INTRODUCTION

Degenerative spinal disease resulting in low back pain (LBP) is one of the most common causes of disability in working age adults. Lumbar spine is the most common location followed by cervical spine. Lumbar canal stenosis (LCS), first described in 1954, is a chief anatomical correlate of LBP. However, studies seeking the role of LCS in the origin of LBP are not many in number, particularly in India. Natural history of LCS in any individual is also unpredictable.

LBP originating from degenerative lumbar spine is very common and magnetic resonance imaging (MRI) has...
become the investigation of choice in the evaluation of LBP and LS degenerative disease. LCS may be primary (due to disorder of development) or secondary (acquired) stenosis – most commonly from degenerative changes or consequent to infection, trauma, etc. Predominant sites of degenerative LS disease are lower three levels of lumbar spine, the focus of our present study.

The natural history of LCS is also still obscure with studies reporting half of the patients remaining stable and a quarter each improve or worsen. In the origin of LBP, apart from anatomic factors such as degenerative LCS, intervertebral disk degeneration (DD), and facet arthropathy all have been stated important, but studies contradict somewhat on their relative importance. Apart from the known anatomic factors related to LBP, one interrelated factor is the psychosocial one as evident in some study.

Aims and objectives
The aims of our present study were to explore the sociodemographic profile of LBP patients, to explore the association between LCS and presence of LBP, to explore the quantitative relation between the lumbar canal diameter (LCD) and intensity of the LBP, and to have a measure of psychosomatic abnormality in our study population.

MATERIALS AND METHODS
A hospital-based analytical cross-sectional study was conducted in North Bengal Medical College and Hospital (NMBCH) from July 2021 to December, 2021. It involved 80 patients with chronic LBP (duration more than 12 weeks) and 41 comparison subjects without LBP who presented with other symptoms to the Neuromedicine Outpatient Department, North Bengal Medical College and Hospital (NBMCH). Patients with chronic LBP, 20 years and above, and willing to give informed consent were included in the study. Patients with history of operation, infection (e.g., TB), trauma, malignancy, or non-infective inflammatory disease (e.g., Ankylosing Spondylitis) in the lumbar region were excluded from the study.

Ethical approval to conduct the study was taken from the Institutional Ethics Committee. Informed consent was taken from all participants. The clinicodemographic data of patients and comparison subjects were recorded using a pro forma (structured questionnaire). Visual Analog Scale (VAS) pain scale was used to assess the intensity of LBP for each patient. A simple form of VAS, understandable to patients, was chosen, with a horizontal straight line of 100 mm length, divided into ten segments, each 10 mm long. Extreme limits – 0 measured no pain and 10th segment (100 mm) means worst pain. Each patient was asked to give score for the most intense pain experienced.

1.5 Tesla MRI of LS spine was done for each of the 80 patients and 41 comparison subjects with particular emphasis to the anteroposterior (AP) diameter of lumbar canal of lower three segments. The least canal diameter of these three was chosen. The cut-off diameter (AP) for LCS taken was 10 mm (i.e., <10 mm considered as LCS) (Youmans Neurological surgery, 6th ed, 2011, Vol. 3).

Within the patient group, number of patients having somatic symptom scale-8 (SSS-8) scores were ascertained. SSS-8 is a brief measure for assessing the somatic symptoms burden which includes eight items, each scored 0–4. Total score being 32, 8, or above is positive for somatic symptoms disorder (SSD). Convenience sampling was used.

Statistical analysis
Descriptive statistics were performed for the calculation of absolute frequencies, percentages and measures of central tendency. Normality was checked using Kolmogorov–Smirnov and Shapiro–Wilk tests. Pearson’s Chi-square test was used to see the association between the two groups (patient and comparison subjects) regarding canal stenosis and P-value was determined. Non-parametric test Spearman’s rho was used to assess the level of association between non-normally distributed VAS score and Lowest Canal Diameter. These data analysis was performed using the SPSS (Statistical Package for the Social Sciences) version 25 and P<0.05 was considered statistically significant.

