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Reduction versus In Situ Fusion in High-Grade Spondylolisthesis

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ABSTRACT

Background Data: Surgical management for high-grade spondylolisthesis is challenging and associated with high morbidity. There are many surgical techniques available for lumbosacral fixation and correction that differ in approaches and outcomes. The main concern during surgery is to decompress the neural element, correct focal kyphotic deformity, and restore or maintain global sagittal alignment.

Purpose: The purpose of this study was to present a case series of patients with high-grade spondylolisthesis who were treated with reduction and fixation and compare the results to in situ fusion technique.

Study Design: Retrospective observational study.

Patients and Methods: We retrospectively reviewed patients with L5/S1 high-grade spondylolisthesis who underwent surgery at our institute in the period between March 2013 and March 2017. Patient's demographic, preoperative, and postoperative data were collected. Taillard's technique and Meyerding's grade for spondylolisthesis were assessed for all cases. Additionally, we measured the pelvic incidence (PI), sacral slope (SS), and pelvic tilt (PT) pre- and postoperatively. The Bridwell grading system was used to assess the degree of radiographic fusion. Preoperative and postoperative clinical outcomes were evaluated using Visual Analog Scale (VAS) and the Oswestry Disability Index (ODI). Complication rates were collected during the follow-up period.

Results: We included 16 cases in the current study. Patients were divided into two groups: reduction group includes nine patients, and in situ group includes seven. There was no significant difference in demographics or radiological data between groups. Moreover, operative data demonstrated comparable results between the two groups ($P<0.05$). Reduction group showed significant increase in L5 palsy compared to the in situ fusion group (0.037), although reduction showed more significant changes regarding correction of deformity (PT and SS). Both techniques were efficient in relieving pain and improving disability at 3-month and last follow-up visits ($P<0.001$).

Conclusion: The present study showed that both reduction and in situ fusion techniques are effective surgical tools in improving clinical outcomes for patients with L5/S1 high-grade spondylolisthesis. Attempt of complete reduction carries a high risk of L5 nerve root injury. Partial reduction under

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complete L5 nerve root decompression and visualization is crucial in reducing risk of injury. However, reduction technique demonstrated superior deformity correction at the index level of spondylolisthesis. (2019ESJ181)

Keywords: High-grade spondylolisthesis, reduction, in situ fusion, lumbar spine, degenerative

INTRODUCTION

Spondylolisthesis is defined as translocation of one vertebral body over another adjacent vertebra in the anterior direction without any defect in the pars interarticularis.[18] Leon L Wiltse[26] has classified this condition into five main groups and this classification was broadly accepted. Isthmic (Type 2, 85% of cases) and dysplastic (Type 1, 15% of cases) spondylolisthesis are the two most common types in young adults and pediatric population. Moreover, it has been reported that the abovementioned two types have in common a strong genetic susceptibility and a significant ethnic variability.[27]

The most commonly encountered type is dysplastic spondylolisthesis that is caused by developmental abnormalities of the lumbosacral junction, while defects and elongation of the pars interarticularis are the main causes of isthmic spondylolisthesis (i.e., spondylolysis). The degree of slippage is commonly measured by the Meyerding grading system. "Spondyloptosis" is defined as the condition where L5 vertebral body is exposed to complete dislocation in front of the sacrum.[5]

The indications for surgical correction and intervention include presence of neurological deficits, progressive deformity in growing children (>50% slippage), or noncompliance to conventional management in adults.[14,22]

The definitive treatment for high-grade spondylolisthesis remains a matter of debate. This may be due to the fact that most of the performed studies involved a variety of types and grades of spondylolisthesis making the assessment of the results of a specific treatment approach to the special entity of high-grade spondylolisthesis a very difficult process. For many years, reducing spinal deformity was performed before fusion surgery with attractive results; however, the issue of surgical reduction versus ''in situ'' fusion is still a matter of debate.[8,21]

PATIENTS AND METHODS

This is a retrospective observational study conducted at the Department of Neurosurgery, Mansoura University, in the period between March 2013 and March 2017. The study was approved by the local ethical committee. All patients were retrospectively reviewed by clinical and radiological assessment, within minimum 2-year follow-up period.

