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Original Research Article

Role of MR Myelography Evaluation of Symptomatic Patient of Degenerative Spinal Disc Diseases in Magnetic Resonance Imaging at 1.5 TESLA

Jyoti[1], Mohit Kumar Dahiya[2], Raushan Kumar[3], Rohit Kumar Dahiya[4]

[1]Assistant Professor, Noida International University
[2]Assistant Professor, Sharda University, Noida
[3]Assistant Professor, H.O.D. [Dept. of RIT] TMU University, Moradabad.
[4]Intern Operations Manager, Columbia Asia Hospital, Gurugram

Corresponding Author: Jyoti

ABSTRACT

The objective of this research work is to analyses the use of MRM (magnetic resonance myelography) along with the CMR LS-Spine (conventional magnetic resonance lumbosacral spine) examination in patients of suspected degenerative spine disease.
Result: - A prospective analysis of 42 consecutive patients of conventional MR LS spine along with additional complimentary MR myelography TES sequence. The contribution of MRM is great in CMR LS spine. 42 patients by correlation with team of 2 radiologists (R1 & R2), (19 positive and 23 negative result) & (15 positive and 27 negative) respectively.
RADIOLOGIST 1: - Out of 42 patients 20 patients gives the positive result and 22 patients gives negative result i.e. 47.62% and 52.38% respectively. The conventional MR LS spine and MRM are independently diagnosed one after another (firstly conventional MR LS spine and then HRM and all the diagnostic information has kept documented.
RADIOLOGIST 2: - Out of 42 patients 18 patients gives the positive result and 24 patients gives negative result i.e. 42.85 % and 57.14% respectively. The conventional MR LS spine and MRM are independently diagnosed one after another (firstly conventional MR LS spine and then HRM and all the diagnostic information has kept documented.
The kappa coherence agreement between the two radiologist (radiologist R1 & radiologist R2), for MRM finding to have MRM finding other than that of CMR LS spine is good agreement with kappa value, 028.
The result of the percentage of the spinal cord termination level variation level at the anatomy of spinal canal in three categories have

- Above the level of T12-L1 IVD level. = (17/42) x 100 = 40.47%
- At or in between the L1 to L2 vertebrae level. (21/42) x 100 = 50%
- Below the level of L2-L3 IVD level. (4/42) x 100 = 9.52%

The patients having PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine & MRM respectively. The PIVD and diffuse disc bulge is clearly seen in CMR LS spine. But in the degenerative spinal disc disease like Straitening of lumbar spine, lumbar canal stenosis & Nerve root compression shows equivalent or even better diagnosis in MRM compared to CMR LS spine.

The result shows that patients having 30.9% PIVD problem (13/42), 45.2% (19/42) in diffuse disc bulge, straightening of lumbar spine and lumbar canal stenosis. Most of the patient shown problem of nerve root compression in 22 patients out of 42 patients i.e. 52.3%.
Key words: MR myelography, degenerative spinal disc disease, Magnetic Resonance Imaging, MRI

1. INTRODUCTION

MRI uses non ionizing radiation to create useful diagnostic images. MRI was initially called NMR imaging after and was used for chemical analysis. NMR was discovered simultaneously by two physicists, Felix Bloch and Edward Purcell, just after the end of World War II. They also shared Nobel prizes in physics in 1952 for their discovery. Magnetic Resonance Imaging of the whole body uses a powerful magnetic field radio-waves and a computer to produce detailed pictures of the parts of the body. Magnetic resonance imaging of the body is performed to evaluate different physiological and anatomical structures of the body's structure such as Blood vessels, Lymph nodes, Cranial nerves, Spine, Brain, Breast and both upper and lower extremities. Organs of the chest and abdomen include heart, kidney, billiary tract, pancreas, etc. MRI is non-invasive technique that is used for soft tissue imaging. MRI has best soft tissue contrast resolution. MRI may be contra-indicated in the case of patient having claustrophobia, patient with metallic implants, dental implants or dentures, stent or cardiac pacemaker. However nowadays MRI compatible implants, dentures, stents are also available by various manufactures (Sijbers J, 1996). [1]

1.1 Anatomy of spine

The spine is made up of bones known as vertebrae. They are roughly circular and between each vertebra there is a disc. The discs are made up of strong "rubber like" tissue which allows the spine to be fairly flexible. (Ohba Y, 2011). [2]

1.2 Anatomy of inter-vertebral disc

Inter vertebral disc are soft, rubbery pads found between the hard bones (vertebrae) that make up the spinal column. The spinal canal is a hollow space in middle of the spinal column that contains the spinal cord and other nerve roots. Disc between the vertebrae allow the flex and bend motion of the spine. Discs are also play a role of shock absorbers. Discs are composed of a thick outer ring of a cartilage (annulus fibrous) and in a gel like substance nucleus pulpous. In the cervical spine, the discs are similar but smaller in size. Two layers of cartilage which covers top and bottom of each disc called as vertebral end plate. It helps in separating from adjacent vertebrae. The annulus fibrous consists of collagen fibers. They are arranged in between 10 to 20 thread like structures called lamellae. The lamellae are arranged in concentric rings that surrounds the nucleus pulpous. The collagen fibre lies parallel to each other. Irradiation of the sinu vertebral nerve is responsible for axial back pain. Vertebral end plates has a layer of cartilage of about 0.1- 1mm thick. Nucleus pulpous anteriorly covered but annulus fibrous only 66% covered by the end plate (Nasser R, 2010). [3]

1.3 PIVD – prolapsed inter-vertebral disc diseases

The term PIVD the protrusion or extrusion of the nucleus pulpous in annulus fibrous. They are of four types or four stages.

