



## Neurosurgery

**TO STUDY THE OUTCOME OF SELECTIVE LUMBOSACRAL NERVE ROOT BLOCK IN LUMBOSACRAL PIVD AND CANAL STENOSIS IN A TERTIARY CARE NEUROSURGICAL UNIT: A RETROSPECTIVE ANALYSIS.**

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**ABSTRACT** **OBJECTIVE:** To assess the outcome of selective nerve root block (SNRB) in conservatively treated patients of radicular lower limb pain.

**METHODS:** Retrospective data of 27 sciatica patients treated with SNRB (Jan 2017 -Jan 2018) was assessed for pain on visual analog scale (VAS) from 0-10 before block procedure, 30 minutes after block, 2 weeks, 1 month, 3 months and at 6 months of follow up.

**RESULTS:** Mean age was 50.7(± 13.2). Mean duration of symptoms was 60.7 days (2-180 days). There were 14 (51.8%) cases of lumbosacral prolapsed intervertebral disc (PIVD), 5 (18.5%) lumbar canal stenosis, 2 (7.4%) cases each of foraminal disc, recurrent PIVD and operated PIVD with facet hypertrophy. 2 (7.4%) patients had normal MRI. Mean VAS before and after SNRB was 9.1(± 0.57) and 0.63(± 1.54) respectively with significant association (p=0.001). None of the patients had radicular pain at 3 and 6 month follow-up visit.

**CONCLUSION:** SNRB is effective in conservative treatment of sciatica

**KEYWORDS :** selective lumbosacral nerve root block (SNRB), sciatica, prolapsed intervertebral disc (PIVD), lumbar canal stenosis, foraminal/lateral disc, block

### Introduction:

Majoring of cases of sciatica have benign and self limiting course as the inflammatory effect of nucleus pulposus diminishes within 2 months and is temporary.<sup>[26]</sup> Mechanical compression and chemical irritation of nerve root both the factors are responsible for symptoms in sciatica.<sup>[20, 24, 31]</sup> Transformational application of local anesthetic and corticosteroid under fluoroscopic guidance on compressed and inflamed root is an effective non-operative treatment option.<sup>[2]</sup>

Macnab in 1971 described selective nerve root block (SNRB) as a diagnostic procedure in radicular pain with negative radiological findings, used it as therapeutic option in patients who had opted non operative treatment.<sup>[19]</sup> SNRB has a diagnostic sensitivity of 100% in disc protrusions with a positive predictive value of 75 – 90% in foraminal stenosis.<sup>[17,34,37]</sup>

Aim of our study was to assess the outcome of SNRB in conservatively treated patients of paracentral / foraminal / extraforaminal disc protrusions and lumbar canal stenosis with radicular lower limb pain.

### PATIENTS AND METHODS

All the patients of lumbosacral prolapsed intervertebral disc (PIVD), canal stenosis, recurrent PIVD with definite root compression on MRI, who were not relieved after 6 weeks of conservative treatment were advised surgery in our Neurosurgical centre. Patients who had refused surgery with distressing radicular symptoms were only offered selective nerve root block. Retrospective data was analysed from January 2017 to January 2018 with following inclusion and exclusion criteria.

### INCLUSION CRITERIA:

1. Persistent radicular pain 6 week after conservative treatment in lumbosacral PIVD and lumbar canal stenosis with severe radicular lower limb pain, not willing for surgery
2. Foraminal and extraforaminal disc with distressing lower limb pain
3. Previously operated PIVD with recurrent disc or radicular pain due to facet hypertrophy
4. Multilevel disc in imaging study, symptoms not consistent with radiological finding

5. Classical radicular lower limb pain with normal MRI finding

### EXCLUSION CRITERIA:

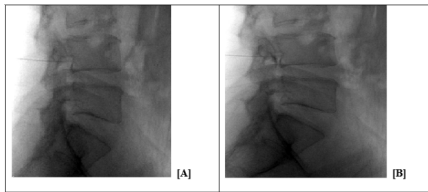
1. PIVD with motor deficit or cauda equina syndrome
2. Central canal stenosis and PIVD patients who required surgery after block

35 patients were treated with SNRB during this period, 8 required surgery, hence excluded and a total of 27 patients were taken in the study. Data was analyzed for pain intensity with visual analogue scale (VAS) (from 0-10) before block and 30 minutes after block. Follow up data was noted at 2 weeks, 1 month, 3 and 6 months after block for any radicular pain in VAS scores.

