

Original Research Article


# MRI is the modality of choice for evaluation of spinal lesions

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## Abstract

**Introduction:** Spine is a longitudinal structure, and precise location of the level of a lesion from clinical examination can be difficult. MRI of spine shows the anatomy of the vertebrae that makes up the spine, as well as the discs, spinal cord and the intervertebral foramina through which the nerves pass. It also allows us to differentiate between healthy tissue and diseased tissue.

**Materials and methods:** This study aimed at diagnosing and following up cases of spinal lesions in the department of Radio diagnosis of SBKS Medical Institute and Research Centre and Dhiraj General Hospital. The study is performed using conventional X-rays and MRI.

**Results:** Maximum numbers of patients were between 41–50 years age group followed by 21-30 and 31-40 years of age group, whereas patients of paediatric (00-10 years) and geriatric (>70 years) age group constituted only 8% patients. Average age of patients was 42.5 years. Lumbar spine was the most commonly affected spine region. Maximum numbers of patients were of degenerative and disc lesions (49%).

**Conclusion:** MRI by virtue of non-invasiveness, lack of radiation hazard and by ability to demonstrate structural changes is investigation of choice for spine and spinal cord pathologies. The ability to image the cord directly rather than indirectly as in myelography, the absence of bone artifact as in computed tomography, and the multiplanar capabilities indicate that MRI is the procedure of choice in the examination of the spinal cord.

## Key words

Spinal Canal Stenosis, Spondylolysis, Hemangioma, Meningocele.

## **Introduction**

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Spine is a longitudinal structure, and precise location of the level of a lesion from clinical examination can be difficult. A variety of diseases affect the osseous and soft tissue structures of the spine. Accurate diagnosis is often challenging, although a number of imaging methods are available for this purpose [1-5].

A revolution in the diagnosis and management of spinal disorders has occurred in the past 15-20 years. Powerful imaging methods can be applied to delineate the complexities of pathological conditions in the spine. Of these, MRI is currently receiving the greatest attention and has emerged as the method of choice for the assessment of virtually all disorders of the spine [1].

MRI is a non-invasive investigative procedure. It uses a powerful magnetic field, radiofrequency pulses and a computer to produce detailed pictures of organs, soft tissue, bone and virtually all other internal body structures. The images can then be examined on a computer monitor, printed or copied to CD. MRI does not use ionizing radiations (X-rays) [2].

MRI of spine shows the anatomy of the vertebrae that make up the spine, as well as the discs, spinal cord and the intervertebral foramina through which the nerves pass. It also allows us to differentiate between healthy tissue and diseased tissue [6-14].

## **Aim and objectives**

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- To diagnose the vertebral and soft tissue (disc, spinal cord, nerves) lesions with high accuracy.
- To enlighten the lesions which are not diagnosed by other modalities (e.g. X-rays, CT).

## **Materials and methods**

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This study aimed at diagnosing and following up cases of spinal lesions in the department of Radio diagnosis of SBKS Medical Institute and

Research Centre and Dhiraj general hospital. The study was performed using conventional X-rays and MRI.

## **Selection of patients**

### **Inclusion criteria**

- Only those patients who are willing to participate in study will be included.
- Patients referred to the radiology department for MRI spine investigation, and found to have positive findings, will be included in this study.
- Already diagnosed cases of spinal lesions and which need follow up radiological investigations and are referred to our radiology department will be included in study.

### **Exclusion criteria**

- Patients presenting to radiology department having spinal lesions in past and are cured completely will be excluded from the study,
- Patients having metallic instruments involving spine, pacemaker and not giving consent.

## **Results and Discussion**

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The study was conducted in 100 patients who presented to our radiology department for MRI examination of spine.

The study comprised of 57 males and 43 females, between age groups of 0 - 90 years. The peak incidence was observed in the age group of 41-50 years, which comprised 23% of patients. Of both the sexes and all age groups, males in 21-30 years and females in the age group of 41-50 years formed the bulk of study i. e. 13% each. Spine diseases were observed least frequently in pediatric (00-10 years) and geriatric (> 70 years) patients (**Table – 1**).

Degenerative conditions of spine are most common conditions affecting 49% of patients in our study. Infective conditions are second common affecting only 12% of patients. Trauma

to spine and congenital lesions were seen in 11% patients each. Metastasis (9%) and benign tumors (6%) were next common condition noted. Primary malignancy was seen in only 2 patients. Demyelinating and vascular diseases were not seen at all (**Table – 2**).