1. Bulging – At this early stage, the disc is stretched and does not completely return to its normal shape when pressure is relieved. Some of the inner disc fibers could be torn and the soft jelly (nucleus pulpous) is spilling outwards into the disc fibers but not out of the discs.
2. Protrusion – At this stage, the bulge is very prominent and the soft jelly center has spilled out to the inner edge of the outer fibers, barely held in by the remaining disc fibers.
3. Extrusion- In this case of herniated spinal disc, the soft jelly has completely spilled out of the disc and now protruding out of the disc fibers.

1.4 The difference between bulging disc and herniated discs

The primary difference between bulging discs and herniated discs re whether they are contained or non-contained:

A contained disc such as bulging disc, has not broken through the outer wall of the inter-vertebral disc, which means the nucleus pulpous remains contained within the annulus fibrous.

A non-contained discs such as herniated disc or ruptured disc, has either partially or completely broken through the outer wall of the inter-vertebral disc. A bulging disc may be precursor to a herniation. When a disc herniated, the contents may compress the spinal cord or the spinal nerve root.

1.5 The anatomy of spinal canal

The spinal canal has direct connection with the brain. The spinal cord descends down wards middle back. It is surrounded for protection by vertebral column. In the vertebral column, the spinal cord is surrounded by the clear fluid known as cerebro-spinal fluid (CSF). The CSF protects the existing delicate nerve roots. The nerve roots consist of nerve fiber which are the messengers of neural signals as it transmits the electrical neural information from the limbs (both upper and lower limbs), trunk and major and minor organs to the brain and also back by ascending and descending tracks respectively. These nerve roots exist from the spinal vertebrae via hole like structure called as vertebrae foramen. The brain and spinal cord is the part of central nervous system (CNS), and it has major role in the regulation, motion, movement& control of function of the body. The sub-division of vertebrae column is listed below: -

Cervical nerve or C-spine: - supply movement and feeling to arms, neck and upper limb

Thoracic nerve or T-spine (also known as dorsal spine or D-spine): -supply the trunk and abdomen (Nasser R, 2010). [3]

Lumbar nerve or L-spine and S-spine: -supply the legs, the bladder, bowel and sexual organs.

1.6 MR MYELOGRAPHY

Myelography is considered as specific and sensitive test for spinal disorders and cerebrospinal fluid (CSF) studies. Although, there are several other imaging diagnostic test for spinal disorders (Sijbers J, 1996) [1] such as Conventional X-ray myelography, CT-Myelography, MR-Myelography, etc.

"Myelography" term was first introduced and discovered by Sicard and Forestier in 1921. Previously iodized oil (lippidol) was used which is first generation of contrast media used till 1944 for X ray myelography test later it was strongly replaced by lophendylate (pantopaque) as contrast agent for intrathecal use. (TaverasJ. M,1990) [4]

The contrast has to remove back at the end of procedure by the process of suction back. In 1976, first CT myelography was published by Dichiro & Schellinger. At the end of the 1980, MR myelography.

MR- myelography, is the study of CSF in spinal canal and spinal disease. MR sequence formed from a segmented multi-shot and single slice TSE sequence. The echo or signal intensity is obtained from fluid inside the spinal canal, between the thecal sac is CSF. (Grams A. E,2010). [5]

As like myelography, CT-myelography and conventional myelography also shows imaging details of thecal sac, dural sleeves, nerve roots, morphological abnormalities, etc. (Morita M., 2011), (Bischoff R,1993) [6,7]

But in MR-Myelography examination there are some additional advantages with respect to its non-invasive technique, no minor or major invasive surgical cut or pin hole surgical cut needed, also no need to inject contrast media directly or indirectly to the spinal cord or thecal sac. MR myelography also do not deal with ionizing radiation, hence radiation dose is not included. Spinal canal is better evaluation than conventional myelography. MR myelography is also, best for evaluation of traumatic injuries of the brachial plexus. In MR myelography patients has not to more for different orientation of planes (Demaerel P,1997), (Hergan K,1996) (Hofman P,1996) (Ramacharya R,2015). [8-11]

Conventional MR lumbo-sacral examination includes three plane localizers using the following sequence: -

- T2W _TSE_SAG
- T1W_TSE_SAG
- T2W_TSE_STIR_SAG
- T2W_TSE_AXIAL
- T1W_TSE_AXIAL

(Additional sequence can also be taken depending on patients' clinical and pathological condition)

MR-myelography is not taken as routine protocol for MR lumbosacral spine or spinal segment MR studies. But to evaluate the role of MR myelography and to evaluate the degenerative spinal disease with MR myelography an intentionally complemented additional MR myelography sequence (segmented multi-shot, single slice TSE sequence) has been included with conventional MR lumbo-sacrum spine and whole spine screening examinations in this study (Gasparotti R,1997) (SandowB. A., 2005) [12,13]

In today's era various imaging modalities are present for diagnostic purpose of spine and its disorders. A myelogram is considered sensitive to specifically only for Cerebro-spinal fluid (CSF) & spinal canal studies. Many spinal diseases are associated with spinal canal and CSF morphology for example disc herniation, spinal bone spurs, spinal stenosis, etc. (Ferrer P,2004) [14]

2. MATERIALS & METHODS

In this study, Quantitative and Qualitative comparative descriptive study involving both MR LS spine and MR-myelography along with their role in evaluation of symptomatic patients of degenerative spinal diseases, over a period of 6months in the MRI room of radiology department of where this study is initiated.