### Technique

Nerve root block was performed as a minor procedure with image intensifier without premedication in prone position and under sterile conditions. Informed consent was taken, Xylocaine sensitivity test was done before the procedure. We performed the procedure as described by Bogduk N [1] by targeting safe triangle i.e. above the exiting nerve root and below the corresponding pedicle. Similar technique was also used by Narozny and co-authors.[21] After preparation, skin was anaesthetized with 2% Xylocaine at the marked entry point. A 22G spinal needle (12cm length) was inserted in craniocaudal direction, needle was advanced slightly after the bony contact was encountered, loss of resistance was felt immediately once foramina was entered, position of needle tip was verified on image intensifier with contrast (0.5ml) in AP as well as lateral view. Non-ionic water soluble contrast containing 370 mg/ml of iodine was used, 0.5 ml was taken after 1:10 dilution. 0.5ml of 0.25% Bupivacaine and 1ml of Methylprednisolone (40mg) was injected. For S1 root block, image intensifier was positioned perpendicular to S1 foramen, spinal needle was inserted perpendicular to the surface of sacrum. Needle position was checked with contrast in both the planes then drug was injected. For foraminal disc block was given one level above the affected disc (in the distribution of radicular pain). Patients were kept under observation for 30 minutes to check for any complications and VAS was recorded for lower limb pain. Complications such as aggravation of back pain, paraesthesia in lower limb was noted. All the patients were given one day of oral antibiotic to avoid risk of infection. Clinical follow up was done at 2 weeks, 1 month, 3 and 6 months.

**Figure 1: Position of 22G needle in safe triangle:[A] without contrast, [B] with contrast in L4 root block**



**RESULTS**

Retrospective data of 27 patients was analyzed by unpaired student 't' test and ANOVA using SPSS software version 22. Mean age was 50.74 (±13.20) years, with 13 male and 14 female patients. Mean duration of symptoms were 60.7 days with a range of 2 – 180days.[Table 1] Patients of foraminal stenosis had severe incapacitating lower limb pain of very short duration also surgery for foraminal and extraforaminal disc is extensive hence they were offered SNRB very early (2-3 days of pain), explaining surgery would be needed in case of recurrent pain. There were 2 patients of foraminal stenosis and both of them had complete pain relief even upto 6 months and did not require surgery.

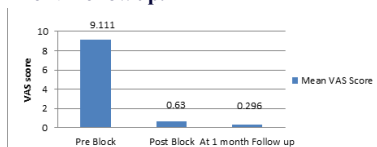
**Table 1 Demographic characteristics of SNRB patients**

Features	Number of Patients
Age (years)	
Mean ± SD (Range)	50.7 ± 13.2 (22 - 79)
Gender Male	13
Female	14
Duration of symptoms in days	
N (Range)	60.7 (2 – 180) days

There were 14(51.8%) cases of Lumbosacral PIVD, 5(18.5%) central canal stenosis, 2(7.4%) cases of foraminal disc. 2(7.4%) had recurrent PIVD at the same level of previous surgery, one presented 6 months and the other 10 months after the first surgery. Two (7.4%) patients were previously operated for PIVD developed facet joint hypertrophy with severe lower limb pain.[Table 2] In 2(7.4%) patient MRI did not show any root compression, only mild disc bulge but they had classical lower limb unilateral radicular pain hence, block was given, out of them one patient had immediate pain relief and did not recur after 6 months of block, the other was a female patient with multiple somatic complaints, was not able to walk due to severe lower limb pain, block was given and there was immediate pain relief but, on 15th day of follow up she had some pain (VAS of 2). 5 patients had mild back pain on the day of block, improved in 2-3 days.

There were a total of 7 (25.9%) patients with unequivocal MRI findings with no clinico- radiological correlation of level including 2 patients with normal MRI. Maximum number of SNRB were given at L5 (9 right + 7 left side) then at S1 level (5 right + 1 left). [table 2] Mean pain score (VAS) before SNRB was 9.1 ± 0.57, it reduced to 0.63 ± 1.54 thirty minutes after block and there was highly significant association between pre-block VAS with post block VAS and 1 month follow-up VAS scores (p=0.001) [Figure 2). None of the patients of SNRB had lower limb pain at 3 and 6 months of clinical follow-up.

