NEED FOR PRECISE PROTOCOL IN MAGNETIC RESONANCE IMAGING OF THE POST OPERATIVE SPINE

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ABSTRACT

Gadolinium enhanced Magnetic Resonance Imaging (MRI) for the evaluation of the post operative lumbo-sacral spine is a sensitive and specific imaging technique. A need for establishing a specific protocol for Failed Back Surgery Syndrome (FBSS) for use in the service hospitals is highlighted for convenience of patient management and preservation of active manpower. The MR scan of 50 patients performed over a span of six months, who complained of persistent low backache even after surgery, were retrospectively analysed. The specificity of this series using MRI in indicating the exact cause of FBSS was clocked at only 30%. The conditions diagnosed were rectifiable. The balance of the patients who could not be offered any specific diagnosis towards the cause, were being managed conservatively / placed in low medical category for a considerable period. It was noted with concern that there was non prevalence of sequence like the fast spin echo with gadolinium enhancement as a routine.

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KEY WORDS : Gadolinium; Magnetic Resonance Imaging; Post-operative spine.

Introduction

MRI has become the modality of choice for evaluating most spinal syndromes since it is innovative and uniquely sensitive to variety of diseases. Mass effect, location in relationship to inter-vertebral disc and relative MR signal intensities are all variables that can aid in differentiation of scar tissue from disc material [1,2,3]. Gadolinium enhanced MR is at present one of the most sensitive and specific imaging modalities available to the neuro-radiology imager for the evaluation of the post operative lumbo sacral spine in the patient presenting with FBSS. On MR scans epidural scar enhances immediately following contrast enhancement. Enhancement degree varies with post operative interval. Epidural fibrosis enhances most strongly on imaging studies that are obtained less than one year following surgery [4,5].

FBSS is a severe, long-lasting, disabling and relatively frequent (5-10%) complication of lumbo-sacral spine surgery. Wrong level surgery, inadequate surgical techniques, vertebral instability, recurrent disc herniation, and lumbo-sacral fibrosis are the most frequent causes of FBSS. Though the clinical results after repeated surgery on recurrent disc herniations are comparable to those after the first intervention, repeated surgery for fibrosis gives only 30-35% success rate and 15-20% of the patients report worsening of

symptoms [6]. Inter-vertebral disc space undergoes little change in MR signal intensity after uncomplicated discectomy. Following contrast administration, enhancement of posterior annulus is seen in over 80% of asymptomatic discectomy patients, whereas enhancement within the central disc space normally occurs in less than 20% of cases [7].

Material and Methods

The post operative MR scans of 50 patients who had complaints of persistent low backache, undertaken between Aug 97 & February 98, were analysed by a panel of two Radiologists and a Neuro-Surgeon. The MRI units locally available were 0.5 T & 1 Tesla. However, none of the studies had included fast spin echo with gadolinium sequences. The involved patients were males of different ethnicity, adult age group and represented cross section of various community.

Results

Pre operative CT scan / CT myelographic studies in all the 50 patients, who had complaints of low backache with sciatica for considerable period (4 months to 2 years) were analysed. The predominant symptoms were loss in the sensory motor (SM) pathways in 14%, urinary bladder symptoms in 14% and muscle weakness in the corresponding affected group in 10% (Table-1). One particular CT scan had shown evidence of complete block at LV 3-4 in a patient presenting with complete paraparesis and urinary retention.

In 30% of these patients of FBSS, the underlying pathology was demonstrated on MR imaging convincingly (Table-3) for taking up the patients for corrective surgery. The largest single cause of this ailment remained to be prolapsed inter-vertebral disc between lumbar vertebrae 4&5 (64%) followed by PIVD LV5-SV1

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TABLE 1

Pre-operative clinical presentation

Symptoms	n	(%)
Only LBA + Sciatica	30	60
Assoc SM loss	7	14
UB symptoms	7	14
Paraparesis	1	2
Muscle weakness	5	10
Total no of patients considered	50	100

SM : Sensory motor

TABLE 2

Pre-operative radiological diagnosis

CT scan + CT myelo	n	(%)
PIVD LV2-3	1	2
PIVD LV3-4	4	8
PIVD LV4-5	32	64
PIVD LV5-SV1	13	26
Associated lumbar canal stenosis	3	6
Total pre-op CT scans analysed	50	100