The overall data was collected with the help of radio-technologist (MR technologist) of SGT University. The data was collected in daily wages with in a continues manner in the SGT Hospital and Research Institute, Grogram, Haryana data was collected from date 1st October, 2018 to date 30th march, 2019.

2.1Research design

The current study used a quantitative, comparative analysis. Quantitative research has the following characteristics: it is well-defined, logically deductive and objective, uses numerical data. Comparative research attempts to establish cause–effect relationships among the variables in the study. Accordingly, an attempt is made to establish that the values of the independent variable have a significant effect on the dependent variable.

2.2 Sampling

In order to calculate the factors affecting the image quality of MR imaging, probability sampling was used. This is a method of sampling where elements are chosen from the population using random methods. In this study convenience sampling was used as the sample was taken from a section of the population that was easily accessible or readily available to the researcher.

The sample used in the current study was obtained from the MRI room of radiology departments in SGT Hospital and Research Institute, Gurgoan, Haryana which were positioned conveniently for the researcher. Data were collected from the entire population, i.e. randomly selected patient and their clinical history were recorded and used as data for the above mentioned research. This research study is condensed under the supervision of experts and existing radiologist along with the existing radio-technologists in the radiology department in SGT Hospital and Research Institute, Gurgoan, Haryana.

2.3 Prospective Study Phase

A prospective image quality improvement of MR imaging was conducted for 6 months. During this time the data of symptomatic patients of degenerative spinal diseases images of MR-myelography and MR LS spine, were collected on daily basis along with the clinical history of patients and relevant information also without ignoring the maintenance of equipment used in the particular scan of the particular patients, but analysis was only done at the end of the prospective study period.

2.4 Data Analysis

The purpose of data analysis is to categorize, organize, manipulate and summarize the data that have been collected . The current study used a quantitative design and statistical strategies. In this context, quantitative data refer to numbers that are collected and then interpreted using statistics. Numerical data are described in a meaningful manner thereby enabling any researcher to understand interrelationships that exist. Data analysis aims to describe statistical analysis results but does not comment on them. The present study deals with the analysis of the role of the MR-myelography evaluation of symptomatic patients of degenerative spinal diseases. For the purpose of this study, is to improve the diagnostic view of spinal disease in MR imaging for the betterment of the radiology and its radio diagnostic field, and for the development of the nations in the field of medical science. The patient's treatment and development of the nation in radiology and medical field.(Gammal T,1995), (Chazen J,2014) [15,16]

During this research study also absorbed a very new kind of factor about MR imaging, which affects the imaging quality very much that is the vital signs of the patients and on the special note, specially blood pressure and pulse rate of the patient. I firmly noticed that patient with hyper blood pressure and high pulse rate tends to give a bad image quality along with artifacts specially flow artifacts and angiograms of those particular patients are also not up to the marks.(Al-Tameemi H,2017) [17]

2.5 Kappa Statics

Reliability is an important part of any research study. The static of kappa coherences assessment is the inter-rater reliability of 2 raters in a particular sample.

Kappa concurrence ia a degree of calculation of accuracy and reliability, agreements. The agreement is measurement is measured between 2 raters (judges). Both the 2 raters separately judge the article object, subject etc. The static Cohens kappa was first introduced by Jacob Cohen's in the journal educational and psychological measurement in 1960.

$$k=\frac{p_o-p_e}{1-p_e}$$

Where P_o is the relative observed agreement among raters and P_e is the hypothetical probability of chance agreement. It can be measured in two ways. First is Inter – rater reliability: it is to evaluate the degree of agreement between the choices made by two (or more independent judges). On the other hand, second is Intra rater reliability: it is to evaluate the degree of agreement presented by the same person at a distance of time. (Nagayama M,2002) [18]

Interpret the kappa statics

Kappa should always less than or equal to 1. It can be negative as well that happens when both observers agreed less than that would be expected by the chance.

The following point that are necessary for kappa calculation for 2 raters are: -

- Both judges agree to include
- Both judges agree to exclude
- Only the first judge wants to include
- Only the second judge wants to include

2.6 Calculating Kappa for the above research: -

- "Radiologist 1" finds that 20 out of 42 patients have MRM finding other than CMR LS spine.
- "Radiologist 2" finds that 18 out of 42 patients have MRM finding other than CMR LS spine.
- Both the radiologist (radiologist 1 and radiologist 2) agreed that 12 of the patients had MRM finding other than CMR LS spine, and that 15patients did not (leaving 14 patients where the doctors disagreed from each other in a peaceful manner).

