Evaluation of lumbar decompression with pre-operative and post-operative MR myelogram

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Citation

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Abstract

Magnetic resonance Myelography(MRM) is noninvasive technique that provide anatomical information about subarachnoid space. Objective of this study was to evaluate accuracy of MRM for demonstration of lumbar decompression and its correlation with clinical outcome. 53 patients of prolapsed disc were imaged with MRM postoperatively and evaluated with pre operative MRM and clinical leg pain relief. Diagnostic accuracy of these imagining strategies for lumbar decompression was calculated and correlated with clinical outcome. MRM when employed in routine practice is of limited value, assisting in establishing diagnosis in minority cases (6%). However, MRM adds only short time (8 seconds) to the overall examination and imaging study like this, which includes pre-operative and post-operative evaluation, is more evidence based and scientific. Routine imaging post-operative MRM cut is not expensive. Hence, post-operative MRM ,rather than whole MRI is highly recommended for patients of lumbar decompression and having postoperative persistent symptoms specifically leg pains.

INTRODUCTION

Disorders associated with degeneration of the intervertebral disc impose an economic burden similar to that of coronary heart disease and greater than that of other major health problems such as diabetes, Alzheimer's disease and kidney diseases (11, 12).

The various techniques that are utilized for disc surgery will depend on the size and location of the herniated fragment. In general they are A.Protruded,B.Preligamentous C. Sequested (Free Fragment) ,D.Intradural, E.Intraforaminal or F.Extraforaminal (Far Lateral).The failure rate for surgeries for disc diseases is as high as 15-20 %. It is extremely difficult which patient will permanently be relieved from disc disease and in whom can surgery be successful. It is a matter of discussion that whether patient will resume his original job or work or he has to change his lifestyle. This study illustrates the usefulness of commercially available Magnetic Resonance Myelography(MRM) in evaluation of cases of lumber disc surgeries, with Purpose to determine whether it improves the interpretation and diagnostic yield at MRI of the lumbar spine in immediate postoperative period. MRM, heavily T2-weighted fast spin-echo imaging with fat suppression, enhances the signal intensity of CSF with subtraction of the surrounding background signal. Adrian G. Krudy , who first described, 1991, the MRM technique, used multiple projections per examination (8).

MATERIAL AND METHODS

Fifty-three patients with signs and symptoms of prolapsed lumbar intervertebral disc (PIVD) who failed to respond to conservative treatment of minimum 6 weeks duration were studied Retrospectively. Patients with PIVD who were having neurological deficits and intractable pain not relieved by adequate conservative were assessed preoperatively regarding informative history through general and neurological examination and were subjected to magnetic resonance imaging scan (MRI) with MRM image. The results of imaging were correlated with physical findings and symptomatology of the patients. All clinico-radiologically proven cases were subjected to surgery.

Postoperatively all patients underwent MRM and clinical evaluation for leg pain relief on 2^{nd} or 3^{rd} postoperative day of lumbar decompression after removal of drain Patients were divided in four groups A, B, C and D depending on radiating pain relief and effect on myelo image postoperatively compare to preoperative myelo block or indention. Patients who did not have pain relief a second look MRM done at the end of 1^{st} postoperarive week to rule out effect of hematoma. MRM was performed using turbo spin-echo sequence with extremely long effective TE. In each patient, three images (in coronal and in bilateral oblique coronal directions) were obtained with a slice thickness of 5 mm with a 0.5 or 1.5 -T unit (Gyroscan ACS-NT; Philips

Medical Systems, Best, The Netherlands).Pain relief assessment by PAIN SCALE both preoperatively and postoperatively after day 2. To help patients describe their pain, we used the pain scale, visual analog scale, the VAS Scale (4).

The categorical pain scale has four categories: none, mild, moderate, and severe. Patients are asked to select the category that best describes their pain. Same scale used to correlate leg pain relief post operatively with Excellent, Good, Fair and Poor of MACNAB classification (7).Clinicoradiological evaluation of MRM image and pain relief.