**Figure 2: Comparison of Mean Pain on VAS scale at Pre Block, Post Block & at 1 month follow up.**



**Table 2. Distribution of SNRB patients according to pathology and level of block**

Diagnosis	Number of patients N (%)
Lumbosacral disc herniation	14 (51.8%)
Lumbar canal stenosis	05 (18.5%)
Foraminal and extraforaminal disc	02 (7.4%)
Recurrent PIVD	02 (7.4%)
Post-op cases of PIVD with facet joint arthropathy	02 (7.4%)
Normal MRI findings (no root compression)	02 (7.4%)

Level of root block	N (%)
Right L3	01 (3.7%)
Right L4	01 (3.7%)
Right L5	09 (33.7%)
Right S1	05 (18.5%)
Left L4	03 (11.1%)
Left L5	07 (25.9%)
Left S1	01 (3.7%)

**DISCUSSION**

Nerve root irritation is cumulative effect of direct chemical response (leakage of substances such as phospholipase A2 from intervertebral disc), mechanical compression and indirect effects like vascular compression and other pathogenic factors.<sup>[20, 24, 31, 32]</sup> The nucleus pulposus generates inflammatory reaction by leukotaxis and increased vascular permeability.<sup>[23]</sup> Studies have documented that inflammatory effect of nucleus pulposus is temporary, it is maximum after 7 days and diminishes within 2 months which explains benign and self limiting course of sciatica in majority of cases.<sup>[26]</sup> Also, natural history of disc prolapse shows that most of them gradually reabsorb on their own.<sup>[3]</sup> Henrik Webner in 1982 in their prospective study has shown that non-operative (medication and physiotherapy) and operative treatment of disc herniations are equally effective upto 4 to 10 years of follow-up but had a drawback of slow recovery and patients were disabled for prolonged period of time in non-operative group.<sup>[38]</sup> Pathophysiology hypothesized for neurogenic claudication is impairment of vascular and/or CSF flow.<sup>[28]</sup> Venous pooling leads to decrease blood flow intum causes metabolic buildup and nutrient deficient state causing nerve dysfunction hence neurogenic claudication. Ambulation increases venous return to the pelvic veins causing engorgement of Batson plexus and increased arterial perfusion and erect posture increase epidural pressure.<sup>[28]</sup>

Local corticosteroid application relieve reversible inflammatory changes and vascular changes caused by mechanical obstruction.<sup>[6]</sup> Lee HM and co-authors in their experimental study have shown that epidural steroid injection inhibits phospholipase A2 activity.<sup>[18]</sup> Olmarker K and co-authors<sup>[25]</sup> in their experimental study on pigs have shown that nucleus pulposus induced effects on nerve function can be reduced significantly with high dose of Methylprednisolone within 24-48 hours after epidural application of autologous nucleus pulposus. Methylprednisolone also has local anesthetic effect.<sup>[15]</sup> Local anesthetics suppress neuronal transmission, inhibit propagation of action potential across the membrane, also alter the function of sodium channels in the membrane resulting in higher threshold for depolarization and decrease in amplitude of action potential and rate of rise and hence, the conduction velocity is diminished.<sup>[29]</sup> Therapeutic selective nerve root block to deliver corticosteroid is less invasive intervention, serve as an effective adjuvant to non-operative treatment.<sup>[21, 30]</sup> Other Suggested mechanisms for anti-inflammatory properties of local anesthetic agents are inhibition of phagocytosis, decrease in phagocyte oxygen consumption, reduction in polymorphonucleocyte lysosomal enzyme release, decrease in superoxide anion production and reversible inhibition of granulocyte adherence.<sup>[6, 10, 11]</sup> Local anesthetic restore the blood flow, this might explain their effect in foraminal stenosis and herniated nucleus pulposus.<sup>[36]</sup> Yabuki and co-authors in their animal model showed that local anesthetic impeded normal radicular blood flow while simultaneously increases intra-radicular flow.<sup>[40]</sup>

