Pattern of Degenerative lumbar Retrolisthesis in Basrah

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Abstract

Although retrolisthesis is not a well-known condition by many medical specialists dealing with back problems and it has been regarded as a radiological incidental finding with no clinical significance, a growing prove is now evolving stating that retrolisthesis could be a cause of many backache complaints and a sequelae of an altered spine biomechanics.

Objectives: to study and analyze the various biomechanical characteristics of retrolisthesis and its relationship with various radiological parameters of the lumbar spine and other patient's factors.

Patients and Method: Forty patients, twenty six males, and fourteen females with an age range from 40 – 66 years with radiological evidence of significant lumbar spine retrolisthesis (slip > 3 millimeters) were evaluated clinically and radiologically by plain radiography and MRI in Basra General Hospital and Ibn AL-Bittar Private Hospital, during the period from the 1st of August 2014 to the 1st of March 2015. After a thorough history and physical examination, various radiological parameters were obtained including the lumbar lordosis, sacral slop, pelvic incidence, pelvic tilt, all those measurements were done digitally. A statistical analysis was made via IBM SPSS ver.17 and the results were compared with that of similar studies.

Results: The retrolisthesis was found to be more common with more slip distance in males than in females, males=**26** (65%), females=**14** (35%), P-value=0.026, the mean of slip in mm in males was (4.002) and in females was (3.71). The patients had a mean BMI equal to (26.025= overweight). The most common level at which retrolisthesis occur in this study was the L5-S1 (40%) then L4-L5 (22.5%).

All the radiological parameters (the lumbar lordosis, sacral slop, pelvic incidence, and pelvic tilt) were lower than the known normal values in healthy subjects.

Conclusion: It seems that retrolisthesis is not just an incidental finding, it may be a kind of a compensatory reaction for an abnormal spine biomechanics. The males are affected more frequently than females with a more slip distance.

The L5-S1 followed by the L4-L5 are the most common sites in both sexes. The degenerative spinal disease is the main cause of retrolisthesis in all patients' groups regardless of sex or age.

Introduction:

Listhesis was defined as displacement (backward or forward) of one vertebra relative to the one below 3 mm or greater. Less than 3 mm displacement is considered to be within the normal range. The selection of 3 mm as the cut point for the definition of disease was based on the fact that this is the criterion commonly used in orthopedic clinical practice [1] This 3-mm cutoff corresponded to a slip of 8% that was used as the lower limit to define retrolisthesis.

Retrolisthesis has historically been regarded as an incidental finding, one that does not cause any symptoms and is considered to be of little or no clinical significance.

The literature has found a possible association between retrolisthesis and increased back pain and impaired back function. [2, 3, 4, 5]

Retrolisthesis is found mainly in the cervical spine and lumbar region but can also be often seen in the thoracic spine [6]

Why retrolisthesis occur? Is it merely a result of a cause an effect scenario? Or it is a compensatory response for an altered spine biomechanics and an attempt from the spine to stay as close as possible to its previous normal alignment?

In this study, we will try to explain the various biomechanical characteristics associated with the retrolisthesis by analyzing some of the important biomechanical parameters in the affected spines, so that, we may figure out the real cause(s) of the retrolisthesis and whether it is by the chance phenomenon in its occurrence or an important compensatory strategy of the spine in response to some of its affections.

In a closed, related mechanical system, there is an important mechanical concept which states that any alteration in a part is followed by a suitable and related change in another part in the form of movement or change of its position, velocity or direction in any form.

This also can be applied to the spine as a whole, and the spinal motion segment in particular, emerging a big question whether retrolisthesis is the end result of a far or near spinal biomechanical change which follow the above mentioned mechanical fact.

Patients and Methods:

This is a descriptive study done to disclose some of the relevant characteristics of retrolisthesis in selected patients' sample.

The sample in this study comprised of 40 patients; 26males 65% and 14 females 35%, age: 40-66 years, with back pain and a proved plain radiological diagnosis of retrolisthesis in the lumbar spine, they were collected from the attendance of Basra General Hospital and Ibn AL-Bittar Private Hospital in Basra, starting from the 1st of August 2014 till the 1st of March 2015.

