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# Epidemiology and Morphological Hallmark in Symptomatic Spondylotic Beninese Patients

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**Abstract:** Spondylolisthesis is a well-known neurosurgical condition, in relation with various factors. The main objective was to report the morphological and radiological hallmark of patients presenting with symptomatic spondylolisthesis. This is a prospective, longitudinal, descriptive and analytical study: 1st April to 30th September 2014. Twenty nine patients were followed up, with female ascendance. The average age is 50 to 69 years. The most frequent level was L4-L5 and in most cases, only one level was involved. Lesions of Grade I were commonest (79.0%). The average values of the SS (sacral slope) and PI (pelvic incidence) was respectively  $36.4 \pm 6.9^\circ$  ( $17.3^\circ$  to  $49.6^\circ$ ) with a median of  $37.8^\circ$  and  $64.9 \pm 9.2^\circ$  ( $42.98^\circ$  to  $87.47^\circ$ ) with a median of  $64.6^\circ$ . LL (lumbar lordosis), had a mean value of  $43.8 \pm 10.8^\circ$  ( $26.2^\circ$  to  $67.0^\circ$ ) with a median of  $43.1^\circ$ . DH (disc height) was 5 to 10 mm in most cases. A report was made with the morphology of the basin of the African woman. Our results are consistent for the most part with the literature data. This present study illustrates a female to male ration of 3. According to BMI (body mass index) assessment, 69% of patients presented with overweight. The main radiologic parameters are compromised with increasing sacral slop and PI and reduction of DH and LL. Findings are characteristic in female population.

**Key words:** Spondylolisthesis, morphological and radiological hallmark, Benin Republic.

## 1. Introduction

Spondylolisthesis is a slippage of a two contiguous vertebral bodies, as a result of structural changes (as isthmic defect) and/or degenerative spinal disorders [1]. Lumbo-sacral junction is mostly involved [2]. Imaging is a key point in spinal diagnosis and several techniques such as plain X-Ray, myelography, CT (computed tomography) scans and MRI (magnetic resonance imaging) studies [3-5].

Human anatomy, body morphotype [6, 7] and professional strengths [8, 9] may induce several biomechanical changes in spinal column [5, 10-12]. Thus, abnormalities of PI (pelvic incidence) may compromise spinal sagittal balance [13] and seem to be a major parameter in degenerative spinal disease when

analyzing the pathogenesis of lumbar spondylolisthesis. Most of spondylolisthesis cases, are often asymptomatic and well tolerated whereas some other cases may become symptomatic and lead to major functional disability [14]. Consequently, assessment of patients' human morphology and spinal radiological characteristics could help predict worsening of spondylolisthesis.

The main objective of this study is to report the morphological and radiological characteristics of patients with symptomatic spondylolisthesis.

## 2. Patients and Method

The study was conducted in two surgical units located in Cotonou, Benin Republic: Department of Neurosurgery-Military Teaching Hospital and Department of Orthopedic Surgery.

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This is a longitudinal, descriptive and analytical design: April 1st to September 30th 2014.

Twenty-nine subjects were included among patients attending neurosurgical consultation related to clinical symptoms of lumbar spondylolisthesis. Were included patients with imaging assessment including complete lumbar spine X-Ray, and a minimum of 6 months follow up after initial care. Patients who previously benefited from spinal surgery or denied therapeutic test were excluded.

Variables included age, sex, weight, height, with BMI (body mass index) and radiological. In the last category were reviewed: location and number of spondylolisthesis, grading according to Meyerding scale [4], and anatomic hallmarks such as SS (sacral slope), LL (lumbar lordosis), PI and DH (disc height), as described in Theiss [11] previous publications.

### 3. Results

Patient's age fitted three groups: 30 to 49 years old ( $n = 4$ , 13.8%); 50 to 69 ( $n = 23$ , 79.3%) and 70 and more ( $n = 2$ , 6.9%). There is a female ascendance with a male to female ratio of 0.32.

Regarding the BMI, 8 patients (27.6%) fitted the

normal range i.e. 18.5 to 24.9 (normal weight). One patient (3.4%) had a BMI less than 18.5 (thinness), 20 patients presented with overweight (BMI between 25 and 29.9) and obesity (BMI more than 30).

During 29 patients, 38 cases of spondylolisthesis were documented. Slippage was increasingly ruled out at L2-L3 in (4 cases), L5-S1 in (5 cases), L3-L4 in (6 cases) and at L4-L5 in (23 cases).

In twenty three cases (80%), slippage involved single-level whereas the remaining presented with multiple levels; 4 cases were found at two levels (13.4%) and two single cases, involved respectively three and four levels.

Grade I spondylolisthesis was found in 30 cases (79.0%), whereas 8 patients (21.0%) presented with Grade II lesions.

Values of the main lumbopelvic parameters assessing the sagittal balance of the spine are detailed in Tables 1-4. Eighteen patients (62.1%) presented with SS greater than  $35^\circ$  with a median calculated value of  $37.8^\circ$  ( $17.3^\circ$  to  $49.6^\circ$ ): Table 1.