Sixteen patients were included in the study. Patients were randomized into two groups: Group I included 9 patients who underwent reduction with posterior lumbar interbody fusion at the index level; Group II included 7 patients who underwent in situ fusion.

Radiographical measurement of spondylolisthesis was performed utilizing the Taillard technique and the Meyerding grade. Pelvic incidence (PI), sacral slope (SS), and pelvic tilt (PT) were evaluated as proposed by Roussouly.[20]

Surgical Technique:

At first, the transverse processes of L5 and S1 were exposed and exposure of L5 and S1 roots by the Gill procedure was accomplished to expose L5 nerve roots laterally.

Reduction Group. After L5 and S1 laminectomy and medial facetectomy, bilateral pedicle screws insertion at L4 and S1, and temporary rods placement and distraction maneuver, the L5/S1 disc was then excised, followed by more distraction to easily access L5 pedicles and insertion of bilateral reduction screws. Visualizing and protecting L5 roots are crucial during L5 screw placement to avoid nerve root injury. The slipped vertebral

body was carefully reduced after connecting the reduction screws to new rod on one side (Figures 1 and 2). Following endplate preparation at the index level and bone graft insertion, the interbody cage was then implanted on the other side, followed by rod insertion. Finally, more lumbar lordosis was created by forceful insertion of the pedicle screws in compression.

'In Situ'' Fusion Group. Following L5 and S1 decompression, patients underwent posterior transvertebral/transdiscal fixation using 7 or 8 mm screw for robust fixation of L5/S1 vertebrae. Transvertebral screws were then connected to rostral adjacent pedicle screws to involve additional points of fixation (Figures 3, 4, and 5). The compression was conducted after completing instrumentation.

Outcome Measures:

Demographic data, indication for surgery, operative and perioperative data, and complications were recorded. Patients completed preoperative and postoperative Visual Analog Scale (VAS) for pain and the Oswestry Disability Index (ODI) along with patient satisfaction questionnaires at 3- and 6-month follow-up visits.

Radiographic assessment for the degree of fusion was done by using the grading criteria of Bridwell:[17] Grade I, fused with remodeling and trabeculae present; Grade II, graft intact but not fully remodeled and incorporated but no lucency present; Grade III, graft intact, potential lucency present at the top and bottom of the graft; Grade IV, fusion absent with collapse or resorption of the graft.

Patient satisfaction was assessed via "five-point Patient Subjective Outcome scores" (worse, unchanged, fair, good, and excellent). Moreover, we included also two questions: ''Do you think that the surgery was worthwhile?'' ''Under the same conditions, would you have the surgery again?''

All the radiological parameters for all the patients were measured retrospectively and independently reviewed.

Statistical Analysis:

The collected data were coded, processed, and analyzed using the SPSS version 22 for Windows® (SPSS Inc., Chicago, IL, USA). Qualitative data was presented as number (frequency) and percent. Comparison between groups was done by chi-square test. Quantitative data was tested for normality by Kolmogorov–Smirnov test and was expressed as mean±SD. Student's *t*-test was used to compare normally distributed data between two groups and Mann–Whitney *U* test was used to compare abnormally distributed data between the two groups. Paired sample *t*-test was used to compare patients in the same group at different time points. For all tests, $P<0.05$ was considered to be statistically significant.

RESULTS

Demographics and Clinical Data

Our study included 5 females (55.55%) and 4 males (44.44%) in the reduction group, while the other group included 4 females (57.14%) and 3 males (42.85%). The mean BMI of the included cases was 23.48 and 23.46 kg/m^2 for both groups, respectively. Furthermore, the mean age was 31.53±5.26 (range, 25–42) and 32.17±4.95 (range, 23–41) years, respectively. Our cases were classified according to the Meyerding classification: the reduction group included four cases for grades III and IV, while the in situ fusion group included 4 cases with grade III and 2 cases with grade IV. Both groups included one case of spondyloptosis. After surgery, the mean follow-up duration was 28.25±4.02 (range, 19–39) and 29.98±3.59 (range, 21–39) months, respectively. All the previous variables do not seem to be significantly different between the two study groups ($P>0.05$) (Table 1).

