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" Effect of isolated L4/5 fusion on L5/S1 in presence or absence of preoperative L5/S1 degeneration short term outcomes "

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Abstract

Background: there is some debate about isolated L4/5 fusion and its effect on L5/S1segment, especially in presence of preoperative L5/S1degeneration and its effect on the postoperative clinical outcome.

Aim of study: to evaluate the effect of isolated L4/5 fusion on radiological and clinical outcome in presence or absence of L5/S1degeneration.

Method: this is a comparative retrospective study between 2 groups of patients had L4/5 degenerative spondylolisthesis underwent standard isolated L4/5posterolateral fusion surgery; the first group had a preoperative L5/S1radiological degeneration while the second group showed no preoperative L5/S1degeneration. The minimum follow up period for those patients were 2 years.

Results: 41 patients were included in this study; first group included 17 patients associated with preoperative L5/S1degeneration and the second group included 24 patients with no L5/S1degeneration. There were no significant differences in clinical and radiological outcome between the two groups when compared at the final follow up. According to the radiological degeneration 4 (23.5%) patients of the first group showed accelerated degeneration while 3(12.5%) patients of the second group showed accelerated L5/S1degeneration. On the other hand 2 (11.8%) patients of the first group showed clinical L5/S1degeneration while 1(4.2%) patients of the second group showed clinical degeneration. There were no significant differences in accelerated degeneration when we compared the two groups.

Conclusion: L5/S1segment could be safely spared in cases of L4/5 fusion in the presence of preoperative L5/S1degeneration if the clinical symptoms are not correlated to the degeneration.

Keywords: adjacent segment disease , spondylolithesis , fusion surgery

Introduction

Fusion of lumbar vertebrae L4/5 is a common spinal arthrodesis procedure used to treat cases with symptomatic degenerative spondylolisthesis (DS) intractable to medical treatment and physiotherapy.(1, 2)

However the fusion surgery still carries the risk of adjacent segment disease especially in presence of preoperative facet or disc degeneration due to biomechanical stress on them.(3, 4)

Most of the literature focused on cranial adjacent segment disease with few reports about the effect of single L4/5 fusion on L5/S1 disc.(5, 6)

Challengingly L4/5 degenerative spondylolisthesis (DS) encountered to show in some cases L5/S1 degeneration especially in old ages and this situation put the surgeon in a debate whether to do single L4/5 fusion or to add S1 to the fusion procedure to avoid clinical deterioration of the patient and the need to reoperation.(5, 7)

Few previous studies reported no correlation between single level L4/5 fusion and accelerated L5/S1 degeneration even in presence of preoperative L5/S1 degeneration.(5, 7, 8)

So, in this study we focused on postoperative L5/S1 segment radiological and clinical degeneration in presence or absence of preoperative degeneration after isolated L4/5 fusion to conclude the influence of single L4/5 fusion on L5/S1 outcome clinically and radiologically.

Materials &Methods

The protocol of this retrospective study was approved by medical ethical committee of Mansoura University faculty of medicine.

Forty one patients who underwent single L4/5 fusion using standard midline approach, four transpedicular screws with posterolateral interbody fusion were included in this study. All patients completed at least 2 years of clinical and radiological follow up.

All patients who included in this study had intractable pain failed to medical treatment and physiotherapy, no previous spinal surgeries while patients with previous spinal surgeries were excluded from this study.Radiographic evaluation in this study included preoperative and postoperative plain X-ray and MRI.

Clinical outcomes were evaluated using the visual analogue scale (VAS) score for back and leg and the Oswestry disability index (ODI) score pre and postoperatively.

We divided the patients into two groups. The first group showed preoperative L4/5 spondylolisthesis and L5/S1 degeneration. While the second group showed only L4/5 spondylolisthesis and not associated with L5/S1 degeneration.

L5/S1 degeneration was defined if one or more of these criteria were apparent: loss of disc height, loss of disc hydration, facet arthropathy, foraminal stenosis or canal stenosis. Foraminal stenosis was considered if the fat around the nerve root was obliterated on T1 weighted sagittal image.(9, 10)

Postoperative radiological evaluation of accelerated or appearance of L5/S1 adjacent segment disease (ASD) s defined as reduction of more than 3mm in disc height on a lateral plain x-ray, appearance of modic changes, osteophyte formations or advanced facet arthropathy.(11, 12)

Clinical degeneration will be defined if new symptoms developed, required a new intervention and correlated with radiological findings.

We finally compared the clinical outcome and the incidence of radiological and or clinical L5/S1 degeneration in both groups whether preoperative degeneration was existed or not.