**Table - 1:** Demographic profile.

AGE GROUP (YEARS)	NO OF CASES		TOTAL (%)
	MALE	FEMALE	
00-10	1	3	4
11-20	5	3	8
21-30	13	4	17
31-40	8	8	16
41-50	10	13	23
51-60	9	5	14
61-70	9	5	14
> 70	2	2	4
TOTAL	57	43	100

**Table - 2:** Final radiological diagnosis of the lesions.

RADIOLOGICAL DIAGNOSIS	NO OF CASES (%)
CONGENITAL	11
INFECTION	12
TRAUMA	11
DEGENERATIVE	49
DEMYELINATING DISORDERS	00
VASCULAR DISEASES	00
BENIGN TUMOURS	06
PRIMARY MALIGNANT	02
SECONDARY MALIGNANT	09

Patients in age group of 0-20 years are most commonly affected by congenital conditions. Infective lesions most commonly affected the age group of 21-40 years. Trauma to spine affected predominantly males and was more common in the age group of 21-30 years. Degenerative spine was the predominant condition affecting the middle aged and the elderly. Benign tumors were more common in middle age groups. Only 2 patients of primary malignancy were observed, one each in 3<sup>rd</sup> and

7<sup>th</sup> decade. Secondary malignancy or metastasis was evenly distributed in 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> decade of life (**Table – 3**).

57 males and 43 females were affected in our study. Both the sexes were most commonly affected by degenerative spine conditions. Traumatic and secondary malignancy both affected predominantly males with only one female affected in each in both the conditions. Congenital and infective conditions affected both sexes almost equally (**Table – 4**).

Backache (98%) is the most common complaint seen in all the patients included in the study. In patients diagnosed with congenital malformations, backache (72.7%) was followed by lumbo-sacral mass (27.2%), lower limb weakness (27.2%) and sensory deficit (27.2%) as the main presenting complaint. In infective conditions, fever (25%) and past history of tuberculosis (50%) were main complaints other than backache. In all patients with h/o trauma, backache was the main complaint in all the patients. Two patients had muscular weakness (18.2%) and one was unable to walk. Backache (100%) followed by radicular pain (67.3%) was the main complaint seen in patients with degenerative and disc lesions. Most of the patients with tumors and metastasis presented with complaint of backache only (**Table – 5**).

Lumbar spine (54%) was most commonly involved in our study, while dorsal spine (28%) was least involved. Cervical spine (72.7%) was predominantly involved in congenital conditions, whereas it was lumbar spine (67.3%) in case of degenerative diseases. Infective conditions involved dorsal spine (63.6%) and lumbar spine (54.5%) almost equally. Same was the case in traumatic spine which involved cervical and dorsal region mainly. Metastases were seen involving all the regions (**Table – 6**).

In our study there were 11 patients diagnosed with congenital spine disorders. Syringomyelia was found in 6 (54.5%) of the patients. Lipomyelomeningocele, Chiari 1

malformation and tethered cord had same incidence of 3 patients each i.e. is 27.3%. Another similar study was done in 1991 by Bradford, David S et al consisting of 42 patients diagnosed with congenital spine abnormalities. Tethered cord (23.8%) had maximum incidence followed by Syringohydromyelia (9.5%) and diastomatomyelia (9.5%) as per **Table - 7**.

**Table - 3:** Disease profile in various age groups.

	0-10	11-20	21-30	31-40	41-50	51-60	61-70	>70	TOTAL
CONGENITAL	3	4	3	0	0	1	0	0	11
INFECTION	1	1	2	5	1	0	1	1	12
TRAUMA	0	0	6	0	2	2	1	0	11
DEGENERATIVE	0	2	5	8	15	8	8	3	49
BENIGN TUMOUR	0	1	1	2	2	0	0	0	6
PRIMARY MALIGNANT	0	0	0	1	0	0	1	0	2
SEC. MALIGNANT	0	0	0	0	3	3	3	0	9
TOTAL	4	8	17	16	23	14	14	4	100

**Table - 4:** Sex distribution according to disease.

	MALE	FEMALE	TOTAL
CONGENITAL	6	5	11
INFECTION	6	6	12
TRAUMA	10	1	11
DEGENERATIVE	22	27	49
BENIGN TUMOURS	4	2	6
PRIMARY MALIGNANT	1	1	2
SECONDARY MALIGNANT	8	1	9
TOTAL	<b>57</b>	<b>43</b>	<b>100</b>