RESULTS
Figure 1 shows the flow chart of the study. There are 80 cases of chronic LBP and 41 comparison subjects. Out of 80 cases, 50 (62.5%) are male, while the rest 30 (37.5%) are female. Similarly in the comparison subjects, 29 (70.7%) are male, while the rest 12 (29.3%) are female. The age distribution of cases ranges from 21 years to 75 years with...
the median age of 42 years. The ages of the comparison subjects range from 16 years to 63 years with the median age of 40 years. Among the cases, the duration of LBP ranges from 90 days to 2920 days (8 years). The mean duration of chronic LBP is 281 days (Table 1).

LCD was measured with MRI and the least of the lower three levels of lumbosacral spine was considered. Among the cases, stenosis (i.e., lowest diameter <10 mm) was present in 34 (42.5%), while it was absent in 46 (57.5%). Among the comparison subjects, stenosis was present in 8 (19.5%), while it was absent in 33 (80.5%). Pearson’s Chi-square test was applied and $P=0.015$, which implies significant difference between cases and comparison subjects as to the presence of stenosis (Table 2).

Pain intensity among the cases was measured using the VAS pain scale, the scores being distributed non-normally. Spearman’s rho Correlation Coefficient was used to see the presence of correlation, if any, of VAS scores with the LCD. $P=0.458$ shows that no such correlation exists between pain intensity and canal diameter (Table 3).

Out of 80 cases (M=50 and F=30), 11 cases (M=4 and F=7) fulfilled the criteria of SSD assessed by SSS-8. Thus, 13.75% of cases had SSD. Furthermore, out of 50 male patients 4 (8.0%) and out of 30 female patients 7 (23.33%) had SSD.

**DISCUSSION**

LBP remains among the greatest concerns for public health system as shown in a European study. A number of MRI identified lesions, for example, canal stenosis, facet arthropathy, and disk protrusion/degeneration are associated with LBP.

LBP, particularly chronic LBP, is a mixed pain syndrome comprising both neuropathic and nociceptive elements arising from both canal and facet joint structures. Contrary to the popular belief neuropathic pain is not restricted to typical radiculopathy, as shown by Attal et al. Our present study focused on the relation between LCS and intensity of LBP, assessed by VAS pain score. The presence and severity of central LCS could be assessed with Schizas qualitative morphological classification based on the CSF/rootlet ratio in axial $T_2$-weighted MRI images at intervertebral disk level. Correlating symptoms and physical examination findings were an important task, particularly when invasive intervention was considered. This was made more challenging in absence of a universally accepted radiographic definitions for the diagnosis of central, lateral, or foraminal stenosis. Most studies relied on criteria published by Verbiest et al., where he defined absolute stenosis as a diameter of <10 mm. Although this method was criticized for ignoring the trefoil shape of lumbar spinal canal and intrusion of ligamentum flavum and disk material in degenerative stenosis, in absence of a better definition, <10 mm is accepted as the current definition of LCS.

For pain assessment, we used VAS pain scale, defined by Gould et al., as a measurement instrument that tries to measure a characteristic or attitude believed to range across a continuum of values that can't be directly measured. VAS, numeric rating scale, and pain severity subscale of brief pain inventory, the three pain measuring tools are shown not to have superior measurement properties among themselves. We used the simplest form of VAS, a straight horizontal line 100 mm long, the ends defined as extreme limits of the parameters to be measured (no pain to pain as bad as can be).

In our study, percentage of male and female subjects was 62.5% and 37.5%, respectively, the ratio being 1.6:1. This correlated well with the Indian study. Regarding age

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**Table 1: Characterization of cases with LBP (n=80) and comparison subjects (n=41)**

<table>
<thead>
<tr>
<th>Variables</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>50 (62.5)</td>
</tr>
<tr>
<td>Female</td>
<td>30 (37.5)</td>
</tr>
<tr>
<td>Comparison subjects</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>29 (70.7)</td>
</tr>
<tr>
<td>Female</td>
<td>12 (29.3)</td>
</tr>
<tr>
<td>Age (Median) in years</td>
<td></td>
</tr>
<tr>
<td>Cases</td>
<td>42 (21–75)</td>
</tr>
<tr>
<td>Comparison subjects</td>
<td>40 (16–63)</td>
</tr>
<tr>
<td>Mean Duration of LBP of patients in days</td>
<td>281 (90–2920)</td>
</tr>
</tbody>
</table>

