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Relation between Lumbar Spinal Degeneration and Anatomic Pelvic Parameters in Nepalese Population

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Abstract:-

➢ ***Background***

Degenerative disease of the lumbar spine is an important cause of disability in the world. It includes conditions such as spondylolisthesis, lumbar disc herniations, disc degeneration, and lumbar spinal stenosis. Patient with degenerative spinal disease most commonly present with symptoms of low back ache of varying degrees, lower limb pain and weakness. There are various spino-pelvic parameters which are used to measure and describe the spino pelvic alignment in an individual. The anatomic variation in these parameters have been found to be a predisposing factor for development of lumbar spinal disease and further the diseases are responsible in changes in the spino pelvic parameters itself. To far, very less is known about how the sagittal spino-pelvic alignment of the Nepalese population with persistent low back pain (LBP) differs from that of the general population. This study contributes to our understanding of the relation between low back pain resulting from degenerations of the lumbar spine and sagittal alignment.

➢ ***Aims and Objectives***

To evaluate the association between anatomic pelvic parameters and specific types of lumbar spinal degeneration. To find the Association of lumbar spinal degeneration with pelvic radius (PR), sacral table angle (STA) and pelvic incidence (PI)

➢ ***Methodology***

Patients with symptomatic lumbar spinal degeneration who were presented to KMCTH OPD from Jan 2019 to July 2020 were included in this cross sectional observational study. Degenerative pathologies were classified as lumbar disc herniation (LDH), lumbar spinal stenosis (LSS), and degenerative spondylolisthesis (DSPL). The constant anatomic pelvic parameters pelvic incidence (PI), pelvic radius (PR), and sacral table angle (STA) were assessed in lateral radiographs of the lumbar spine and compared between the pathologies.

➢ ***Results***

Among the screened patients, 206 fulfilled all the inclusion criteria and were analyzed in this study. The mean age of the patients was 51.61 years (range, 23–87 y).The age distribution varied significantly between groups. The mean PI for women was (59.75+/-2.20 mm) was significantly larger (P =0.0002) than that for men (56.05+/-2.23).No sex differences were found with regard to PR men (136.55 ± 7.33 degrees); women-134.88 ± 8.07 degrees) (P =0.112) and STA for men (97.83+/-4.74 degrees) and women (97.300+/-4.71degrees) (P =0.41).

For all 3 pelvic parameters, group comparisons revealed significant inter group differences (PR, STA, ANOVA P<0.05 and PI ANOVA P=0.04.

➢ ***Conclusions***

We found all the constant anatomic parameters to be specific for distinct types of degeneration, suggesting pelvis shape is a predisposing factor for their development.

Keywords:- *Lumbar Spinal Degeneration, Sacral Table Angle, Pelvic Incidence, Pelvic Radius, Spinopelvic Balance.*

I. INTRODUCTION

Degenerative disease of the lumbar spine is an important cause of disability in the world. They are major sources of low back pain. It includes conditions such as spondylolisthesis, lumbar disc herniations, disc degeneration, and lumbar spinal stenosis. Patient with degenerative spinal disease most commonly present with symptoms of low back ache of varying degrees, lower limb pain and weakness.[1]

For the purpose of lumbago and degenerative spine disease management, sagittal balance and spinopelvic organization are essential. *Balance or* equilibrium (from the Latin aequilibrium, from aequus "equal" and libra "balance, weight") is a notion that describes a condition in which the forces present are equal, *or such that none surpasses the sum*

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of the others. Sagittal balance and its association with lumbar degeneration disease is most neglected science in orthopaedic field. The three-dimensional spatial orientation of the pelvis and spine has even been connected to the origin of spinal deformities.[2,3] For the management of many spinal deformities, morphology of the spine in the sagittal plane is essential. The pelvic parameters are pelvic incidence (PI), sacral slope (SS), and pelvic tilt (PT). The spinal parameters are lumbar lordosis (LL) and thoracic kyphosis (TK).[4]

Based on previous studies it is established that chronic low back ache is associated mainly with three risk factors like history of LBP with associated limitations and treatments, dissatisfaction at work, and poor general medical condition.[5] Finding a correlation between the patients' spinopelvic parameters and the lumbar spinal degeneration disease will help surgeons to objectively grade the severity and help in surgical decision-making as well as compare data across the globe. In this study, we aim to find any correlation spinopelvic parameters and lumbar spinal degeration disease

II. METHODOLOGY

A. X-Rays

Standard lateral upright radiographic views of lumbo-sacral spine X ray was taken to assess the anatomic spinopelvic parameters.