**Table - 5:** Symptomatology with respect to disease.

	BACKACHE	REDICULAR PAIN	NUMBNESS	TINGLING SENSATION	OTHERS
CONGENITAL	8	2	2	2	8
INFECTION	12	4	0	0	6
TRAUMA	11	1	1	1	3
DEGENERATIVE	49	33	10	11	6
BENIGN TUMOURS	7	1	0	0	0
PRIMARY MALIGNANT	2	2	1	1	1
SECONDARY MALIGNANT	9	0	0	0	2
TOTAL (%)	98	43	14	15	26

**Table - 6:** Predominant spine involved.

	<b>CERVICAL</b>	<b>DORSAL</b>	<b>LUMBAR</b>
CONGENITAL	8	5	4
INFECTION	1	7	6
TRAUMA	6	5	1
DEGENERATIVE	15	1	33
BENIGN TUMOURS	2	3	2
PRIMARY MALIGNANT	0	2	1
SECONDARY MALIGNANT	3	5	7
TOTAL (%)	35	28	54

Tuberculosis was the only infective condition that we came across in our study. It mainly involved lumbar (54.5%) and dorsal spine (36.4%). 5 patients had h/o pulmonary tuberculosis, while one was a diagnosed case of tubercular spine. Pre/para vertebral collection (90.9%) was seen in almost all the patients which produced extradural cord compression in 7 out of 11 patients in our study. Spine deformity was present in 2 patients (**Table – 8**).

**Table - 7:** Congenital conditions involved.

	<b>PRESENT STUDY (11 PATIENTS)</b>
SYRINGOHYDROMYELIA	6(54.5%)
DIASTEMATOMYELIA	1(9.0%)
TETHERED CORD	3(27.3%)
LIPOMYELOMENINGOCELE / LIPOMYELOCELE	3(27.3%)
CHIARI I MALFORMATION	3(27.3%)
KLIPPEL FEIL SYNDROME	1(9.0%)
BASILAR INVAGINATION	1(9.0%)
PLATYBASIA	1(9.0%)

In our study 49 patients were diagnosed with degenerative and disc lesions. Lumbar spine was predominantly involved, while dorsal spine was least affected. Disc protrusion (33 patients) and bulge (28 patients) were responsible maximally for symptoms in these patients. Associated spinal canal stenosis was seen in 25 patients (**Table – 9**).

Of the 13 patients diagnosed for extradural tumor, 9 patients had metastatic disease. All the 3 patients of intradural extramedullary lesions had neurofibromatosis. Most of the intramedullary lesions were congenital in origin except for one which was diagnosed as ependymoma/ astrocytoma (**Table – 10**).

Spinal cord was found normal in majority of the patients (52%). Dural theca or mild spinal cord compression was found in 29% of the patients was mainly the feature of traumatic and infective spine. Space occupying lesion (SOL) was predominantly seen in congenital lesion and was mainly Syringohydromyelia. Tethered cord was seen in only 3 patients in the entire study (**Table – 11**).

### **Conclusion**

- MRI by virtue of non-invasiveness, lack of radiation hazard and by ability to demonstrate structural changes is investigation of choice for spine and spinal cord pathologies.
- The ability to image the cord directly rather than indirectly as in myelography, the absence of bone artifact as in computed tomography, and the multiplanar capabilities indicate that MRI is the procedure of choice in the examination of the spinal cord.
- Maximum numbers of patients were between 41–50 years age group followed by 21-30 and 31-40 years of age group, whereas patients of paediatric (00-10

years) and geriatric (>70 years) age group constituted only 8% patients, suggesting middle aged people i.e is the working age group, being most

frequently affected by lesions of spine and spinal cord. Average age of patients was 42.5 years.