PIVD : Prolapse inter-vertebral disc

TABLE 3

Post operative MRI in FBSS (Conventional spin echo) 50 patients

Radiological diagnosis offered	n	%
Residual / recurrent disc herniation	12	24
Spinal canal stenosis	3	6
No specific cause for FBSS	35	70

(26%) (Table-2). Bilateral foot drop with urinary retention was evident in only one patient in this series. The patient had undergone emergency laminectomy and discectomy at LV3 for relieving the symptoms. Re-exploration after four months had revealed considerable residual fibrosis which was reasonably well excised. The patient who had to suffer the agony of foot drop and intermittent urinary self catheterisation during this period, could finally enjoy the success of corrective surgery.

Discussion

The most common causes of FBSS are recurrent / persistent herniation of nucleus pulposus at the operated site or other sites of epidural scar fibrosis, facet arthrosis / spinal stenosis, neuritis, referred pain from non-spinous sites. Some rather uncommon causes could be discitis, osteomyelitis, epidural abscess, arachnoiditis or epidural haematomas [8].

In only 30% of patients of FBSS, the available MR imaging unit could demonstrate the cause convincingly (Fig-1). Other common causes of FBSS like infections, arachnoiditis, radiculitis, pseudo-meningocele etc. could not be demonstrated successfully in this series of images studied in the absence of gadolinium

enhanced fast spin echo sequences.

The three major indications for gadolinium in the evaluation of the post operative lumbo-sacral spine [9] are in the elucidation (Fig 2a ,b & c) and differentiation of:

(a) residual or recurrent disc herniation with or without associated scar formation

(b) isolated epidural fibrosis and

(c) spinal leptomeningeal, and / or neural inflammation (infectious or aseptic) and /or neural degeneration.

It should be noted that imaging after 20 to 30 minutes of contrast agent administration is not helpful because many herniations enhance centrally within the delayed time frame. The basis of this imaging strategy is that the vessels in the scar tissue are relatively homogeneously distributed, while in disc herniation the vessels are quite heterogenous or centrally absent. The initiation of MR imaging with approximately two minutes of the gadolinium injection is important because some disc herniations can be somewhat vascularised and therefore may enhance relatively early [9].

T2 weighted fast spin echo images are superior to conventional spin echo images in the lumbo-sacral spine because of improved image quality resulting from better spatial resolution and reduced motion artefact. Sagittal and axial fast spin echo T2 weighted images are helpful in assessing neural foramen narrowing, central and lateral recess, spinal stenosis, hydration status of the inter-vertebral disc, abnormal signal intensity of the disc and cancellous bone, and signal intensity of abnormal intra or peri-spinal soft tis-

Fig. 1 : Sagittal T2 gradient image demonstrating the post operative scar fibrosis. The discs have kept bright signal intensity.

Fig. 2 : Post resection status for disc hernia at LV4-5
(a) T1 sagittal image shows collapsed inter space at LV4-5 and a persistent disc hernia at LV3-4. (b) Post gadolinium injection sagittal (c) axial images, demonstrates definite enhancement of the mass located on posterior aspect of LV3-4 along with the disc space at LV4-5

sue masses (e.g. disc herniation, epidural scar/abscesses/phlegmon) [10,11]. Sagittal and axial T1 weighted spin echo images obtained before and immediately after the bolus of intravenous injection of gadolinium are almost imperative in the evaluation of the post operative lumbar spine [12-15]. Fat-suppression techniques improve relative intensity and homogeneity of contrast enhancement of epidural fibrosis thereby distinguishing it from recurrent disc herniation [2].

Homogenous enhancement after intravenous gadolinium administration, caused by granulation tissue and / or fibrosis, explains the mild regional epidural mass effect seen commonly in post operative imaging of successful lumbar discectomy patients [9]. Studies have shown that between 6 to 18 months after lumbosacral surgery, vertebral endplates produce enhancement in at least 19% patients and enhancement of posterior annulus has also been reported in the majority of asymptomatic post operative patients [3].

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