All the patients were evaluated clinically and radiographically after applying the inclusion and exclusion criteria as below:

The Inclusion Criteria:

1. The age is more than 18 years old.
2. Radiological proof of lumbar spine retrolisthesis (defined as a backward slip > 8% or 3 millimeter)

The Exclusion criteria were as follow:

1. Any case following major back trauma, old or recent.
2. Spinal or paraspinal Infections or Tumors, old or recent.
3. Postoperative cases, old or recent.
4. Obvious congenital and/or Developmental anomalies, including scoliosis.

All patients were subjected to full clinical evaluation including history, physical examination and plain radiographic examinations to the Lumbar spine and pelvis (both AP and Lateral views in standing position, fixed not dynamic films) with MRI scanning of the lumbosacral spine. All the examined parameters were documented in the patient's questionnaires.

After that the parameters were collected and analyzed statistically using the (IBM SPSS version 17.0) software, and a significant P value was set at =< 0.05.

Obtaining the measurements of the various radiological parameters were done on the digital photos of the patient's plain radiographies of a size (17 * 14 inches) in lateral views to the lumbosacral spine while the patient was standing with a film-tube distance equal to (72) inches, then the calculation was made after correction of the magnification effect associated with the plain radiographic technique by a special

computer software; (Image J) ®, as followed:

- **The pelvic incidence (PI)** [7] is defined as the angle subtended by a line connecting the axis of the femoral heads to the midpoint of the endplate of S1 and a perpendicular line to the endplate of S1 at its midpoint. Figure(1)
- **The sacral slope (SS)** [7] is defined as the angle between the superior endplate of S1 and the horizontal plane. Figure(1)
- **The pelvic tilt (PT)** [7] is defined as the angle between a line joining the midpoint of the superior endplate of S1 and the axis of the femoral heads with the vertical plane. Figure(1)

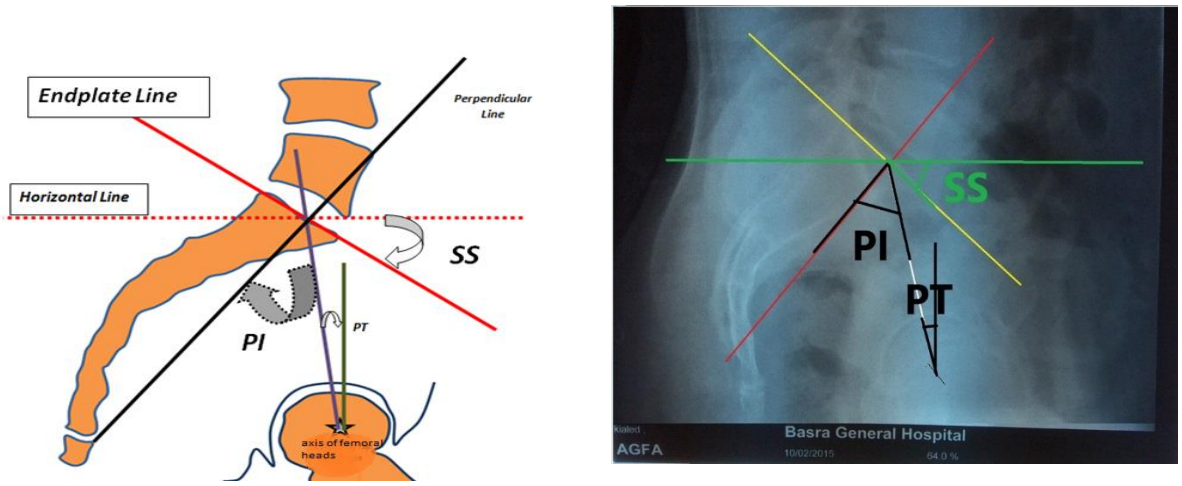

Figure (1): The pelvic incidence (**PI**), the sacral slope (**SS**) and the pelvic tilt (**PT**), showing the way of making the measurements.

The retrolisthesis Slip:

Measurement of retrolisthesis by Iguchi method [8]. A line is drawn along the inferior end plate of the vertebra that suspected to be slipped backward. Two lines are erected perpendicular to this line to pass through the adjacent posterior corners of the vertebral bodies. The distance between the points at which these 2 lines intersect the end plate line is the amount of retrolisthesis as shown in figure (2).

