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Original Article

Total spine and posterior fossa MRI screening in adolescent idiopathic scoliosis (177 cases)

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ABSTRACT

Background: MRI screening for idiopathic scoliosis is controversial. Considering our clinical experiences, the results of MRI in all patients with idiopathic scoliosis were evaluated.

Methods: In a prospective clinical study, all neurologically normal patients with idiopathic scoliosis screened by posterior fossa and total spine MRI.

Results: After excluding 9 patients for mild neurological findings, in other 177 patients (132 female, 45 male), the average age and curve angle was 15±2 years and 59±17º (30 to 135º), respectively. Convexity was to right in 146 and to left in 31 cases. MRI was positive in 12 cases (6.8%). In 5 cases (2.8%), neurosurgical intervention was necessary prior to scoliosis surgery. There was no relation between age, sex, presence of pain or curve angle and positive MRI findings (P>0.05). Left convexity was significantly related to positive MRI findings (P=0.013). In males with left convex curves, the probability of positive MRI findings was 8.8 folds other patients.

Conclusion: Considering our results and other reported articles, it seems that routine MRI screening of all patients presenting as idiopathic scoliosis is necessary for detection of underlying pathologies.

Key words: Idiopathic Scoliosis, MRI, Spine Syrinx, Chiari

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Scoliosis is a relatively common cause of presentation to an orthopedic spine surgeon. Although scoliosis has many causes, its most common type is idiopathic.

Its diagnosis is based on the exclusion of known causes with normal history or physical examination (except related to spinal deformity) and normal radiology.

Unfortunately, there are no reliable predetermined algorithmic steps in the management of patient with scoliosis [1].

Spine MRI in adolescent idiopathic scoliosis (AIS) is controversial. Some authors believe that it should be performed in atypical cases, but others believe that the prevalence of positive MRI findings is equal between typical and atypical scoliosis [1-7]. In the patients diagnosed as idiopathic scoliosis, 2 of 45 patients in Maiocco study [8] and 6 of 72 patients in Shen study [9] have positive MRI findings.

Considering this controversy and some interesting finding in our patients, we evaluated the results of MRI screening in all patients with clinical and radiological idiopathic scoliosis.

Subjects and Methods

In a clinical prospective study from 1995 to 2002, the patients between 11-20 years olds with idiopathic scoliosis, requiring operative treatment were enrolled. History taking, system review and complete physical and neurological exam were performed by a fellow and again by a staff spine surgeon. A consulting pediatrician or neurologist examined patients with positive findings again. The patients with positive neurological symptoms or signs or unusual pain (except mild pain related to activity) were excluded.

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Total spine and posterior fossa MRI was performed by a 1.5 Tesla coil (Philips company). The parameters for the sequences varied according to the patients. The usual images included spine echo sagital T1, T2 axial, T2 weighted and axial dual TSE.

The data was analyzed by SPSS soft ware.

Results

After exclusion of 9 cases for mild neurological findings, the study included 177 neurologically normal patients: 132 females (74%) and 45 males (26%). The mean age was 15 ± 2 years (range from 11 to 22 years). The mean Cobb angle of major curve measured as 59 ± 17 degrees (range from 30 to135 degree). Convexity was to the right side in 146 patients (82%) and to the left side in 31 patients (18%). Sixty four patients (19%) reported mild pain and abnormal MRI was observed in 12 patients (6.8%) (Table 1).

Neurosurgical intervention was necessary in 5 cases (2.8%): Left and right convexity in 3 and 2 cases, respectively. Their sex, age (at presentation or beginning), curve severity and presence of pain didn't statistically related to positive MRI findings. Left convexity had statistically significant relation with positive MRI findings (X^2 test, P=0.02).

Male patients with left convex deformity had more probability of positive MRI findings (X^2 test, P=0.01).

Discussion

Spine MRI in patients with AIS is controversial, especially considering no definition for AIS clearly. The most important reason for MRI is detection of occult spinal cord lesions, which can lead to serious neurological deficit if not diagnosed.