All statistical analysis were executed using SPSS for windows (version 14.0,SPSS,Inc,Chicago,IL).Idependent student T test was used to compare between the two groups and the difference of intergroup were analyzed using Fisher's exact test and the results were considered to be statistically significant if p value <0.05.

Results

In this study two groups were involved the first who had L5/S1degeneration and the second who had no L5/S1 degeneration.

The first group included 17 patients (6 male and 11 female) with mean age 49.56±7.59, while the second group included 24 patients (10 male and 14 female) with mean age 50.76±8.11.

In the first group, preoperative VAS score of back and leg improved from 6.73±1.02 and 6.81±0.91to 2.54±0.74 And 2.08±0.86 at the end of follow up, respectively, while the ODI score improved from 62±15 to 23±19.2.In the second group the preoperative VAS score of back and leg improved from 6.68±1.09 and 7.01±08.91to 2.94±0.67 and 2.09±0.64 at the end of follow up, respectively, while the ODI score improved from 58±1811 to 18.2±16.5. After comparing both groups there were no significant differences between the two groups for postoperative back, leg pain or ODI score.

According to postoperative radiological L5/S1 accelerated degeneration 4 (23.5 %) patients of the first group showed accelerated degeneration in the form of facet degeneration in one, foraminal stenosis in one and loss of disc height in the others. 2 (11.8%) of them showed clinical symptoms in the form of back pain in one of them who underwent local injection of the facets and improved on physiotherapy, while the other showed radicular pain

in his right leg related to right S1 foraminal stenosis and underwent right S1 Foraminotomy only without need to add fusion.

Among the second group 3 (12.5 %) patients showed radiological degeneration in the form of decrease of disc height in one patient and facet arthropathy in the others, and clinical degeneration was apparent in one (4.2%) of the last two who underwent radiofrequency to relieve the back pain. But upon all that no significant differences were reported between the two groups in relation to the incidence of degeneration whether radiologically or clinically.

Discussion

Spinal fusion surgery aimed to maintain solid arthrodesis in the affected level.(13) While considering that, it should be remembered that solid arthrodesis increases the stress and mobility on the adjacent segments. (14)

The occurrence of ASD had been studied a lot with a comprehensive meta-analysis reported the rate of ASD after lumbar fusion to be about 26%.In this meta-analysis 94 studies from 19 countries with 34716 patients were included to reveal the prevalence of radiological adjacent segment degeneration was 4.8% to 92.2%.(15)

However, the incidence of repeated lumbar surgery performed for this degeneration was much lower and ranging from 2% to 15%. All of the studies document, at least to some degree, disc degeneration at the adjacent segment.(16)

Many studies have described the occurrence of cranial ASD after L4/5 with little studies focused on the caudal segment (L5/S1) degeneration especially after single L4/5 fusion.(5)

Kaito et al (17) reported that after L4/5 PLIF for their 85 patients, none of them underwent surgery at the L5/S1 although the presence of preoperative degeneration at this level ,but they focused more on cranial ASD as they considered L5/S1 degeneration rarely causes clinical manifestations.

Nakai et al (18), in their study after a mean 8.6 years of follow up reported that they often observed ASD at a cranial adjacent segment after PLIF.

Accordingly, it has been thought that ASD often occurs at a cranial segment after fusion surgeries. Okuda et al (19) in a study with minimum 10 years follow up for patients

underwent single L4/5 fusion reported that O-ASD was mainly observed at L3/4 level (77%), followed by L5/S1 segment (13%) and then by both segments (10%).

Therefore, all reports of studies of ASD after L4/5 PLIF, described L3/4 ASD occurrence after fusion surgery with little focus on L5/S1 degeneration as they reported that it didn't require surgical intervention.(16)

All this debate may be contributed to the fact that some surgeons will add S1 fusion in presence of L4/5 pathology to avoid increasing the stress on L5/S1 to avoid the need of reoperation on the future. Thus, the debate will be higher in the presence of L5/S1 degeneration.

On the other hand, some studies focused only on the L5/S1 level after single L4/5 fusion or what is called floating L5 fusion, especially it is well known there are sparing L5/S1 when doing surgery for obvious pathology at L4/5 (20) and previous studies have shown that there are inferior results of two-level fusions compared with single-level fusions (21). Also L5/S1 fusion reported to affect sacroiliac joint accelerating its degeneration (22). While the preservation of L5/S1 motion decrease the postoperative buttock stiffness complaint. (14)

With all these controversies, the main goal of this study was to observe L5/S1 segment after single L4/5 single fusion in presence or absence of preoperative L5/S1 degeneration especially only one study focused on the existence of preoperative L5/S1 degeneration and its effect on the clinical and radiological outcome.so the study aimed to add another experience on this topic.