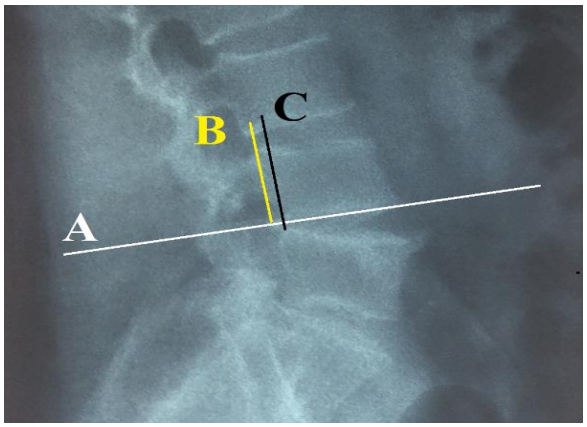

Figure (2): The method of measuring the backward slip on lateral erect standing plain radiography (Iguchi method).

The Lumbar lordosis: [9]

This is measured on the erect lateral radiograph of the lumbo-sacral spine, as the angle between the superior end-plates of L1and S1, using the Cobb's method. Figure (3)

The other parameters; namely the patient's age, gender, smoking habit, body mass index, the presence of backache, radiculopathy with the duration of his/her complaint and MRI findings,. All were grouped for each patient in an Excel® file using the Microsoft Office® 2013 and statistically analyzed using the (IBM SPSS version 17.0) software.

Figure (3): The method of measuring the angle of lumbar lordosis using the Cobb's method.

Results:

The different demographic parameters for the patients were summarized in table (1).

Table (1) The demographic parameters

Gender	**Males**		**Females**	**P-value**
	26 (65%)		**14 (35%)**	**0.026**
	Minimum	**Maximum**	**Mean**	**SD**
Age	**40**	**66**	**50**	**±6.63**
BMI	**19.60**	**36.85**	**26.02**	**±4.05**
Duration of pain in months	**4**	**72**	**18.4**	**±13.99**
	Smoking Habit			
Never	**30**			
Former	**8**			
Current	**2**			

The presenting symptoms for the patients were ranged from backache, and adiculopathy, in isolation or a combined presentation as shown below in table (2).

Table (2) The frequency of the presenting complaints

The Presenting Complaint	Backache	Radiculopathy	
		Rt	Lt
Number of Cases	**40** (100%)	**19** (47.5%)	**12** (30%)

Radiological findings of retrolisthetic levels in form of narrowing of intervertebral disc space, osteophytes and end plate sclerosis were summarized in table (3).

Table (3) Radiological findings of retrolsthetic levels.

Radiological findings of retrolsthetic levels	No. of retrolisthetic level.
Narrowing of intervertebral space	36(83%)
Osteophytes	30(69%)
End plate sclerosis	18(41%)

The MRI findings of retrolisthetic levels in form of disc T2 signal loss (signifying disc dehydration), posterior degenerative changes (facet joint arthropathy and ligametum flavum hypertrophy) and modic changes (I, II, III) were summarized in table (4).

Table (4) MRI findings of retrolsthetic levels

MRI findings of retrolsthetic levels	No. of retrolisthetic level.
Disc T2 signal loss	33(76%)
Posterior degenerative changes	13(30%)
Modic changes	11(25%)

The patients 'radiographic parameters that was used in this study were measured by the computer and the results as shown below in table (5).

Table (5) The radiographic parameters

	Minimum	Maximum	Mean	SD
Retrolisthesis slip in mm	**3**	**5**	**4.25**	**±0.74**
Pelvic incidence	**25^0**	**68^0**	**36.35^0**	**±8.65**
Sacral slope	**11^0**	**53^0**	**25.95^0**	**±8.97**
Pelvic tilt	**5^0**	**15^0**	**10.27^0**	**±3.04**
Lumbar Lordosis	**25^0**	**63^0**	**36.22^0**	**±8.21**

The measurements of the specific characteristics of each retrolisthetic level and its main features in the form of the level it affect and the magnitude of the slippage in millimeters were as shown below in table (6).