A – Pain relief, myelo regression B – Pain relief, no myelo regression

C – No Pain relief, myelo regression D – No Pain relief, no myelo regression

RESULTS

In this study 53 patients were studied prospectively from JUNE 2005 to JUNE 2007. They were examined by senior consultant and also were operated by senior consultants. In present series, most common presentation was backache with sciatica. There was left side predominant than right and bilateral. Least common presentation is only backache. Out of 3 patients having backache only one had complete recovery while other two had fair to poor result. The average duration of preoperative back pain was 14.6 months and that of preoperative leg pain was 7 months. The average duration of conservative management was less than 6 months in 36 patients and rest had more than six months.

The level of involvement was nearly equal 26 of L5 -S1 and 27 of L 4 -L 5. Central or posterocentral position of the prolapsed disc was most common followed by paracentral, posterolateral and lateral in that order. Intraoperatively Nineteen patients had massive disc prolapsed. Average postoperative hospital stay was 5 days.There was inadvertent dural tear in three patients. All three dural rent repair was done under vision. All three patients recovered uneventfully. Two patients had temporary retention of urine after the surgery, which relieved by single catheterization. Three patients complained postoperative headache, relieved by intravenous saline hydration and analgesics. Transient back pain was complained by four patients postoperatively, relieved by analgesics. No other major complications like DVT, pulmonary embolism, nerve root injury, retroperitoneal injury or wound infection occurred in our study.

In this study immediate postoperative leg pain relief was assessed according to VAS scale. The preoperative mean ±SD VAS score was 9.34± 0.84 which improved to 2.19±0.84 postoperatively. A paired student t ¬test showed that the above changes were statistically significant ($p<0.001$), which shows a significant reduction in patient's perception of pain. On evaluation of pain relief and MRM regression , 46 patients (86.79 %) had significant pain relief as well as myelo image block or filling defect regression -- GROUP A., 4 patients (7.55 %) had good pain relief myelo image had no improvement –GROUP B .1 patients (1.89 %) show no significant regression in MR myelo block as well as no clinical radiating pain relief - GROUP D., while even though good myelo relief 2 patients (3.77 %) did not show clinical relief. – GROUP C

Figure 1

Fig A - shows pre-operative MRM with extradural Indentation at L5-S1.This patient underwent Right L5-S1 fenestration and dissectomy. Fig B - shows post-operative MRM on 3 rd postoperative day with regression of indentation. Postoperative VAS Scale was 1, SLR pain free. Evaluation shows excellent pain relief following lumbar decompression and corelating with MR Myelo Image

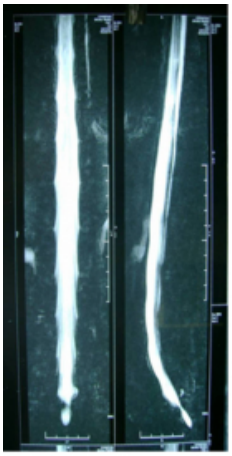


Fig A

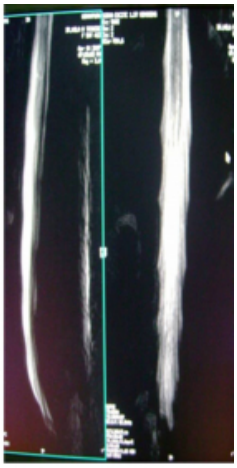


Fig B.

Early postoperative data of 53 patients were analyzed using modified Macnab criteria .19 patients showed excellent, 29 good, 2 fair and 3 poor results. 48 patients (90.57 %) shows complete regression in postoperative MRM . MRM image of Double block (L4-L5, L5-S1 AND D12-L1, L4-L5) do not show any regression, block persists in postoperative MRM. One MRM block at (L2 –L3) persists as it is in preoperative MRM. Two postoperative MRM remains same as preoperative MRM as there where no indentation as well as no block in preoperative image too. Sensitivity 91.99 % and

Accuracy 95.83 %.

DISCUSSION

The various techniques that are uitliseMRI is routinely used in the evaluation and management of patients with back surgery to evaluate adequacy of decompression. Extensive soft-tissue changes present in the immediate postoperative period severely limit the usefulness of MR imaging in that period for evaluating persistent symptoms. This limitation can be overlooked by change in filling or regression in indention or block of MRM. Complications following lumbar spine surgery are reported to occur in 15 to 30% of cases(12).. Imaging of recurrent pain following lumbar surgery, often with a clinical presentation that is poorly specific in nature, is sometimes difficult. Selection of the initial imaging technique must simplify the diagnostic work-up. Because of its high contrast resolution, pre- and post contrast MRI is the most effective imaging technique.