MRI evaluation in patients with AIS had revealed different results:

In Maiocco study, one chiari and syrinx and one syrinx were detected within 45 patients with normal neurology [8].

Winter found out one thoracic syrinx and 3 chiari malformation within 140 patients without necessary to neurosurgical intervention for any cases[10].

Emery and Redondo found out 20 syrinx and 19 chiari within 25 scoliosis and 20 patients with mild neurological findings [11].

In Shen study, 2 chiari type I, one case of fatty collection in vertebral body and unequivocal findings in 4 cases were observed within 72 patients [9].

Schwend et al found out 12 syrinx, one syrinx and astrocytoma, one dural ectasia within 95 cases and necessity to neurosurgical intervention for 4 patients [12].

Do et al reported 4 chiari, 2 syrinx and one fatty infiltration of vertebral body within 327 cases without necessity to neurosurgical intervention [13].

Some studies recommend MRI screening in all cases of surgical scoliosis while others refuse it. In our study on 177 patients with idiopathic scoliosis and normal neurological findings, 12 cases had positive MRI findings and 5 patients had need neurosurgical intervention.

Six patients had small syrinx, mainly in lower cervical or upper thoracic area without necessity to neurosurgical intervention. One female with a right thoracic curve and one male with a left thoracic curve had tehterring of the spinal cord. Our consulting neurosurgeon believed that detethering was necessary before scoliosis correction.

One female with left thoracic scoliosis had platybasia without any underlying problem. She hasn't needed any intervention for platybasia.

A female with left thoracic scoliosis had an extensive syrinx with necessity to decompression before scoliosis surgery.

One 14 years old male with left thoracic scoliosis had chiari type 1 and extensive syrinx, which was operated before scoliosis correction.

Finally, one 13 years old female with a right thoracolumbar scoliosis and equivocal neurological findings had an intramedullary astrocytoma, which was operated and referred to oncologist.

We cannot exclude some cases from AIS group and perform MRI for them and label the remaining as AIS without a spinal canal evaluation.

Since there are reports of severe paraplegia in the patients with missed scoliosis or syringo-

myelia after corrective scoliosis surgery, it is necessary to diagnose these patients before correction of scoliosis[14]. Physical examination or curve characteristics cannot diagnose underlying syringomyelia, but MRI seems to be the best diagnostic tool.

Another problem which should be considered, is the mild neurological abnormalities especially sensory findings that may be missed in routine neurological examination by an orthopedic surgeon. MRI is a safe and noninvasive which should be performed in the evaluation of AIS.

Conclusion

Based on this research and other reported articles and for preventing severe irreversible neurological injury following correction of spine deformity, it seems that total spine and posterior fossa MRI should be performed in all scoliosis patients with unknown etiology considering history, physical examination and plain X-Ray findings, especially surgical candidates.

Table 1: MRI findings in patients with Idiopathic Scoliosis

No	Age (years)	Sex	Location	Side	Degree	MRI findings	Neurosurgical intervention
1	16	Female	T_4 – T_{11}	Right	45°	Lowlying cord	Yes
2	16	Male	T_7- T_{12}	Left	40°	Tethered cord	Yes
3	14	Male	T_7- L_1	Left	97°	Syrinx C4-C7 +Chiari type I	Yes
4	14	Female	T_5- T_{11}	Left	60°	Syrinx total cord	Yes
5	13	Female	T_{10}-L_4	Right	60°	Intramedullary lower thoracic tumor	Yes
6	15	Female	T_2- T_7	Left	55°	Syrinx (C5 to C6)	No
7	13	Female	T_7- L_1	Right	54°	Small syrinx	No
8	18	Male	T_4 - T_{11}	Right	42°	Syrinx (C6-T2)	No
9	13	Female	T_5- T_{11} T_{12}- L_4	Right Left	54° 30°	Syrinx (C6-T1)	No
10	18	Female	T_1- T_7 T_8- L_2	Right Left	90° 93°	Syrinx (Mid thoracic)	No
11	16	Male	T_6- T_{12}	Right	50°	Syrinx (thoracic)	No
12	13	Female	T_7- L_2	Left	78°	Platybasia	No

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