Table (6) The characteristics of the retrolisthesis according to the lumbar spine level

	Frequency of retrolisthesis	**Minimum slip in mm**	**Maximum slip in mm**	**Mean of Slip**	**SD**	**P-Value**
L1 – L2	**2 (5 %)**	**3**	**3**	**3**	**0**	0.93
L2 – L3	**8 (20 %)**	**4**	**5**	**4.16**	**0.675**	0.04
L3 – L4	**8 (20 %)**	**3**	**5**	**4.24**	**0.546**	0.16
L4 – L5	**9 (22.5 %)**	**4**	**5**	**4.25**	**0.485**	0.23
L5 – S1	**16 (40 %)**	**3**	**5**	**4.56**	**0.765**	**0.04**

The sex of patients and its relation to the most common level it affects were summarized as shown below in table (7).

Table (7) The Frequency of retrolisthesis in each level in the patients.

		In all Patients		In Males		P-Value	In Females		P-Value
L1-L2	Frequency of Retrolisthesis	2	5%	1	2.5%	0.01	1	2.5%	0.01
L2-L3	Frequency of Retrolisthesis	8	20%	5	12.5%	0.056	3	7.5%	0.052
L3-L4	Frequency of Retrolisthesis	8	20%	5	12.5%	0.056	3	7.5%	0.052
L4-L5	Frequency of Retrolisthesis	9	22.5%	7	17.5%	0.06	2	5%	0.064
L5-S1	Frequency of Retrolisthesis	16	40%	11	27.5%	0.03	5	12.5%	0.043
Total		43*	107.5%	29	75%		14	32.5%	

*** There are 43 level with retrolisthesis in 40 patients, because 3 patients have multilevel retrolisthesis.**

The sex of patients and its relation to the mean of the posterior slippage were summarized as shown below in table (8).

Table (8) The mean of the posterior slippage in each level in the patients.

		In all Patients	In Males	P-Value	In Females	P-Value
L1-L2	Mean of slip in mm	3	3	0.00	3	0.00
L2-L3	Mean of slip in mm	4.16	4.04	0.46	3.9	0.43
L3-L4	Mean of slip in mm	4.24	4.14	0.35	3.7	0.34
L4-L5	Mean of slip in mm	4.25	4.27	0.45	4.02	0.54
L5-S1	Mean of slip in mm	4.56	4.58	0.03	3.93	0.04

The radiological parameters of patients and its relation to the sex as shown below in table (9).

Table (9) the characteristics of radiological parameters

	In all Patients	In Males	P-Value	In Females	P-Value
Mean of Pelvic incidence	**36.35**	**37.65**	**0.76**	**38.65**	**0.75**
Mean of Sacral slope	**25.95**	**28.95**	**0.65**	**31.68**	**0.68**
Mean of Pelvic tilt	**10.27**	**13.95**	**0.75**	**15.56**	**0.76**
Mean of lumbar lordosis	**36.22**	**10.45**	**0.03**	**9.37**	**0.76**

The different radiographic parameters of the patients were compared with normal values as shown in table (10).

Table (10) The comparison of the different radiographic parameters in normal values and in cases of retrolisthesis.

The Parameter	The Normal Mean*	The readings in this study
Lumbar lordosis(°)	**66.36**	**36.22**
Sacral slope(°)	**41.18**	**25.95**
Pelvic tilt(°)	**11.96**	**10.27**
Incidence(°)	**53.13**	**36.35**

*(10)

The treatment of the patients were summarized as below in table (11).

Table (11) Treatment of retrolisthesis.

No.of patients	Type of Treatment		
34	**Conservative Treatment**		
6	**operative Treatment**	**4**	**Laminectomy**
		2	**laminectomy +discectomy**
		0	**Instrumentation**

Discussion:

In this study, we shed a light on the increasing awareness among spine surgeons that retrolisthesis could be more than an incidental radiological finding and it could play a real role in the pathophysiology of back pain in the affected patients.

Why and how retrolisthesis cause symptoms? A study done by O'Brian in 1983 showed that retrolisthesis can cause narrowing of the disc space when the annulus fibrosus bulges posteriorly [11]. Concurrently, there can be a relative translation of the superior articular process of the vertebra caudal to the mobile segment in the direction of the intervertebral foramen. This can cause a lateral stenosis that can produce painful radicular symptoms [12]

Studies on both white and African American women showed that retrolisthesis was associated with a higher likelihood of low back pain [4, 5]. Although once believed to be a benign finding, it is becoming more apparent that retrolisthesis can be a source of morbidity for patients.