B. Technique of Radiological Examinations

After proper bowel preparation by giving 2 continuous night doses of 2 tablet of Gasix and Dulculax morning fasting X-ray was taken in lateral standing position with knees fully extended and hands on the supraclavicular fossae . No patients were asked for X-ray for the sole purpose of the study. The distance between the film and the focus was 2 meters .The images were imported into the measurement software and desired spino pelvic parameters was measured. The desired parameters were pelvic incidence (PI), sacral table angle(STA) and pelvic radius(PR)

C. Image Analysis

Before analysis, DICOM images of the preoperative lateral upright standing radiographs for each patient were taken from the local PACS and imported into the measurement program (Surgimap V.2.2; Nemaris Inc., New York). Under the highest feasible image magnification, the following three parameters were measured:
1.Pelvic Radius (PR) 2.Pelvic Incidence (PI) 3.Sacral Table Angle (STA)

Mean values were used for statistical comparisons between groups.

III. RESULTS

A. Gender Distribution

Among **the** total of 206 patients were included in this study of which 102 were Male(49.51%) and 104 Female (50.49%).The gender distribution has been shown in figure 1 respectively.

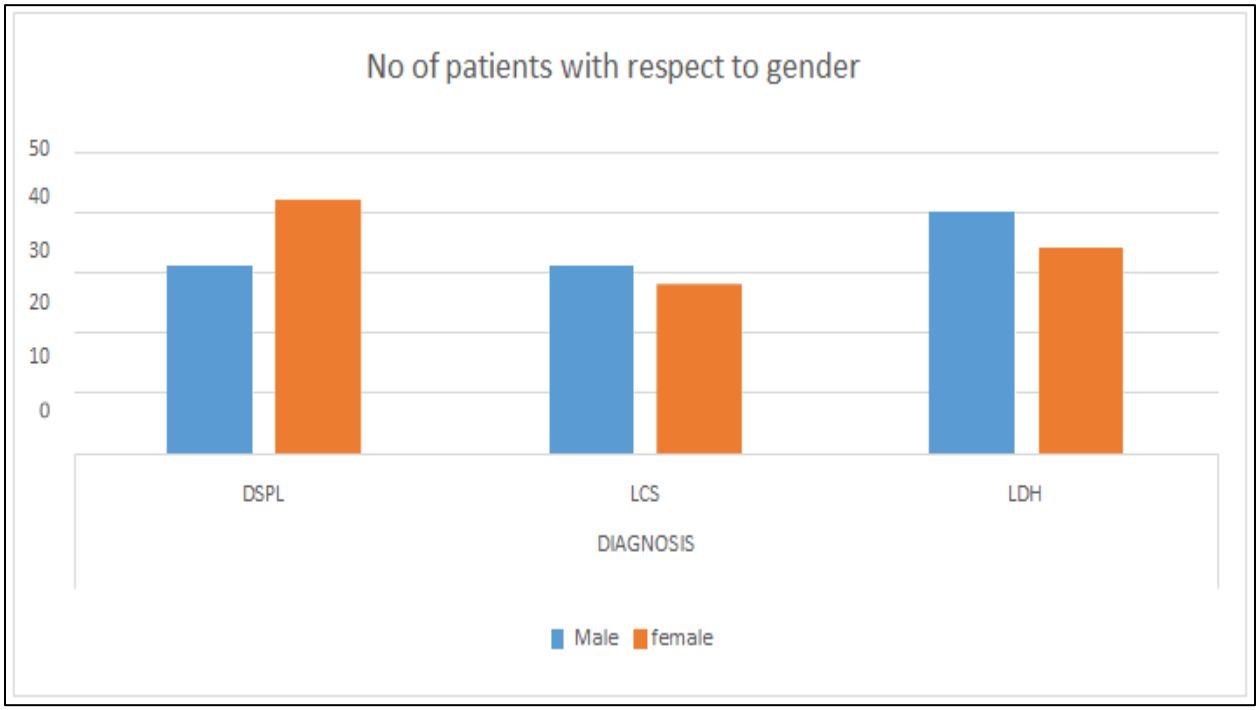

Fig 1 Gender Distribution

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B. Age Distribution:

The mean age of the patient group was 51.61±14.02 years with minimum being 23 years and maximum being 87 years. The mean age among male patient was 53.20±14.47 years and among the female patient was 50.61±13.45 years.

C. Occupation

Out of the total 206 enrolled in the study majority of the patient weresecurity guard(n=49) followed by businessman(n=46), teacher(n=41), labourer(n=39) and housewife(n=31).