Operative Data

The mean amount of blood loss was 239±109.5 (range, 75–700) ml and 242±101.4 (range, 60–675) ml for both groups, respectively. Operative time did not significantly differ between the two groups, being 190.58 (range, 118-248) and 180.75

(range, 125-232) min, respectively. Regarding complications, two cases in the reduction group experienced L5 nerve palsy postoperatively, while this complication was not reported in the other group (P=0.037). Superficial wound infection occurred in one case in each group. Hospital stay did not differ also between the two groups (4.5±1.32 (range, 2–10) and 4.36±1.54 (range, 1–9) days, respectively). These data are illustrated in Table 2.

Correction of Deformity

The degree of deformity correction was evaluated by comparing pre- and postoperative standing whole spine X-ray films of all the cases at the latest follow-up. The cases who underwent ''in situ'' fusion correction of deformity did not reveal any statistically significant difference at the last follow-up in regard to PI, PT, and SS, while the other group who underwent reduction revealed significant reduction of PT (from 40±16 (range, 17–70) preoperatively to 32±14 (range, 17 –54) postoperatively). Moreover, SS has increased significantly from 36±11 (range, 9–47) up to 48±12 (range, 21–61). The test employed for PI and SS test is paired sample *t*-test and for PT Wilcoxon signed-rank test. These data are illustrated in Table 3.

Clinical Outcomes

All cases were evaluated for the degree of fusion. Grade I fusion was detected on 5 and 3 cases in the study groups, respectively (55.55% and 42.85%), while grade II was detected in 2 cases in each group (22.22% and 28.57%). Both grades III and IV were represented in one case in each group. The majority of patients' satisfaction scores were ranging between excellent and good for both groups. In terms of the satisfaction scores, one case in each group reported the clinical outcome as unchanged or fair (Table 4).

Pain and Disability

According to VAS and ODI scores, there was a significant improvement of pain and disability for both groups at 3-month and last follow-up visits (P<0.001) (Table 5).

Table 1. Patient's demographics.

Parameters	Reduction (N=9)	In Situ fusion (N=7)	P value
Age	31.53±5.26	32.17±4.95	0.774
Gender			
Male -Female	4 (44.44%) 5 (55.55%)	3 (42.85%) 4 (57.14%)	0.827
BMI	23.48±1.52	23.46±1.82	0.936
Meyerding classification			
-III -IV -Spondyloptosis	4 4 1	4 2 1	0.856
Slip vertebra			
-L4 -L5	3 6	3 4	0.714
Follow-up	28.25±4.02	29.98±3.59	0.693

Table 2. Operative and perioperative data.

Parameters	Reduction (N=9)	In situ fusion (N=7)	P value
Blood loss	239±109.5	242±101.4	0.746
Operative time	190.58±48.3	180.75±40.16	0.524
Complications			
L5 nerve palsy	2 (22.22%)	0 (0%)	0.037
Wound infection	1 (11.11%)	1 (14.2%)	0.746
Hospital stay	4.5±1.32	4.36±1.54	0.834

Table 3. Correction of deformity.

Group	Parameters	Preoperative	Postoperative	P value
Reduction	-PI	75±14	77±16	0.612
	-PT	40±16	32±14	0.024*
	-SS	36±11	48±12	0.012*
In situ fusion	-PI	78±18	78±15	0.947
	-PT	26±12	25±13	0.861
	-SS	55±16	56±15	0.831

Table 4. Clinical outcomes using grading criteria of Bridwell and patient satisfaction.

Parameters	Reduction	In situ fusion	P value
Fusion grading			
-I	5	3	0.759
-II	2	2	
-III	1	1	
-IV	1	1	
Satisfaction			
-Excellent	3	2	0.826
-Good	4	3	
-Fair	1	1	
-Unchanged	1	1	
-Worse	0 (0%)	0 (0%)	

Table 5. Pain and disability using VAS and ODI scoring.