Our observations show that only three patients showed clinical deterioration with only one needed surgical intervention.

However radiological degeneration progressed and was high in patients with preoperative L5/S1 degeneration than those with intact l5/S1, which accepted with previous study hat reported progression of L5/S1 degeneration radiologically but without clinical deterioration.(23)

Choi et al (5), in their study have evaluated the L5/S1 segment after isolated L4/5 surgery with MIS-TLIF and ALIF for 7 years using different modalities of radiology in their follow up and reported that the presence of pre-existing L5/S1degeneration doesn't affect the clinical and radiological outcome after isolated L4/5 fusion with incidence of (12.1% vs. 18.2 % radiologically) and (5.2% vs 4.5 % clinically) which was correlated with our findings.

Ghieselli et al (20) ,in their series of L5/S1 survivorship after single L4/5 fusion reported that 90% of cases showed no radiological degeneration and there were no cases that shows degeneration had a bad clinical outcome.

In contrast Park et al (8) reported higher incidence of ASD in cases with pre-existing degeneration and this degeneration negatively affected the clinical outcomes.

Two of the previous studies operated with the same approach of our study while choi et al as described before use MIS approach to avoid L5/S1 capsule violation and decrease the incidence of L5/S1 arthropathy. This coincides with penta et al(24) who advocates the ALIF fusion to decrease the incidence of L5/S1 degeneration. But this approach needs more experience and training opposite to PLIF approach which is familiar to spine surgeons. Delicate dissection and high care may decrease the chance of L5 capsule violation and subsequent degeneration.

Limitation of our study included short period follow up, variation in patient's weight ,few numbers of patients and type of fusion .Further studies are recommended to compare extended fusion to single level one.

Conclusion

L5/S1 segment could be safely spared in cases of L4/5 fusion in the presence of preoperative L5/S1 degeneration if the clinical symptoms are not correlated to the degeneration.

Table (1) comparison of patient characteristics according to the presence or absence of preoperative L5/S1 degeneration

	Preoperative degeneration	Non existing degeneration	P value
No.	17	24	
M/F	6:11	10:14	
Age	49.56±7.59	50.76±8.11	0.66
VAS pre back	6.73±1.02	6.68±1.09	0.48
VAS pre leg	6.81±0.9 1	7.01±0.89	0.271
ODI pre	62±15	58±18	0.216
VAS post back	2.54±0.74	2.94±0.67	0.188
VAS post leg	2.08±0.86	2.09±0.64	0.179
ODI post	23±19.2	18.5±16.2	0.152