D. Body Mass Index

Among the 206 patient of the study 125 of them were overweight(60%) and 3 of them wereunderweight(1.5%).

Table 1:Comparative Mean Values between Groups

DIAGNOSIS		PI	PR	STA
DSPL	Mean	58.5885	127.7255	96.8848
	N	73	73	73
	Std. Deviation	3.16731	1.93762	1.03689
LCS	Mean	57.7560	144.3751	103.3458
	N	59	59	59
	Std. Deviation	2.76956	6.33742	3.93079
LDH	Mean	57.3967	136.6273	93.6272
	N	74	74	74
	Std. Deviation	2.69441	2.75754	2.49396
Total	Mean	57.9219	135.6918	97.5651
	N	206	206	206
	Std. Deviation	2.92310	7.74626	4.72691

Table 2 :Showing Level of Significance Between Parameters and Groups Within Groups

		Sum of Squares	Df	Mean Square	F	Sig.
PI	BetweenGroups	54.474	2	27.237	3.258	.040
	Within Groups	1697.148	203	8.360		
	Total	1751.622	205			
PR	BetweenGroups	9146.073	2	4573.037	294.253	.000
	Within Groups	3154.857	203	15.541		
	Total	12300.930	205			
STA	BetweenGroups	3152.833	2	1576.416	224.158	.000
	Within Groups	1427.619	203	7.033		
	Total	4580.452	205			

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IV. DISCUSSION

For the first time, we have shown a connection between various characteristics of pelvic anatomy and different forms of lumbar degeneration with symptoms. For the Indian population and the Caucasian population, Borkar et al. have provided a detailed description of these parameters. [7]

A total of 206 patients were included with mean age 51.61 ranging from 23 to 87 years. Other studies show degenerative lumbar disease become symptomatic in third through sixth decades of life[8] which is earlier in our population. Age group of 41-50 years were mostly affected by lumbar degeneration disease lower than study by Padlina et al where 50-80 age groups were mostly affected. We found DSPL to be common among female with a sex ratio 1:1.35 which is low compared with study by Kalichman[9] to be 1:3 and LDH common in males sex ratio of 1.17 which is again lower in our population as compared to study by Kamran et al. We found comparatively larger spinopelvic parameters values when comparing with that of western population in a study conducted by Patrick[10] but similar to Indian population conducted by Borkar et al[7].

Roussouly et al found degeneration patterns can be linked to single sagittal snapshots of this flexible and variable organ appears controversial.[11] Thus, a connection to the pelvis, a basic spinal constant, appears to be essential for forecasting spinal loads and possibly spinal degeneration patterns. Data that could forecast the role that pelvic shapes play in degeneration would directly affect management planning in addition to screening and prevention.

In our study though we have data different that from previous studies while comparing with variouspelvis types, the reason can be different in spinopelvic parameters of Nepalese population compared to that of western population. So with our outcome we have our own standard patterns to lead us toward diagnosis of these diseases in refrence to spinopelvic parameters though away from previous studies but helpful for our population. Because pelvic anatomy and spinal shape are directly related, the four types of pelvis will alter the load on spinal structures and the sagittal spinal profile.

In the current study, there was a statistically significant difference between PI and gender, with higher PI values in females. Similar outcomes were reported by Vialle et al. [12.]

Cases with more anterior degeneration (DDD and LDH) had a smaller PI than cases with more posterior degeneration (LSS and DSPL), which is consistent with the findings of Barrey et al.[13]

Furthermore, our observed PI in patients with DSPL was also larger than in a study published by Barrey et al1,[13] but is very similar to the PI reported by Funao et al.[14] Because the PI is positively correlated with lumbar lordosis.[13]

The PI is a function of the pelvic anatomic thickness and the sacrum shape/sacropelvic anatomy with regard to the orientation of the sacral plateau. Therefore, observations with regard to the PR and STA can be explained. Nevertheless, we believe that the PR and STA are underestimated parameters defining pelvic shape as a fundamental predictor of spinal shape, load, and function as well as its role in the lumbar degeneration process.

V. CONCLUSION

Upon completion of this study, we discovered that every constant anatomic parameter was unique for different kinds of degeneration, indicating that the shape of the pelvis may have a role in the development of these degenerations. The different spinopelvic radiographic parameter values of a sample of symptomatic Nepalese people are presented in this study. About half of the radiographic parameters examined in the sample showed a significant difference between males and females. The values that were obtained are similar to the values that the literature presents as normal. Additional comprehensive research is required to corroborate the results of this investigation. Spinopelvic parameter analysis aids in directing the surgical approach during spinal surgery.

Conflicts of Interest

There are no conflicts of interest.

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