The Kappa statistic is calculated using the following formula:

$$\frac{\text{Observed agreement - chance agreement}}{\text{1-chance agreement}}$$

First step: -
filling 2 X 2 table as follows:

		Radiologist 1	
		Yes	No
Radiologist 2	Yes	12	8
	No	6	15

The observed agreement is: (a + d) / N
Where, "a" = both the raters (radiologist) agreed to include the patients as a positive find.
And, "b" = both the raters (radiologist) disagreed to include the patients as a positive find or agreed to exclude the patient as negative finding.
N = total no of observation (Patients)
= (12 + 15) / 42
= 0.64
The observed agreement percentage is: [(a + d) / N] x 100
= 0.64 x 100 = 64%

To calculate the chance agreement, note that "Radiologist 1" found 20/42 patients to have MRM finding other than CMR LS spine and 22/42 to not have MRM finding other than CMR LS spine. And "Radiologist 2" found 18/42 patients to have MRM finding other than CMR LS spine and 24/42 to not have MRM finding other than CMR LS spine.
Thus, "Radiologist 1" said 'yes' to 47.62% of the time. "Radiologist 2" said 'yes' 42.85% of the time.
Thus, the probability that both of them said 'yes' to have MRM finding other than CMR LS spine was 0.47 x 0.42 = 0.1974.
The probability that both physicians said 'no' to have MRM finding other than CMR LS spine was 0.52 x 0.57 = 0.2964. The overall probability of chance agreement is 0. 1974 + 0. 2964 = 0.4932.
Thus the Kappa would be:

$$\text{Kappa} = \frac{0.64 - 0.4932}{1-0.4932}$$

Kappa= 0.28

A kappa value of 0.28 indicates good agreement between observers.

As, the kappa test analyses value can be classified as: -

- – 0.20 slight agreement
- 0.21 – 0.40 good agreement
- 0.41 – 0.60 moderate agreement
- 0.61 – 0.80 substantial agreement
- 0.81 – 1.00 almost perfect or perfect agreement

kappa is always less than or equal to 1. A value of 1 implies perfect agreement and values less than 1 imply less than perfect agreement.
It's possible that kappa is negative. This means that the two observers agreed less than would be expected just by chance

3. RESULT

A set of consecutive 42 patients with minimum and maximum age of 18-60 years respectively. Where 7 patients are in the age group between15-25, 13 patients are in the age group between25-35, 9 patients are in the age group between35-45, 9 patients are in the age group between45-55 & 4 patients are in the age group between55-65. The mean age is 37. The total no. of female patients is 22 out of 42 and 20 patients are male out of 42 patients.

3.1 Evaluation of Usefulness of MRM Along with CMR LS-Spine

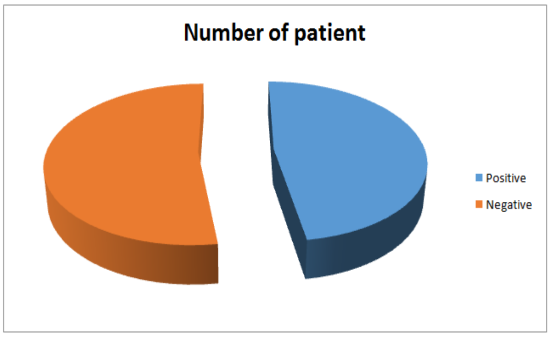
A team of 3 radiologists along with the supervision of the head radiologist and head of the department (HOD), has contributed in this research. Among 3, Two of the radiologist has reported the case study of both CMR LS Spine and MRM. The first and second radiologist has considered as R1(radiologist no.1) and R2(radiologist no.2) respectively for the sake of simplicity and to maintain confidentiality of the result. All the patients who have the MRM finding has considered as the positive patient and the patient those who have no additional findings same or other than conventional MR myleography are obviously considered negative patient.(O'Connell M,2003)(Mollà E,2005) [19,20]

In observation of R1 :-Out of 42 patients 20 patients gives the positive result and 22 patients gives negative result i.e

47.62% and 52.38% respectively. The conventional MR LS spine and MRM are independently diagnosed one after another (firstly conventional MR LS spine and then HRM and all the diagnostic information has kept documented.
The kappa concordance has been used in finding & evaluation of result of this research work.

Table 3.1 shows the result for the radiologist no.1 (R1)

Result	Number of patient
Positive	20
Negative	22

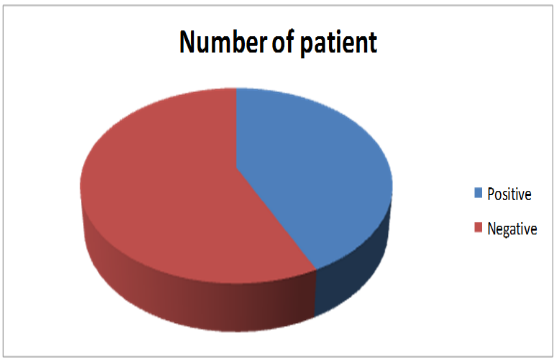


Graph 3.1 shows the result for the radiologist no.1 (R1)

In observation of R2 :-Out of 42 patients 18 patients gives the positive result and 24 patients gives negative result i.e. 42.85 % and 57.14% respectively. The conventional MR LS spine and MRM are independently diagnosed one after another (firstly conventional MR LS spine and then HRM and all the diagnostic information has kept documented.
The kappa concordance has been used in finding & evaluation of result of this research work.