In this respect, gadolinium – enhanced MRI is generally considered superior to all other imaging techniques(10). The reported accuracy of enhanced CT is 71 %, unenhanced MR 79% and post-gadolinium MRI 96-100 %(19). MRI has generally replaced CT myelography as the primary diagnostic tool in lumbar disc herniation. However, it is recognized that although MR provides superior diagnostic information regarding the spinal cord and spinal canal, but the relatively poor contrast observed between bone, disc material and the normal contents of the exit foramina results in suboptimal delineation of lumbar decompression at root and foraminal level. Conversely , the susceptibility artifacts at soft tissue that may be observed with gradient echo imaging are associated with poor accuracy (3).

MRM represents a relatively recent development in MRI and has theoretical advantages in the visualization of the thecal margins, nerve roots and nerve root sheaths (1,8). Several papers have described the usefulness of MR myelography in the investigation of lumbar degenerative diseases (20). The value of MRM in the diagnosis of disc herniation and spinal stenosis had been evaluated by two groups of people in past in 2003. MH Pui , YA Husen evaluated 72 patients with MRM prior to surgery to determine its value in the diagnosis with MRI . They concluded MRM did not significantly improve the diagnostic accuracy of MRI, it allowed a better overall view of the dural sac and root sleeves. M.J.O'Connell,et al studied total of 207 patients for MR examination of the lumbar spine for evaluation of low back pain or spinal radicular symptoms. Similar conclusion by them postulated that MRM when employed in routine practice was of limited value, assisting in establishing a diagnosis in a minority of cases 6 %(15) .Evalution of role of MRM in lumbar spine imaging done by Thorton MJ., et al (20) in 1999 , and in Cervical spine for cervical spondylotic radiculopathy done by D Birchall ., et al (3)in 2003 suggested similar findings that MR Myelography is a useful adjunct to conventional MR axial and sagittal imaging.

As such there is no study until now showing clinical correlation between MRM image and clinical leg pain relief postoperatively in patients of lumbar disc herniation underwent disc surgeries. . The objective of this study was to evaluate the lumbar decompression postoperatively with help of MRM with clinicoradiological correlation with preoperative findings of same.

The diagnostic accuracy of MR myelography is reported to be insufficient to justify its use as an independent diagnostic technique only in 6 %(15). Furthermore, the addition of MR Myelography to conventional MRI does not significantly improve the diagnostic accuracy of MR in the investigation of lumbar degenerative disease (14). The limited diagnostic efficacy of the technique has been attributed to the observation that lumbar disc protrusion may displace only the epidural fat and not the thecal sac (20). However, when used as an adjunct to conventional MRI, MR myelography has been shown to be useful for the further characterization of equivocal findings in a proportion of cases and to increase the diagnostic confidence in these settings. The difference between the sensitivity and accuracy of MRI (89.0 – 95.6%, 89.1-95.7%) and MRM (82.4-89.0%, 82.6-89.1 %) was not significant. There was no significant improvement with the addition of MRM of MRI (91.2-97.8%, 91.3-97.8%)(14).Otherwise, there is little evidence to support the use of MR Myelography in the routine imaging of lumbar degenerative diseases.

In this study, patients of lumbar disc herniations are evaluated with the purpose to correlate MRM image immediate postoperatively and if needed repeat at end of 1st week with clinical subjective finding of leg pain relief. Patients of group A and D (48 out of 53 - 90 %) follows same correlation of clinical finding supported by MR myelo image early postoperatively. GROUP A, most of the patients, can very well support adequate surgical decompression. While persistent of early myelo block with clinical non relief of leg pain –GROUP D - give some red flags about decompression either adequacy or level. Persistence of block in immediate postoperative MRM but

not that much in 1 weak post operative MRM may be due to hematoma which may be the cause of persistence of block and leg pain. Relief of symptoms after 2 months corresponds to MRM block regression at 2 months.