**Table - 8:** Tubercular spine.

	NO	P/H/O TB	PRE/PARA VERT COL.	EXTRA DURAL CORD COMP BY ABSCESS	DEFORMITY
CERVICAL	1	1	1	1	0
DORSAL	4	2	4	3	1
LUMBO-SACRAL	6	3	5	3	1

**Table - 9:** Evaluation of disc lesions.

DISC LESION	TOTAL PATIENTS- 49
DISC BULGE	28
DISC PROTRUSION	33
DISC EXTRUSION	06
DISC FRAGMENTATION	00
LYSIS WITH LISTHESIS	15
S.CANAL STENOSIS	25

**Table - 10:** Tumors, cysts and tumor like conditions.

	NO OF PATIENTS
EXTRADURAL	13
INTRADURAL	3
EXTRAMEDULLARY	
INTRAMEDULLARY	9

- The overall male: female sex ratio was 1.3:1. Thus, presenting slight male predominance.
- Lumbar spine was the most commonly affected spine region overall conditions in our study, except for congenital and traumatic lesions in which cervical spine was more commonly involved.
- Maximum numbers of patients were of degenerative and disc lesions (49%) and most commonly disc protrusion and disc bulge. Infective pathologies were the second most common.
- Patients with degenerative and disc lesions are usually middle and elderly

aged, who present with chief complaints of backache and redicular pain to lower limbs.

- Lumbar spine was most commonly involved in degenerative and disc lesions followed by cervical spine. Dorsal spine was involved in only one patient.
- All the patients with redicular pain had unilateral/bilateral nerve root compressions. Spinal canal stenosis was seen in 20 patients out of 49 patients with degenerative and disc lesions.
- Most of the patients with degenerative and disc lesions responded well to conservative treatment and physiotherapy. Most of the patients of spinal canal stenosis did not respond to conservative treatment, Laminectomy with Discectomy was the common procedure performed. Thus, supporting the role of MRI preoperatively.
- Congenital lesions were more common in 00-20years of age group, with almost equal prevalence in both the sexes.
- Syringohydromyelia was the most common congenital condition observed followed by tethered cord and associated Chiari 1 malformation.
- Classic MR finding of syringohydromyelia is an enlarged cord with a central or slightly eccentric fluid-filled cavity that parallels CSF in signal intensity. A sharp interface between the normal cord and syrinx is typical.

Increased signal intensity around the syrinx on T2WI probably represents cord gliosis, oedema or myelomalacia.

- MRI has the advantage of diagnosing any associated congenital abnormalities. As in case of syringohydromyelia, 3 patients had associated Chiari 1 malformation, thus favouring the need of focused study.
- Tuberculosis of spine is the most common infective condition affecting spine in our country, as all the 12 patients with infective spine pathology were affected with tuberculosis.
- Tuberculosis was more common in 2<sup>nd</sup> and 3<sup>rd</sup> decades of life, with no sex preponderance. Dorsal and lumbar spines are commonly affected.
- MRI plays an important role in the diagnosis of spinal tuberculosis with a high specificity and sensitivity. It allows demonstration of bony, soft tissue and neural pathology. Post contrast T1WI show heterogeneous enhancement thus confirming the presence of abscess formation.
- Trauma was most common in 21-30 years of age group, and mostly affected cervical spine. There was strong male

predominance with 10 out of 11 patients affected being male.

- MRI was helpful in demonstrating spinal cord lesions in traumatic patients thus enlightening the conditions not seen on plain x-rays.
- Neurofibroma was the most common benign tumour found in our study. One case each was found in cervical, dorsal and lumbar region.
- Among the malignant conditions, metastasis was the most common condition found. Most of the metastasis took place from CA lung.
- Differentiation of malignant lesions and granulomatous lesions with bone erosion can be made on MRI scan with enhancement pattern, extension pattern and involvement and sparsity of intervertebral discs.
- Consequently, MRI appears to be the optimal imaging modality to be performed in cases of spine and spinal cord lesions which can be due to various causes as spinal cord tumours, extramedullary intradural tumour, epidural lesions, syringo-hydromyelia, spinal cord compression by primary or secondary spinal canal stenosis and traumatic lesions of the spinal cord.

**Table - 11:** Spinal cord features.

	NOR	THECA/ S.C COMP	DISP	CONT	MAL	EDEMA	SOL	TETHERED CORD
CONGENITAL	0	2	0	0	1	0	7	3
INFECTION	2	7	3	0	0	0	0	0
TRAUMA	2	8	3	3	1	3	1	0
DEGENERATIVE	42	5	0	2	0	3	0	0
BENIGN TUMOR	2	3	3	0	0	0	0	0
1° MALIGNANT	0	0	1	0	0	0	0	0
2° MALIGNANT	4	4	2	0	0	0	0	0
TOTAL	52	29	12	05	02	06	08	03

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