Table 3.2 shows the result for the radiologist no.2 (R2)

Result	Number of patient
Positive	18
Negative	24



Graph 3.2 shows the result for the radiologist no.2 (R2)

To calculate the chance agreement, note that "Radiologist 1" found 20/42 patients to have MRM finding other than CMR LS spine and 22/42 to not have MRM finding other than CMR LS spine. And "Radiologist 2" found 18/42 patients to have MRM finding other than CMR LS spine and 24/42 to not have MRM finding other than CMR LS spine.
Thus, "Radiologist 1" said 'yes' to 47.62% of the time. "Radiologist 2" said 'yes' 42.85% of the time.
Thus, the probability that both of them said 'yes' to have MRM finding other than CMR LS spine was 0.47 x 0.42 = 0.1974.
The probability that both physicians said 'no' to have MRM finding other than CMR LS spine was 0.52 x 0.57 = 0.2964. The overall probability of chance agreement is 0. 1974 + 0. 2964 = 0.4932.
Thus the Kappa would be:

$$\text{Kappa} = \frac{0.64 - 0.4932}{1\text{-}0.4932}$$

Kappa= 0.28

A kappa value of 0.28 indicates good agreement between observers.

As, the kappa test analyses value can be classified as: -

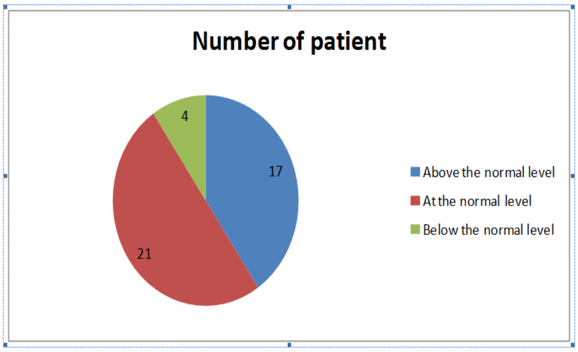
- 0.01 – 0.20 slight agreement
- 0.21 – 0.40 good agreement
- 0.41 – 0.60 moderate agreement
- 0.61 – 0.80 substantial agreement
- 0.81 – 1.00 almost perfect or perfect agreement

kappa is always less than or equal to 1. A value of 1 implies perfect agreement and

values less than 1 imply less than perfect agreement.
It's possible that kappa is negative. This means that the two observers agreed less than would be expected just by chance

3.2 THE SPINAL CORD TERMINATION LEVEL

The spinal cord termination level is also verified by the respective radiologists at the time of reporting of their respected patients. The data was then documented and presented in the result. The normal level of spinal cord termination in a normal adult is at the L1-L2 IVD level. More specifically the point at which spinal cord terminate is called the conus medullaris. (Krudy A ,1992)(Ramacharya R, 2015) [21,22] Hence patients with spinal cord termination level at the anatomy of spinal canal is divided in three categories as follow in table 5.3:



Graph 3.3: - showing numeral data for the above level and lower level of spinal canal termination level and normal level patients.

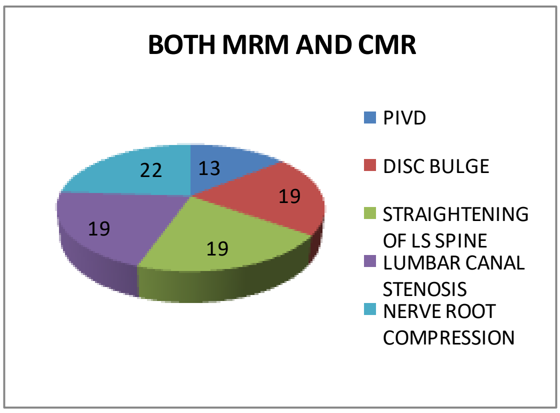
The result of the percentage of the spinal cord termination level variationlevel at the anatomy of spinal canal in three categories have

- above the level of T12-L1 IVD level. = (17/42) x 100 = 40.47%
- at or in between the of L1 to L2 vertebrae level. (21/42) x 100 = 50%
- below the level of L2-L3 IVD level. (4/42) x 100 = 9.52%.