Parameters	Group	Preoperative	3-month follow-up	Last follow-up	P value
VAS	-Reduction	7.78±0.48	3.59±0.56	2.38±0.72	< 0.001
	-In situ	7.87±0.86	3.89±0.59	2.29±0.98	< 0.001
ODI	-Reduction	51.56±16.15	29.56±10.76	19.23±8.65	< 0.001
	-In situ	52.52±9.76	29.48±7.85	18.16±8.16	< 0.001

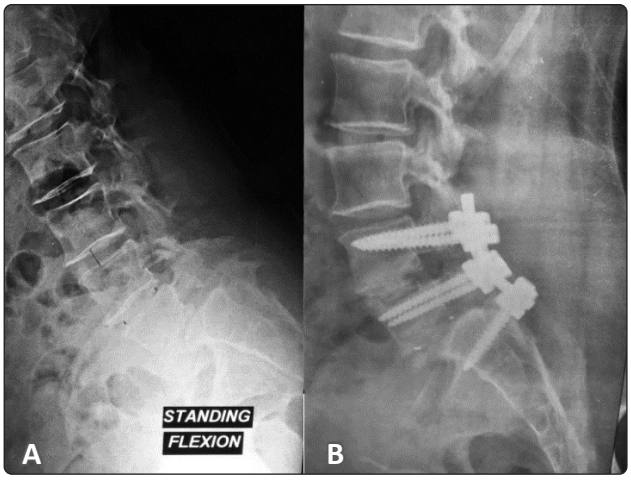

Figure 1. (A) Preoperative standing lateral view LSS X-ray shows L5/S1 high-grade isthmic spondylolisthesis. (B) One-year postoperative standing lateral view LSS X-ray illustrates partial reduction and L4/5/S1 fixation with intervertebral cages.

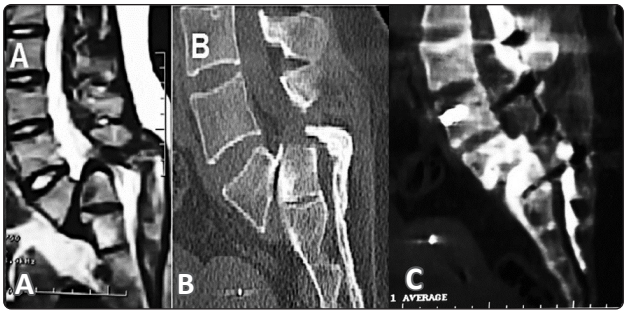

Figure 2. (A) Preoperative sagittal T2 LSS MRI shows L5/S1 isthmic high-grade spondylolisthesis "spondyloptosis". (B) Sagittal reconstruction LSS computed tomography (CT) image for the same patient shows L5/S1 spondyloptosis. (C) One-year postoperative sagittal reconstruction LSS CT image shows partial reduction and fusion at index level with L5/S1 intervertebral cage.

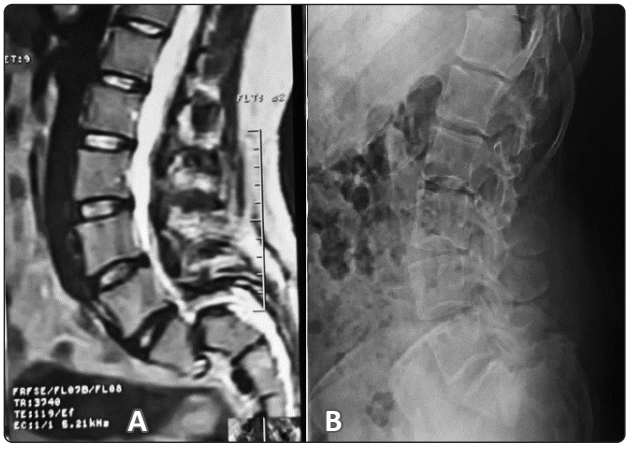

Figure 3. (A) Preoperative sagittal T2 LSS MRI shows L5/S1 isthmic high-grade spondylolisthesis "spondyloptosis". (B) Preoperative standing lateral view LSS X-ray shows L5/S1sponyloptosis.

