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Original Article

Role of redundant nerve roots in clinical manifestations of lumbar spine stenosis

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ABSTRACT

Background: Redundant nerve roots (RNRs) are defined as elongated, thickened, and tortious appearing roots of the cauda equina secondary to lumbar spinal canal stenosis (LSCS). The study compared the clinical and radiological features of patients with LSCS with versus without RNR.

Methods: This retrospective study was performed on 55 patients who underwent decompressive surgery for degenerative LSCS. Patients were divided into two groups based on the presence of RNR in their preoperative magnetic resonance imaging, as evaluated by a radiologist blinded to the study design. Medical records were reviewed for basic demographic, clinical MR presentation, and outcomes utilizing Japanese Orthopaedic Association (JOA) scores.

Results: The mean age of enrolled patients was 57.1, with mean follow-up of 4.0 months. RNR was found in 22 (40%) of patients with LSCS. These patients were older than those patients without RNR (62.2 vs. 53.7). Interestingly, there were no statistically significant differences in clinical presentations, duration of symptoms, and outcomes using JOA scores between the two groups.

Conclusion: RNR is a relatively common radiological finding (i.e., 40%) in patients with LSCS. It is more likely to be observed in older patients. However, no significant differences were noted in clinical presentation and functional outcomes with respect to the presence or absence of RNR.

Keywords: Degenerative spine disease, Elongated nerve roots, Lumbar spine stenosis, Redundant nerve root

INTRODUCTION

Redundant nerve root (RNR) of the cauda equina is a radiological observation characterized by elongated, enlarged, tortuous nerve roots in patients with lumbar spinal canal stenosis (LSCS).[2] Myelography remains the gold standard for diagnosing RNR.[3,6-9]

Although the management of LSCS remains the same for patients with/without RNR, some consider RNR a poor prognostic factor.[6,10,11] Here, we reviewed data regarding the impact of RNR on clinical presentation, prognosis, and long-term outcomes in LSCS patients.

MATERIALS AND METHODS

Patient selection

A total of 55 patients were over the age of 18 and averaged 57.1 ± 12.1 years of age. Thirty-two (58.2%) females and 23 (41.8%) males were enrolled in the study. This was a retrospective cohort study in neurosurgery. Patients had MR documented LSCS, and all had undergone surgical decompressive procedures (2015). Patients were diagnosed with/without RNR based on preoperative sagittal magnetic resonance imaging (MRI) studies as shown in Figure 1, reviewed by a radiologist blinded to the study design.

Patients in both groups exhibited similar preoperative modified total Japanese Orthopaedic Association (JOA) score (7.4 ± 2.3 vs. 7.3 ± 2.9; $P > 0.05$) [Figures 2 and 3].

Medical record review included an assessment of patients' clinical, radiographic, and outcome data; low back pain (i.e., all had low back pain), neurogenic claudication/neurological deficits (i.e., motor, sensory, and sphincteric-urinary incontinence), and outcome analysis (i.e., based on JOA score) [Tables 1-3].

All individual preoperative JOA scores, except straight leg raise (SLR) test and urinary bladder function, were observed to be higher in the non-RNR group with none being statistically significant. Unforeseen, mean SLR test and bladder function scores were higher in the RNR group, 1.5 ± 0.7 and 5.4 ± 1.6, respectively, compared to non-RNR group, 1.2 ± 0.6 and 4.9 ± 1.8, respectively, but the differences were not significant ($P > 0.05$).

The follow-up ranged from 0 to 23.1 months (average 4.0 ± 4.5 months).

Statistical analysis

Continuous data were presented as mean, standard deviation for normally distributed variables or shown as frequency/percentages. Linear regression was used to assess difference in means between continuous data, and Pearson Chi-square test was used to assess difference between categorical data. Logistic regression was used to assess differences between categorical and continuous variables.

Table 1: Patient characteristics in RNR and non-RNR groups.

Patient characteristics	RNR group (*n*=22)	Non-RNR group (*n*=33)	*P*-value
Age (mean years)	62.2±8.9	53.7±12.9	0.015*
Gender (female: male)	11:11	21:12	0.315
Diabetes mellitus	12	11	0.118
Hypertension	14	13	0.078
Stay at hospital (mean days)	6.23±5.61	5.45±3.91	0.547
Duration of symptoms (mean years)	3.37±3.76	5.63±6.84	0.176

*The difference is statistically significant, RNR: Redundant nerve root

Figure 1: Sagittal magnetic resonance imaging of an enrolled patient with lumbar spinal canal stenosis. A serpentine redundant nerve root can be observed extending from L2 to S1.

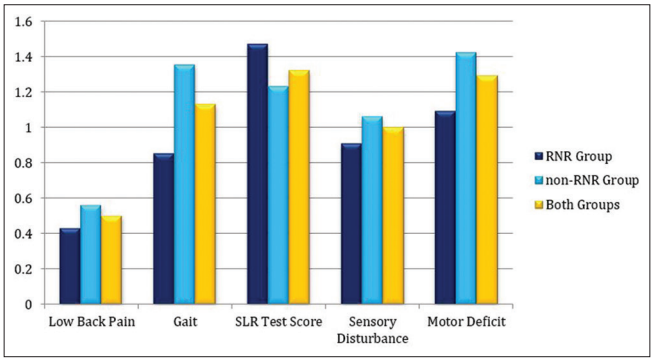

Figure 2: Comparison of preoperative Japanese Orthopaedic Association scores for each group.