LBP: Low back pain

**Table 2: Association between low back pain and presence of canal stenosis**

<table>
<thead>
<tr>
<th>Stenosis</th>
<th>Cases</th>
<th>Comparison group</th>
<th>Pearson’s Chi-square</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>34</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Absent</td>
<td>46</td>
<td>33</td>
<td>6.321</td>
<td>0.015</td>
</tr>
<tr>
<td>Total</td>
<td>80</td>
<td>41</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3: Correlation between VAS scores and Lowest Canal Diameter**

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>1</th>
<th>2</th>
<th>P-value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS Scores</td>
<td>80</td>
<td>-0.084</td>
<td>0.458</td>
<td></td>
</tr>
<tr>
<td>Lowest canal diameter</td>
<td>80</td>
<td>-0.084</td>
<td>0.458</td>
<td></td>
</tr>
</tbody>
</table>

*Spearman’s rho, Correlation is not significant at the 0.05 level (two-tailed), VAS: Visual analog scale*
distribution of cases the range was 21–75 years (median age 42 years), whereas the Indian study\(^3\) showed maximum number of cases (34\%) were in the 4\(^{th}\) decade.

In our study, the range of the duration of the LBP was 90–2920 days, the mean being 281 days. In a Czech study, the mean duration was much more, mean 66.1 months (range 3–360 months). However, this might have reflected the difference in study designs in two studies.

Our study showed a significant association between presence of LBP and presence of LCS. Pearson’s Chi-square test was applied to ascertain any significant difference between cases and asymptomatic subjects as to the presence of stenosis that showed \(P=0.015\) which was significant. This contradicted with the finding of the Indian study\(^3\), where they found insignificant relation \((P=0.7927)\) between axial back pain and canal stenosis. This was the finding also of other study by Siddique et al.\(^2\) In real life scenario, apart from canal stenosis, many other lesions such as Modic change (MC) are associated with LBP.\(^2\) A large-scale population-based cohort study concluded that MC was associated with presence and severity of LBP.\(^2\) We opine that more studies are needed, which will compare symptomatic (LBP) versus asymptomatic groups of subjects on the basis of single pathologies (e.g., DD and canal stenosis) separately as well as multiple pathologies with multivariate analysis. Still, our study clearly indicated canal stenosis as an associate of LBP which might be used as a guide in future studies or clinical intervention.

We performed statistical tests of normality (within the patient group with LBP) in the duration of LBP, VAS score, and lowest canal diameter. No significant correlation of VAS pain score with lowest canal diameter was found. These findings correlated with other studies conducted by Kuittinen et al.,\(^2\) and Geisser et al.\(^1\) Absence of this correlation could be explained in view of the fact that canal stenosis was not the single key element in the pathogenesis of LBP.

Our study also focused on the presence of SSD in association with LBP. Out of 80 cases in total, 11 cases (13.75\%) fulfilled the criteria of SSS-8. Of 50 male subjects, 4 (8.0\%) and, of 30 female subjects, 7 (23.33\%) had SSD. This may direct one’s attention to the facts that (1) psychosocial factors may play important roles in the origin and maintenance of LBP and (2) gender may be a differential factor in the interplay of SSD and LBP. This finding was in keeping with other studies like that conducted by Bener et al.\(^1\) Although our data were not statistically analyzed, this calls for a larger study focusing on the relation between LBP and psychosomatic factors.

**Limitations of the study**

The sample size was small and the observation time was short. The patient selection criteria for the above study are arbitrary. Furthermore, it may not reflect the general population since the study samples were selected from the patients seeking treatment in hospital.

**CONCLUSION**

1. There was statistically significant association between presence of LCS and LBP
2. No significant correlation was found between intensity of LBP (VAS pain score) and LCD
3. 13.75\% patients in our study with LBP had somatic symptom disorder (SSD) (male – 8.0\% and female – 23.33\%). Thus, psychosomatic factors might have played important roles in the origin and maintenance of LBP.

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**REFERENCES**


Authors Contribution:
MM- Literature review and manuscript preparation, data collection; DPC- Concept and design of the study, preparation of the first draft, data collection and data management; AC- Revision of the manuscript; PS- Statistical analysis and interpretation; NKB- Overall supervision, guidance about the psychiatric parts of the study, finalizing the manuscript

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