Figure 2

Fig C - shows pre-operative MRM with extradural Indentation at L2-L3 .This patient underwent L2-L3 Laminectomy and Dissectomy . Fig D- shows post-operative MRM on 3 rd postoperative day with persistence of myelo block . Postoperative VAS Scale was 10, SLR painful restricted 10.Repeat evaluation at 1 week shown in Fig. E shows some regression of block and some pain relief. Surgeon was sure about surgical decompression and Patient treated conservatively and had pain relief after 2 months which is also correlating with MR Myelo Image with regression of block

Fig. C

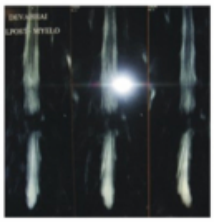


Fig. D

Fig.E

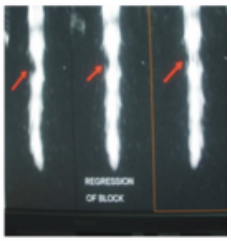


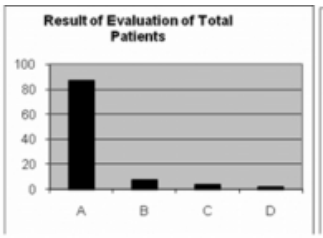
Fig.F

While GROUP C patients give good confidence to surgeons about decompression at operated level though no significant pain relief clinically found initially. This patient give good response to antipsychotic drugs and on regular follow up there is over all good relief of symptoms, which was initially, hides decompression. These patients should be evaluated preoperatively with MMPI (The Minnesota Multiphase Personality Inventory). MMPI is one of the most reliable and well-documented tests used to predict pre injury susceptibility to back injury and the potential for failure of conservative and surgical treatment. Unfortunately, MMPI is lengthy and difficult to administer in an orthopedic clinical setting and probably is best given by a psychiatrist or psychologist. GROUP B patients include whose postoperative MRM image remains same as preoperative. These includes two types of patients, patients with double level block where lower symptomatic block was adequately decompressed at operated level shows persistence of block in spite of good pain relief, Rest of patients where preoperative MRM image also do not shows block or indentation. So, Double level PIVD patients postoperative evaluation need good clinical correlation as their MRM image are not conclusive postoperatively about decompression.

So, Most of the patients (included group A and D -- 47 out of 53 -- 88.67 %) had good immediate correlation in findings of radiation pain relief and regression of indentation or myelo block while comparing preoperative MRM image with that of postoperative. So sensitivity of MRM is 88.67 % and accuracy of MRM is 95.83 % which is correlating with 82.4 % and 89.1 % respectively of MH Pau and YA Husen findings (14).

Figure 3

Table a



A – Pain relief, MRM regression.
B – Pain relief, no MRM regression.
C – No Pain relief, MRM regression.
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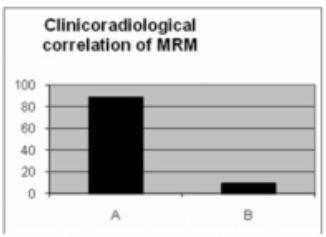

A – No. of Patient correlating with MRM.
B – No. of Patient not correlating with MRM

The results of our study reflect that in the early postoperative period after lumbar disc surgery MRM is a non-invasive and clinically superior diagnostic test to have clinico radiological correlation than MRI T1 OR T2 images where it limit the accuracy of the interpretation. MRM when viewed in isolation had an insufficient diagnostic accuracy to justify its use as an independent imaging technique for the evaluation of lumbar disc herniation. The challenge for the future is to be able to better correlate what is seen on imaging studies with the patient's symptoms. Obtaining these expensive studies too early in the treatment of self-limiting disorders is costly and often misleading for both the physician and the patient. This is an approach to justify judicious timing of imaging studies and discuss pitfalls in their interpretation in the evaluation of lumbar disc prolapsed following decompression.

In conclusion, MRM when employed in routine practice is of limited value, assisting in establishing a diagnosis in a minority of cases (6%) (16). However, MRM is a robust sequence and adds only a short time (8 seconds) to the

overall examination, and it is arguable that routine use should be made in the imaging of patients when available for evaluation of lumbar decompression where economy is a factor. Furthermore, imaging study like this, which includes pre-operative and post-operative evaluation, is more evidence based and scientific. Routine imaging post-operative MRM cut is not expensive. Hence, the post-operative MR Myelography is highly recommended for patients of lumbar decompression and having postoperative persistent symptoms specifically leg pains.

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