In this study; being merely a descriptive type, we can't formulate a trusted hypothesis about the association between retrolisthesis and back pain, this needs more big experimental study or randomized controlled clinical trials.

All patients share the same type of retrolisthesis, the partial type, this may reflect that other types of retrolisthesis are rare occurrence among patients of similar parameters. All patients were also having degenerative spinal condition, of varying degrees.

We agree with other studies in regard the gender; retrolisthesis was seen in male [13, 14]

Other study, as in that of Jeon C-H (2013) [15] no statistically significant gender variation was noted in the patients suffering from back pain with a pure and significant retrolisthesis.

The prevalence of retrolisthesis did not vary by sex, age, race, smoking status, or education level when compared with individuals with normal sagittal of spine. [13, 4]

The age of the patients were ranged from (40) years to (66) years, although the inclusion criteria in this study involved any adult age group starting from age of (18) years, no age was shown to be less than (40) years; which may be regarded as the start line of degenerative process as the facet joint degeneration is relatively uncommon in persons under 40 years [16], if we add to this fact that all the patients were having lumbar spine degeneration of varying degrees, we can figure out a significant relationship between the retrolisthesis and degeneration.

The average BMI of the all patients was **(26.025, SD ± 4)**, this means that the predominate body habitus in retrolisthesis patients is the normal to overweight style. Our finding goes with that of Shen et al (2007) [13], they found that retrolisthesis patients had a BMI with a mean equal to (28) with (SD±6.1).

We could explain this as the retrolisthesis is not only require some type or form of posterior weakening in order to occur, it also need a more than normal or average posteriorly directed shearing force applied on the relevant vertebra, this is manifested by the net

result of the overweight body mass. Our conclusion is that retrolisthesis is a disease of the over weighted persons.

The pelvic incidence (PI), sacral slop (SS), the pelvic tilt (PT), and the lumbar lordosis in our patients were all statistically lower than that of normal subjects and patients with anterolisthesis in other studies which were taken as a comparison with our results[10,17]. When the lumbar spine is hyperlordosis, the contact force on the posterior joints and the intervertebral tilt will increase, thereby increasing the forward sliding force. By contrast, the contact force on the anterior intervertebral disc will increase with hypo lordosis, subsequently decreasing the intervertebral tilt.

As hypolordosis is related to a lower SS, and subsequently lower PI, [18, 19] backward displacement could occur in patients with a low PI for this reason.

In contrast, Degenerative anterolisthesis was reported to have a higher PI, SS, and lumbar lordosis than that in retrolisthesis. [20, 21]

The main level with more frequent retrolisthesis was the L5-S1, (16 patients, 40%) probably due to the high stress which is applied for this level (junctional level).

This was different than other studies were the retrolisthesis occur more commonly in higher lumbar spine levels, namely in L3-L4 (44.3%) followed by L2-L3 (35.7%) as stated in Jeon C-H (2013. [15]

Treatment and what is its most accepted option, was also not a totally agreed point among all researchers, the choice depends on multiple factors in deciding which way is the best and most suitable for both the patient and his/her treating surgeon.

Before all, the conservative style was still, and will probably stay to be, the standard for Retrolisthesis treatment, since there are no proofs that posterior vertebral slipping may in itself be a cause of low back pain [10], also the surgical treatment may result in a more posterior slippage as a result of lowering the disc height after discectomy [22].

Only 6 patients from the 40 patients were treated surgically in form of laminectomy (4 patients) and less commonly a laminectomy with discectomy (2 patients).

No patient in this study was in need for fusion, this was due to the fact that a bilateral laminectomy and discectomy had not been carried out for any patient.

Conclusion:

1. Retrolisthesis is commoner than it was assumed.
2. Partial retrolisthesis is commonest type
3. The L5-S1 is the commonest level for retrolisthesis followed by L4-L5 and then by other higher lumbar levels.
4. The degenerative spinal disease is the main cause of retrolisthesis in this study.
5. Retrolisthesis is more common in males; with more slip, than in females.
6. Retrolisthesis is associated with less lumbar lordosis than in the normal populations.

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