3.3 EVALUATION OF SYMPTOMATIC PATIENTS OF DEGENERATIVE SPINAL DISC DISEASE IN MRI ALONG WITH MRM

Table 3.3 Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine & MRM respectively

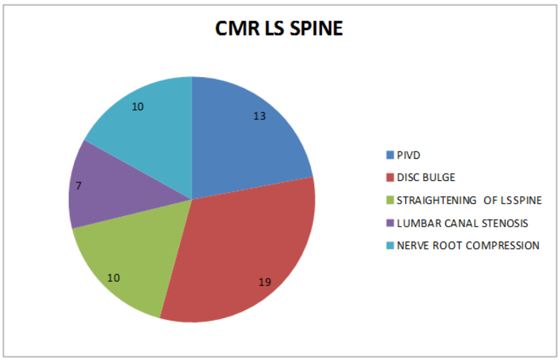
PIVD		Disc Bulge		Straitening of lumbar spine		Lumbar canal stenosis		Nerve root compression	
CMR LS SPINE	MRM	CMR LS SPINE	MRM	CMR LS SPINE	MRM	CMR LS SPINE	MRM	CMR LS SPINE	MRM
13	0	19	0	10	9	7	12	10	12
13		19		19		19		22	



Graph no. 3.4: -Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine

Table 3.4 Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in CMR LS spine

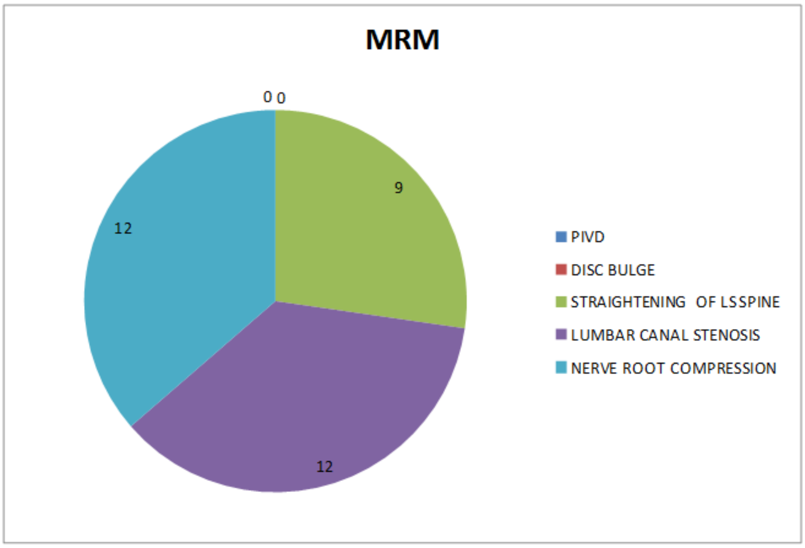
PATHOLOGY	NUMBER OF PATIENT
PIVD	13
DISC BULGE	19
STRAIGHTENING OF LS SPINE	10
LUMBAR CANAL STENOSIS	7
NERVE ROOT COMPRESSION	10



Graph 3.5 Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine

Table 3.5 Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in MRM

PATHOLOGY	NUMBER OF PATIENT
PIVD	00
DISC BULGE	00
STRAIGHTENING OF LS SPINE	9
LUMBAR CANAL STENOSIS	12
NERVE ROOT COMPRESSION	12



Graph 3.6 Showing no. of patients showing PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in MRM

The table 3.3, and the graph3.4 shows no of patients having PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine & MRM respectively. And the graph clearly shows that PIVD and diffuse disc bulge is clearly seen in CMR LS spine. But the indegenerative spinal disc diseaselike Straitening of lumbar spine, lumbar canal stenosis & Nerve root compression shows equivalent or even better diagnosis in MRM compared to CMR LS spine.

The patients show 30.9% PIVD problem (13/42), 45.2% (19/42)in diffuse disc bulge, straightening of lumbar spine and lumbar canal stenosis. Most of the patient shown problem of nerve root compression in 22patient out of 42 patients i.e. 52.3%.

Diagnostic output of CMR LS Spine shows that PIVD is seen in 13patients 30.9%, diffuse disc bulge is seen in 19patients out of 42patients i.e. 45.2%. whereas Straitening of lumbar spine and nerve root compression is seen in 10 out of 42patients which states 23.8% and lumbar canal stenosis seen in 16.6% patients i.e. 7out of 42 patients.

The diagnostic output of MRM is representing that PIVD& diffuse disc bulge is not seen any patients out of 42patients i.e. 0%. whereas lumbar canal stenosis and nerve root compression is seen in 12patients out of 42patients which states 28.5%. and. 9 out of 42 patients shown Straitening of lumbar spine i.e. 21.4%.

Also there are many other pathologies like "Tarlov cyst" which are better seen in only MRM and not in CMR LS spine examination. Shown below with case study: -