In 13 patients (44.8%) PI was equal or greater than  $65^\circ$  with a median calculated value of  $64.6^\circ$  ( $42.98^\circ$  to  $87.47^\circ$ ): Table 2. This PI of  $65^\circ$  and over was found

**Table 1** Main values of SS according to sex.

Value of the SS	Male, n (%)	Female, n (%)	Total, n (%)
< 35	2 (28.6)	9 (40.9)	11 (37.9)
35-45	5 (71.4)	11 (50.0)	16 (55.2)
$\geq 45$		2 (9.1)	2 (6.9)
Total	7 (100.0)	22 (100.0)	29 (100.0)

**Table 2** Main values of PI according to sex.

PI ( $^\circ$ )	Male, n (%)	Female, n (%)	Total, n (%)
< 45	1 (14.3)		1 (3.5)
45-65	6 (85.7)	9 (40.9)	15 (51.7)
$\geq 65$		13 (59.1)	13 (44.8)
Total	7 (100.0)	22 (100.0)	29 (100.0)

**Table 3** Main values of LL.

Value of LL ( $^\circ$ )	Male, n (%)	Female, n (%)	Total, n (%)
< 30		1 (4.6)	1 (3.4)
30-50	6 (85.7)	14 (63.6)	20 (69.0)
50-70	1 (14.3)	7 (31.8)	8 (27.6)
Total	7 (100.0)	22 (100.0)	29 (100.0)

**Table 4** Main value of DH (mm).

Value of DH (mm)	Patients
< 5	6 (15.8)
5-10	30 (79.0)
>10	2 (5.2)
Total	38 (100)
Average	6.7 ± 2.1
Median	6.7

mainly among women (13 cases; 59.1%).

In 21 cases (72.4%) LL was less than 50° with a median calculated value of 43.1° (26.2° to 67.0°): Table 3.

DH ranged from 5-10 mm in 30 cases (79%), less than 5 mm was in 6 patients (15.8%) and 10 mm and more in 2 cases (5.2%). The median calculated value was 6.7 mm (1.9 to 10.2): Table 4.

#### 4. Discussion

Our results point out specific morphological characteristics in population presenting with spondylolisthesis in Cotonou. The ratio of women to men suggests a female dominance with 75.9% of global population. Similar notes were written by Uduma et al. [12] in Nigeria (82.61%), Tagbor et al. [15] in Togo as well as Morel et al. [16] in France (82.85%) and Rahman [17] in Bangladesh (57.1%). In Nigeria Uduma found the same peak in the fifth decade [12]. In most of series, patients' medium age runs from 50 to 69 years old. As in Cotonou it was 58.6 ± 9.5 years (30 to 77 years), Tagbor et al. [15] reported peak at 54 years old in Togo, whereas Bejia et al. [18] in Tunisia reported a middle age of 57.9 ± 9.5 years. These findings suggest that degenerative etiology of spondylolisthesis begins in middle age as previously respectively reported by Denard et al. [19] and Jacobsen et al. [20].

In this series, our patients are overweight (34.5%) either obese (34.5%) comparing to control group (reference population) whose BMI was 24.8 kg/m<sup>2</sup>, definitely significantly higher than the patients population ( $p = 0.030$ ). Our results are closed to those of Schuller et al. [22] who reported a mean BMI of

28.2 kg/m<sup>2</sup> in spondylosis patients.

In our study, the average calculated PI (64.9 ± 9.2°) was higher than the ideal rate (55 ± 11.2°) reported by Guigui et al. [21] in the normal population. Our results are consistent with previous high value of PI reported by Morel et al. [16] (62.6°) and Schuller et al. [22] (66.2°) in European patients with spondylolisthesis. Barrey et al. [23] also reported in France an average value of PI of 60.1° higher than in the control group (52.0°). As described by Labelle theory increased PI appears to be a prognosis factor that rises the risk of occurrence and worsening of spondylolisthesis [24]. This is illustrated by the dominancy of female population in patients with PI higher than 65° (13 cases; 59.1%). Traditional practices such as carrying babies in their back, and heavy loads may play changes on basic morphotype in African women. Walicka-Cupryns et al. [25] has reported that a backpack heavier than 10% of body weight can cause shallowing (i.e. reduction) of the LL and a verticalisation of the sacrum.

High value of PI is thought to be generally associated with high SS and significantly higher comparing with the reference group. Our results (36.4 ± 6.9°) matched descriptions done by Morel et al. [16] (37°), Barrey et al. [23] (40.1°) and Schuller et al. [22] (42.1°).

High PI is also correlated with high LL. In our study 72.4% of cases presented surprisingly with LL below 50°. Opposite our findings, Barrey et al. [23] found high value of PI with  $p$  value < 0.0005.

Changes in PI are mostly specific of female population (59%).

Been had reported the existence of parameters such as age, sex, ethnicity and sport could affect the angle of

LL [26]. Consequently lower LL in our spondylolisthesis population (with female dominancy) could be an imbalance compensation to reach a better sagittal balance of the spine body.

Abnormalities in both BMI and radiologic have previously been reported by Onyemaechi et al. [27] and suggested that raised BMI could induce biomechanical changes in the lumbosacral spine particularly in lumbosacral angles.

## 5. Conclusion

Spondylolisthesis is a multifactor disease. This present study illustrates a female to male ration of 3. According to BMI assessment, 69% of patients presented with overweight. The main radiologic parameters are compromised with increasing sacral slop and PI and reduction of DH and LL. Findings are characteristic in female population.

Consequently, those hallmarks could help predict occurrence or worsening of sagittal instability.

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