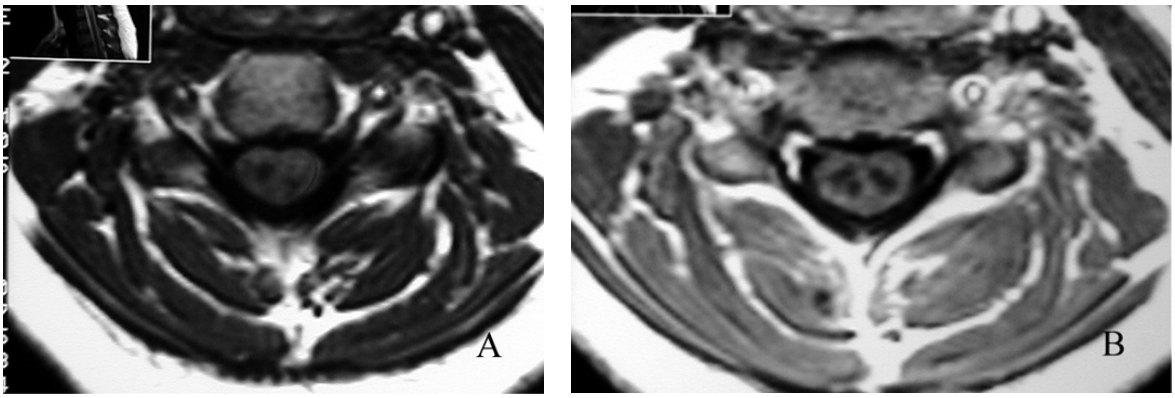

Fig. 3 Axial T1wi before (A) and after (B) Gd-enhancement demonstrate a black-hole and incomplete ring enhancing lesion at the cervical cord level

Table 4. Imaging availability characterized by findings fulfilled McDonald criteria for dissemination in space

McDonald criteria	Brain + spine MRI	Brain MRI	Spinal MRI	Total
Fulfilled	4	2	0	6
Not fulfilled	6	9	4	19
Total	10	11	4	25

Table 5. Observed cases (%) in relation to number of abnormal MRI criteria

Number of abnormal MRI criteria*	Cases (%)
0	3 (12%)
1	9 (36%)
2	7 (28%)
3	1 (4%)
4	5 (20%)

* Barkhof's criteria[6]

presented cases were oval shaped. This may have delayed the early recognition of MS in the presented patients. Infratentorial lesion was also commonly found in the presented cases (58% vs 55%[5]). The common feature was confluent pattern. The present study showed a higher rate of abnormal brain MRI (85%) compared with the report of Chong et al (66%)[1]. The authors also found that two cases with cervical cord lesions had medulla lesions, which appeared as a continuous extension from the cervical lesions. Though the significance of this finding is unclear, it seems to be helpful for early recognition and close follow up to give a diagnosis of MS.

By using Barkhof's criteria for dissemination in space, the authors found a lower rate of detecting CDMS[6]. The sensitivity in the present study was only 24% with these criteria. Though the present study was a retrospective study, recruiting only CDMS cases due to selection bias might make the result unreliable. The authors should expect a higher rate of detection of MS in the presented cases. On the other hand, the authors found that most of the presented cases had only 1-2 criteria from the MRI criteria. The present study implied that the McDonald MRI criteria might not be sensitive enough in detecting Thai MS. A previous belief that MS is a rare disease for an Asian population may not be true as the diagnostic criteria from the Western countries seems inadequately sensitive. More studies with a prospective design that includes all clinical isolated syndromes to get both negative and positive conversion to MS are needed.

Conclusion

The present study confirmed some distinct features of MRI abnormalities in Asian MS. The MRI McDonald criteria for detection of dissemination in space may have to be re-evaluated for Eastern countries.

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ภาพเอมอาร์ไอระบบประสาทของผู้ป่วยมัลติเพิล สเคอโรซิสในไทย

อรสา ชวาลภาฤทธิ์, นราพร ประยูรวิวัฒน์

มัลติเพิล สเคอโรซิส เป็นโรคที่พบน้อยในประเทศไทย การศึกษานี้เพื่อวิเคราะห์ลักษณะผิดปกติที่พบในภาพเอมอาร์ไอในผู้ป่วยไทย โดยใช้หลักเกณฑ์ของ แมคโดเนล โดยศึกษาย้อนหลังในผู้ป่วยที่ได้รับการวินิจฉัยทางคลินิกด้วยหลักเกณฑ์ของโปสเซอร์ ว่าเป็นมัลติเพิล สเคอโรซิส 25 ราย เป็นหญิง 24 ราย ชาย 1 ราย อายุเฉลี่ย 35.24 ปี ผู้ป่วยที่มีอาการทางสมอง 9 รายมีความผิดปกติของภาพเอมอาร์ไอสมองทุกราย ผู้ป่วย 10 ราย (ร้อยละ 58.8) พบความผิดปกติที่ตำแหน่งใต้เทนต์ต่อเรียลและส่วนใหญ่เป็นเมดดูลา รอยโรคที่มีสัญญาณภาพสูง (T_2 lesion) ส่วนใหญ่พบที่รอบเวนตริเคิลหรือติดกับคอร์เทกซ์ ผู้ป่วย 6 ราย (ร้อยละ 35.3) มีจำนวนรอยโรค ทั้งหมดอย่างน้อย 9 จุด ผู้ป่วย 3 ราย (ร้อยละ 17.6) มีสัญญาณภาพสูงขึ้นหลังฉีดสารปรับความชัด ผู้ป่วย 15 รายมีภาพเอมอาร์ไอของไขสันหลัง มี 13 ราย มีความผิดปกติ ส่วนใหญ่พบที่ไขสันหลังระดับคอและมีจำนวนรอยโรค 1 รอย ความยาวของรอยโรคน้อยกว่า 1 ช่วงกระดูกสันหลัง 5 ราย และมากกว่า 2 ช่วงกระดูก 8 ราย พบว่า 6 รายมีสัญญาณภาพของรอยโรคสูงขึ้นหลังฉีดสารปรับความชัด ทั้งหมดนี้ครบตามหลักเกณฑ์การวินิจฉัย ของแมคโดเนล 6 ราย (ร้อยละ 24) สรุปจากการศึกษานี้พบว่าลักษณะความผิดปกติของเอมอาร์ไอในโรคนี้ของ ผู้ป่วยไทยแตกต่างจากรายงานจากประเทศตะวันตก