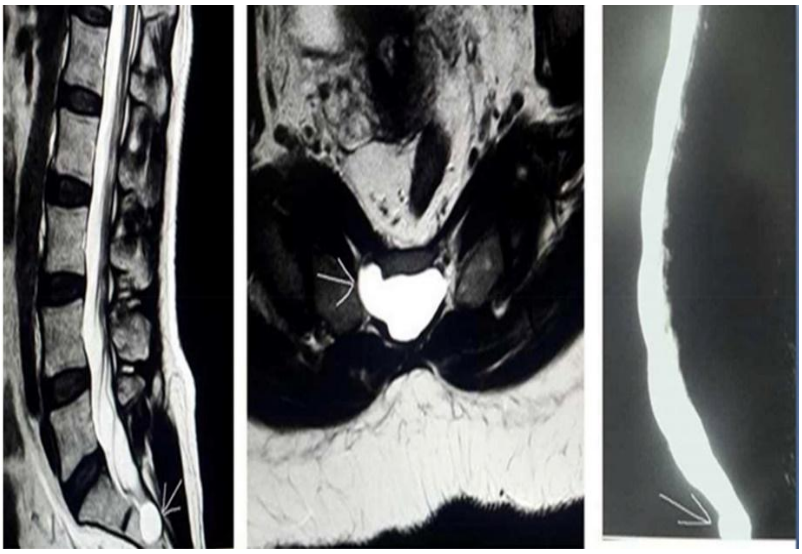


Figure 3.1 case study 1

Case #1: MRI Lumbosacral spine of 46years old male with low backache of two years duration. (a) T2W Sagittal section shows a hyperintense small round lesion as an incidental finding present on the dorsal aspect of S3 vertebral body (white arrow). (b) T2W axial section shows the same lesion as perineural cyst on left side (white arrow). (c) MR myelography shows subtle findings of prominence of the caudal end of the spinal cord (white arrow).

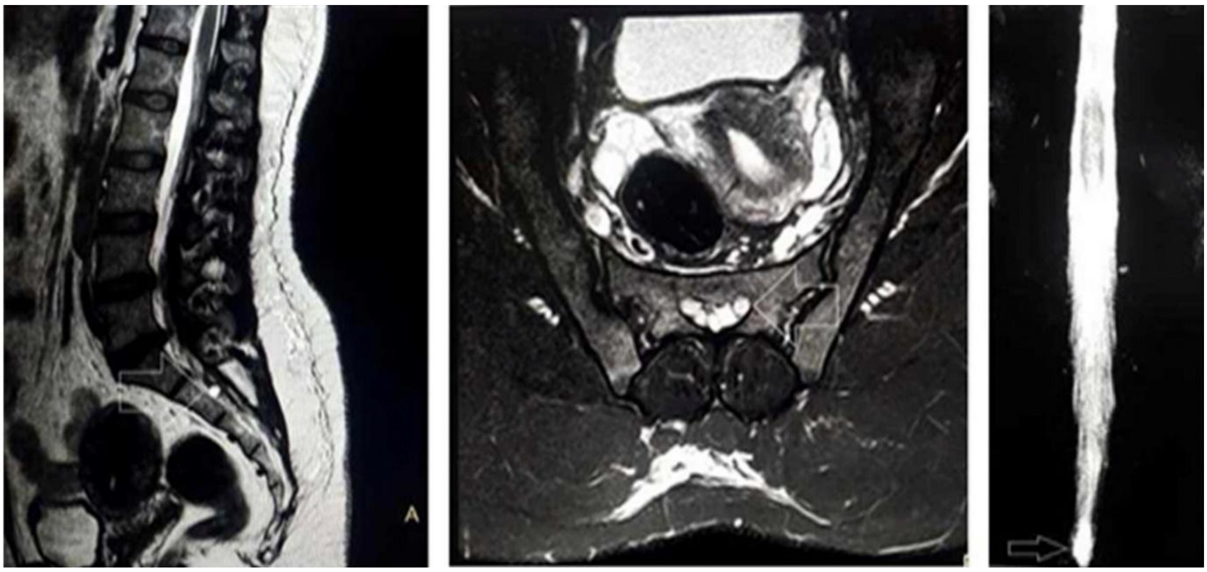


Figure 3.2 case study 2

Case #2: MRI Lumbosacral spine of 63years old male anaesthetist with low backache and urinary bladder disturbances. (a) T2W Sagittal section shows a well defined hyperintense lesion on the dorsal aspect of S2 vertebra (white arrow). (b) T2W axial section shows the same lesion on right side at the same level with some bony erosion (white arrow). (c) MR myelography shows a well defined rounded prominence at the caudal end of the spinal cord (white arrow).