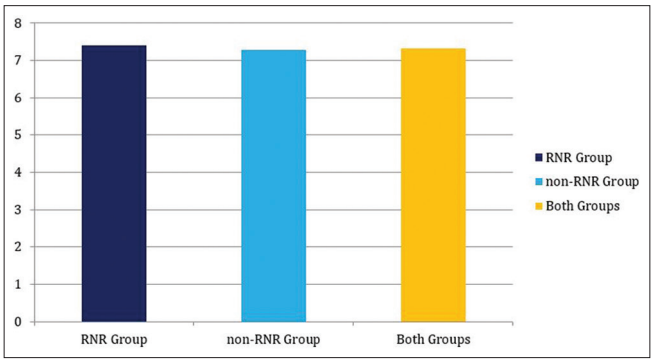

Figure 3: Comparison of modified total Japanese Orthopaedic Association[a] for each group. [a]Only applicable for this study. The score was designed with respect to the available data from the retrospective review of patient records.

Table 2: Clinical features of RNR and non-RNR groups at admission, discharge, and last follow-up.

Clinical features	RNR group		Non-RNR group		*P*-value
	n	*n* (%)	*n*	*n* (%)	
Preoperative					
Low back pain	22	22 (100.0)	33	33 (100.0)	–
Neurogenic claudication	22	21 95.5)	33	29 (87.9)	0.338
Sensory disturbance	22	17 (77.3)	33	20 (60.6)	0.197
Motor deficit	22	14 (63.6)	33	13 (39.4)	0.078
Urinary incontinence	22	2 (9.1)	33	8 (24.2)	0.154
Abnormal SLR status	15	5 (33.3)	24	14 (58.3)	0.300
Immediate postoperative					
Neurogenic claudication	21	0 (0)	33	0 (0)	-
Sensory disturbance	21	1 (4.8)	33	2 (6.1)	0.456
Motor deficit	21	2 (9.5)	33	3 (9.1)	0.465
Urinary incontinence	21	0 (0)	33	2 (6.1)	0.242
Last follow-up					
Low back pain	19	6 (31.6)	29	11 (37.9)	0.892
Neurogenic claudication	16	2 (12.5)	22	7 (32.8)	0.338
Sensory disturbance	18	2 (11.1)	28	11 (39.3)	0.114
Motor deficit	19	4 (21.1)	29	5 (17.2)	0.934
Urinary incontinence	19	1 (5.3)	31	4 (12.9)	0.435

RNR: Redundant nerve root, SLR: Straight leg raise

Data were analyzed on Stata version 12 (StataCorp LLC, College Station, TX, USA).

RESULTS

Preoperative MR documentation of RNR

RNR was present on preoperative lumbar MRI studies in 22 (40.0%) patients (RNR group) and absent in the remaining 33 (60.0%) patients (non-RNR group).

Clinical features of RNR patients

Patients with RNR were older, averaging 62.2 ± 8.9 years of age versus non-RNR group patients averaging 53.7 ± 12.9 years old ($P = 0.015$).

The differences in symptoms present at discharge and at last follow-up were not statistically significant for either group ($P > 0.05$) (i.e., sensory disturbances and urinary incontinence at discharge were less common in the RNR group, but they exhibited more motor deficits all of which did not achieve "significance") [Tables 2 and 3].

Table 3: Preoperative JOA scores of RNR and non-RNR groups.

Preoperative JOA scores	RNR group		Non-RNR group		*P*-value
	n	mean±S.D.	*n*	mean±S.D.	
Low back pain	14	0.43±0.51	18	0.56±0.51	0.477
Gait	13	0.85±0.90	17	1.35±1.17	0.202
SLR test score	15	1.47±0.74	22	1.23±0.61	0.284
Sensory disturbance	22	0.91±0.92	32	1.06±0.84	0.521
Motor deficit	22	1.09±0.87	33	1.42±0.71	0.125
Urinary bladder function	20	5.40±1.57	31	4.94±1.82	0.352
Modified total JOA[a]	20	7.40±2.28	30	7.27±2.90	0.860

[a]Only applicable for this study. The score was designed with respect to the available data from the retrospective review of patient records, JOA: Japanese Orthopaedic Association, SLR: Straight leg raise

Intraoperative dural tears occurred in five patients with and five patients without RNR, but this difference was not significant ($P > 0.05$).

DISCUSSION

This study assessed the clinical presentation and functional outcomes of patients with LSCS with/without RNR. We found that RNR was present in 40.0% (22 of 55) of cases, consistent with the prior literature (range 33.8–42.3%).[1,4,5,11,14]

Although some have argued that RNR is a poor prognostic factor; we found no significant differences in outcomes in this study in patients with/without RNR.[1,5,6,10-13] The only significant difference observed was the older average age at presentation for patients with RNR, a finding corroborated by Min *et al*.[5]

Although greater motor deficits and urinary dysfunction were found in patients with RNR at the time of preoperative assessment and discharge, along with a higher incidence of intraoperative dural tears, these findings were not statistically significant.

CONCLUSION

The present study demonstrated that 40% of MR studies document RNR in patients with LSCS on preoperative MR studies. Nevertheless, this finding does not appear to have any significant impact on the clinical presentation and neurological outcomes for these patients.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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