Riew KD et al<sup>[30]</sup> suggested that non operative treatment of sciatica with therapeutic selective nerve root block to deliver local corticosteroids has good outcome, also, Narozny and Co-authors<sup>[21]</sup> reported SNRB as an effective and less invasive non operative management. Studies have reported good efficacy of transforaminal injections for diagnostic and therapeutic purposes.<sup>[17,34]</sup> Weiner & Fraser have evaluated result of nerve root blocks in 30 patients of foraminal and extraforaminal disc herniation, showed immediate pain relief in 27 patients in which 3 required surgery due to recurrent leg pain, 2 were lost to follow up. In his study 22 out of 28 (79%) patients had substantial and permanent pain reduction during 1 – 10 year follow up.<sup>[39]</sup> Our study had 2 cases of foraminal stenosis, both had complete relief of pain even at sixth month follow up. Derby et al<sup>[7]</sup> have mentioned that for trans-foraminal epidural steroid injections needle is positioned without provoking pain hence procedure related pain is very less as needle is targeted in the safe triangle needle tip lies above and lateral to the nerve and drugs can be administered in anterior epidural space and needle penetrates the lateral half of foramen at its superior margin and hence, there is minimal risk of dural puncture.<sup>[16,35]</sup>

Pfirrmann et al also suggested that the lateral part of the safe triangle is the best target point for SNRB as it causes minimal treatment induced pain.<sup>[27]</sup> In our study none of the patients had procedure related pain or dural puncture as we have also used safe triangle as the target point.

Use of steroid in conservative treatment with short and mid-term effectiveness is generally accepted.<sup>[8]</sup> 2 week follow-up has been chosen by Jamison RN in their study which they have related to the duration of therapeutic effect of corticosteroids.<sup>[14]</sup> We had also taken 15 days as first follow-up after SNRB. Most studies on epidural steroid injection show markedly declining effect after 3months.<sup>[15]</sup> However, some studies have evidenced potential long term effect of corticosteroids.<sup>[4]</sup>

Studies have documented that spinal injection are safe and accurate when performed with image guidance.<sup>[9]</sup> In a prospective study of 139 diagnostic SNRB procedures, no major complications were reported.<sup>[13]</sup> North RB et al in their study mentioned SNRB as non-specific in diagnosing radiculopathy, but, volume of local anesthetic injected at nerve root level was 3ml - a relatively large amount and is expected to spread in adjacent tissue thereby reducing specificity.<sup>[22]</sup>

Studies have reported complications from SNRB include infection, bleeding, allergic reaction, nerve root injury, spinal cord injury, seizure, stroke. A case report of 3 patient sustaining paraplegia or paraparesis have been documented, undetected needle penetration and injection of depot steroid into spinal artery or artery of adamkiewicz resulting in spinal cord infarction was the proposed mechanism.<sup>[12]</sup> Some studies have suggested proper needle placement within neuroforamen can prevent spinal cord / intramedullary infection.<sup>[33]</sup> In a series of 888 fluoroscopically guided spinal injection procedures (including EBI, SNRB, facet joint and lumbar symptomatic blocks), there were 8 reversible complications, 3 subarachnoid needle placement, 2 allergic reaction to local anesthetic, 1 vasovagal response with severe bradycardia and one case of pain exacerbation, but the study had included multiple types of spinal injections.<sup>[35]</sup>

No major complication was noted in our study which may also be related to the use of very low volume of contrast agent (0.5ml), local anesthetic (0.5ml), corticosteroid (1ml), safe triangle as target point under fluoroscopic guidance and also use of oral antibiotics.

### Limitations

This is a retrospective study of only one year duration with very limited number of cases, hence, sensitivity and specificity of the procedure could not be calculated. Number of lateral disc in our study was only two, we suggest well designed prospective study with larger number of patients.

### CONCLUSION

Selective nerve root block is an effective procedure for radicular lower limb pain caused due to lumbosacral PIVD (paracentral / foraminal / extraforaminal), central canal stenosis and recurrent PIVD. Procedure related complications are minimal. For foraminal and extraforaminal lumbosacral PIVD this may be considered for immediate pain relief.

### ACKNOWLEDGEMENT:

The authors would like the opportunity to thank Mr. O C Varghese, Mrs Sunitha Sharma, Mr Anil Sen for their contribution in official work for this manuscript.

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