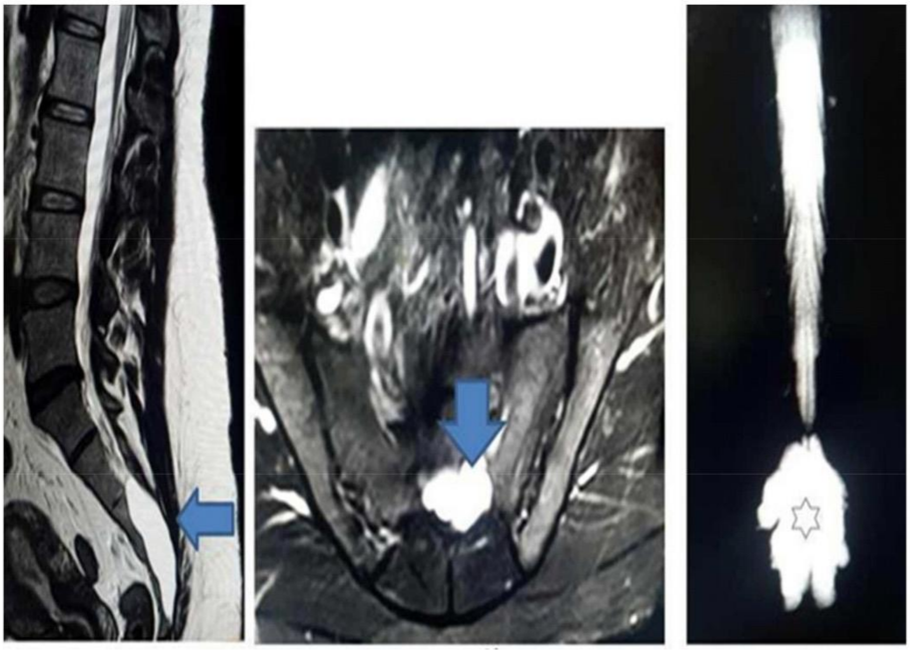


Figure 3.3 case study 3

Case 3- MRI Lumbosacral spine of 36-years old female medical doctor with low backache and sexual dysfunction of increasing severity. (a) T2W Sagittal section shows a big vertically expanded hyperintense lesion against dorsal aspect of sacral vertebrae (horizontal blue arrow). (b) T2W axial section shows the expanded hyperintense lesion at mid sacral level (inverted blue arrow).(c) MR myelography shows multiple perineural cysts as finger like projections from the lower end of the cord (black star).

DISCUSSION

Many studies have been taken in respect to addition of MR myelography along with MR LS spine.

In one the literature a prospective method of analysis has been used in 1025 consecutive patients for study of both conventional MR spine and MR myelography.The classification was taken position when visible structure and morphological alteration were noted the kappa result was poor in this study.

Another research has concluded that a modification of Krudy's technique (fast spin echo with fat suppression) that provided better spatial resolution with a larger matrix and thinner contiguous slices. This has been proven a good research as it proved that with a good image quality of MR myelography a good diagnostic result can be acquiring. (Kang S,2010) [23]

One more study state that using MR Myelography to Improve Inter Observer Agreement in the Evaluation of Lumbar Spinal Canal Stenosis and Root Compression" to evaluation if interobserver agreement using MRI in the evaluation of lumbar spinal canal stenosis and root compression can be improved upon combination with magnetic resonance myelography. (Randolph,2005) (Govila VK,2019) [24,25]

In this research a team of 3 radiologists along with the supervision of the head radiologist and head of the department (HOD) sir has contributed. Among 3, two of the radiologist has reported the case study of both CMR LS Spine and MRM. The first and second radiologist has considered as R1 and R2.

A prospective analysis of 42 consecutive patients of conventional MR LS spine along with additional complimentary MR myelography TES sequence. The contribution of MRM is great in CMR LS spine. 42 patients by correlation with team of 2 radiologists (R1 & R2), (19 positive and 23 negative result) & (15positive and 27negative) respectively.

In this research along with conventional MRI LS spine one additional MR myelography is applied. The MRM with segmented multi shot, single slice TSE sequence is employed and a great result with number of findings has been recorded which are not available with only conventional MR LS spine scanning.

MR myelography allows better Dural sac and root stems visualization in sagittal and coronal single shot TSE MRM sequences respectively.

The MR LS spine is enough for LS spine and disc study but in this study, it has been found that with the addition of MRM, the diagnostic results become better and additional informational are gained which may work full for patient's further treatment.

The addition of MRM enhanced adequate visualization of intra-dural structure and nerve root compression, straitening of lumbar spine, spinal canal stenosis, narrowing of foramina and subarachnoid space, etc.

The MRM along with conventional MR LS spine study increases the diagnostic confidence in evaluation of spinal canal, nerve root, narrowing and stenosis.

The MRM act as complement in the diagnostic information so obtained by conventional MR LS spine and hence state itself as a useful protocol.

CONCLUSION

The MRM has improved the diagnostic accuracy along with MR LS spine study. The role of MRM in terms of better diagnostic interpretation of LS spine MRI is most of the cases of this study shows positive results with enhanced diagnostic accuracy.

Lumbar spinal canal stenosis, nerve root compression, loss of LS spine curvature was scan better with the protocol and combination of MR and MRM. The interpretation of MRM along with conventional MR LS spine increased the level of diagnostic accuracy and better diagnostic options.

The result clearly shows that the role of MR myleography along with conventional MR LS spine in evaluation of symptomatic patient of degenerative spinal disc disease is helpful and can bes used in protocol.

The kappa coherence agreement between the two radiologist (radiologist R1 & radiologist R2), for MRM finding to have MRM finding other than that of CMR LS spine is good agreement with kappa value, 028.

The result of the percentage of the spinal cord termination level variation level at the anatomy of spinal canal in three categories have

- Above the level of T12-L1 IVD level. = (17/42) x 100 = 40.47%
- At or in between the of L1 to L2 vertebrae level. (21/42) x 100 = 50%
- Below the level of L2-L3 IVD level. (4/42) x 100 = 9.52%

The patients having PIVD, Disc Bulge, Straitening of spine, lumbar canal stenosis & Nerve root compression in both CMR LS spine & MRM respectively. The PIVD and diffuse disc bulge is clearly seen in CMR LS spine. But the in degenerative spinal disc disease like Straitening of lumbar spine, lumbar canal stenosis & Nerve root compression shows equivalent or even better diagnosis in MRM compared to CMR LS spine.

The result shows that patients having 30.9% PIVD problem (13/42), 45.2% (19/42) in diffuse disc bulge, straightening of lumbar spine and lumbar canal stenosis. Most of the patient shown problem of nerve root compression in 22patient out of 42 patients i.e. 52.3%.

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