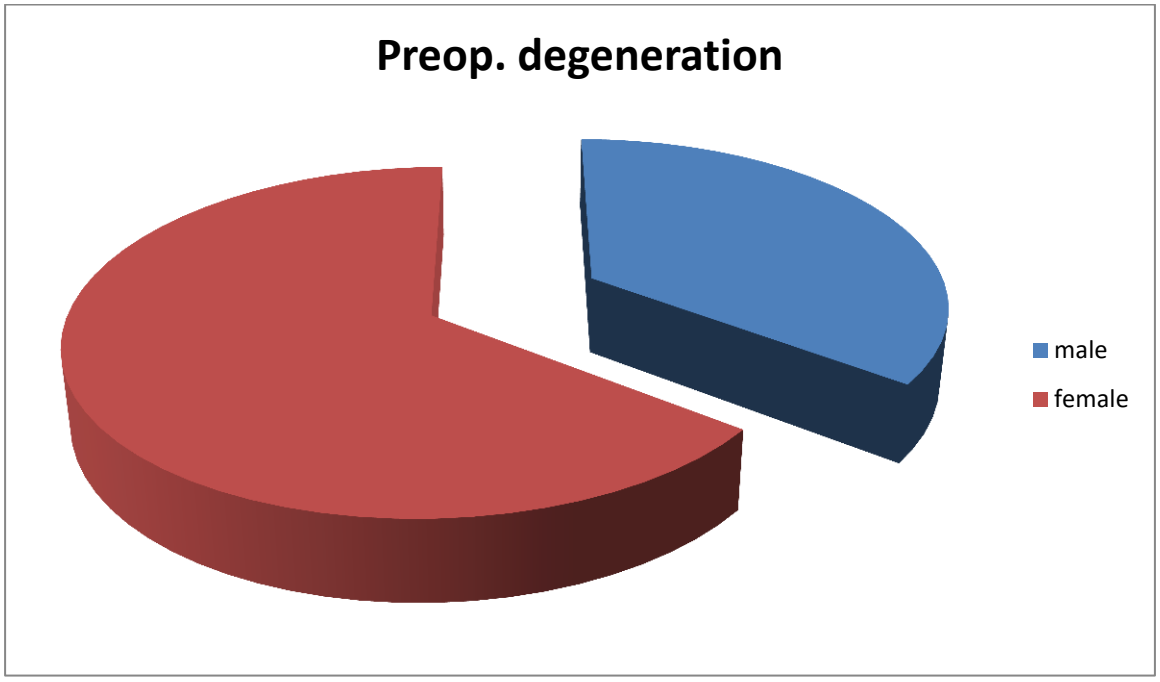

Fig. (1) : pie chart for gender percentage in the first group with preoperative L5/S1 degeneration [17 cases] M/F 6:11

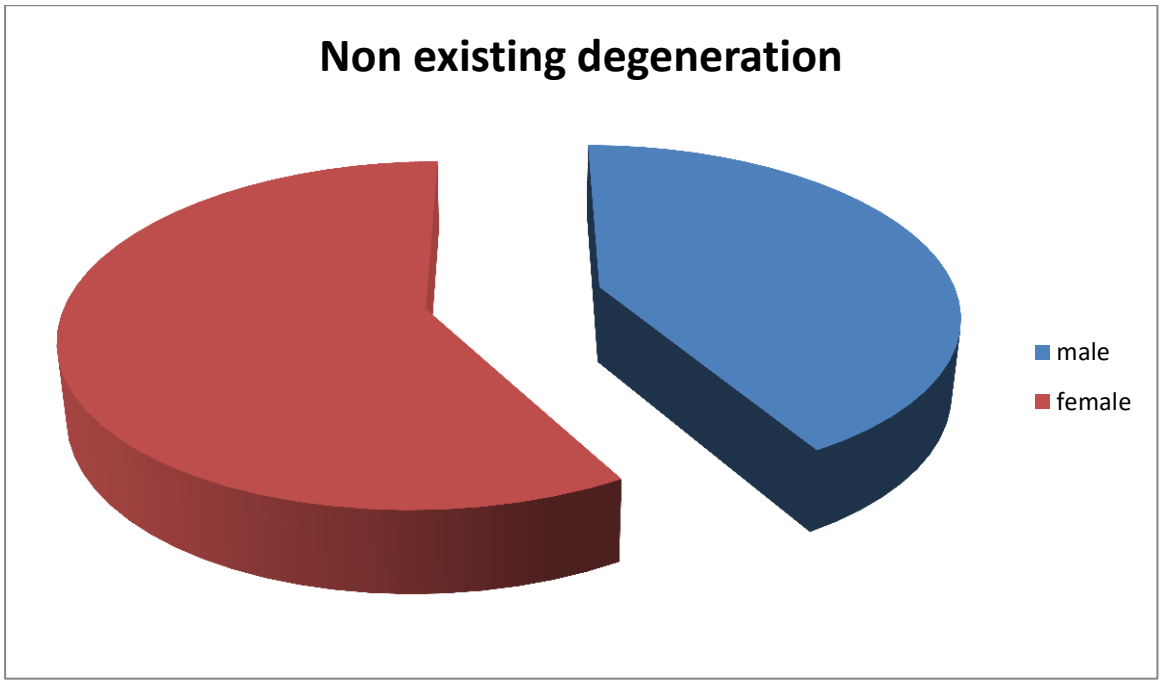

Fig. (2) : pie chart for gender percentage in the second group with preoperative L5/S1 non existing degeneration [24 cases] M/F 10:14.

Fig. (3) radiology of female patient 47 years old with L4/5 spondylolithesis underwent fixation with 4 screws + 2 rods..(A) sagittal T1 LSS MRI shows L4/5 spondylolithesis with no L5/S1 degeneration.(B) sagittal T2 LSS MRI shows L4-5 spondylolithesis with preserved L5/S1 disc space.(C) preoperative LSS X-ray AP view.(D) postoperative L4/5 fusion with 4 screws and 2 rods.(E) preoperative LSS X-

ray laterasl views showing L4/5 spondylolithesis.(F) postoperative LSS X-ray shows L4/5 fusion and decrease in L5/S1 disc height.

List of abbreviations:

DS degenerative spondylolisthesis

VAS visual analogue scale

ODI Oswestry disability index

ASD adjacent segment disease

M/F male / female

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