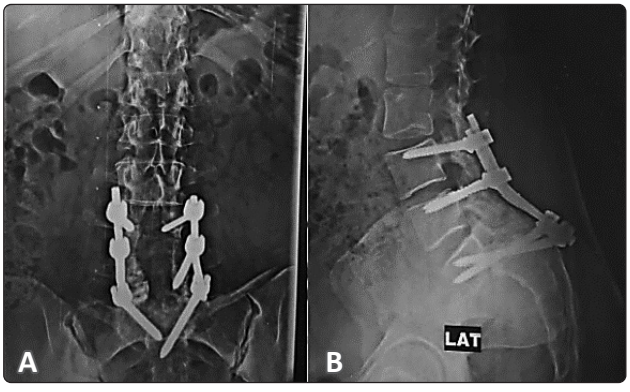

Figure 4. One-year postoperative standing anteroposterior (A) and lateral (B) LSS plain X-ray shows in situ fusion at the index level of surgery utilizing S1/L5 transvertebral/transdiscal screws.

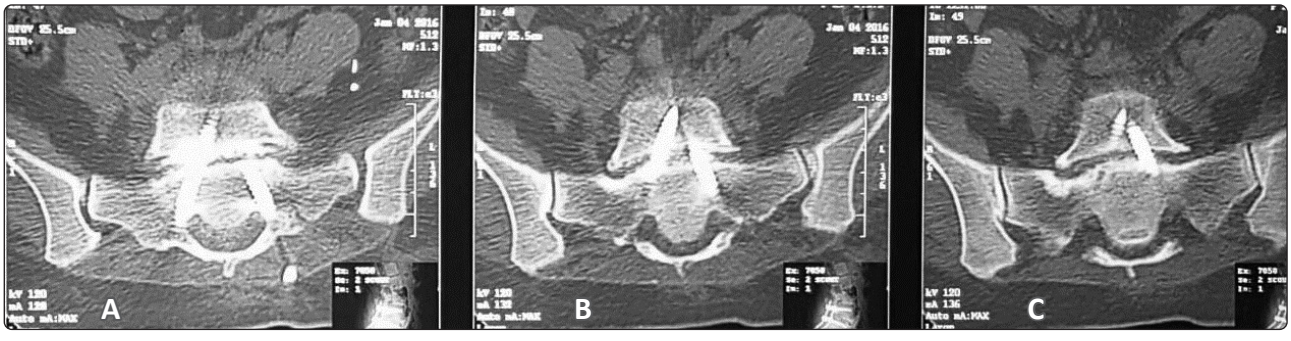

Figure 5. (A, B, C) Postoperative serial axial CT images at L5/S1 level shows bilateral transvertebral S1-L5 screws.

DISCUSSION

Pain relief is the main purpose of surgical management of spondylolisthesis; however, selection of the optimal surgical procedure is still under discussion. An increasing attention has been given to the correction of associated deformity or spinal imbalance before or during the surgery.[9,10,11] Although in situ fusion is the most commonly performed surgical procedure, it has been associated with multiple complications like pseudarthrosis (incidence 0-19%), extension of the fusion to a normal L4 level, and worsening of all the indicators of the deformity, especially the slip angle. On the other hand, prefusion instrumental or noninstrumental reduction, particularly in patients with grade 3 and 4 spondylolisthesis, has been reported to decrease the incidence of pseudarthrosis between 0% and 8%. Moreover, adding of anterior fusion and structural grafting has been recently shown to be related to highly successful fusion rates with reduction of high-grade spondylolisthesis. The use of a different reduction technique has been associated with higher fusion rates; however, it has been also linked to many complications such as neurologic deficits, prolongation of treatment period, and failure of reduction.[25]

During our study, 16 patients with spondylolisthesis who underwent fixation were retrospectively analyzed. The cases were classified into two groups: reduction group and the in situ fusion group; there were no statistically significant differences between the two groups in the studied outcomes including spinal fusion rate and perioperative outcomes.

In our study, the mean age of the included cases was 31.53 and 32.17 years, respectively. Moreover, there was no statistically significant difference between the two groups regarding sex, age, BMI, or spondylolisthesis class. Another study[12] evaluated the same two techniques and included patients with average age of 19.6 years (range, 15.8–27.9 years).

Fan and his associates performed a study of cases with isthmic spondylolisthesis who underwent reduction versus in situ fusion and compared the different clinical outcomes between the two groups, but they used the minimally invasive techniques. Similar to our study, age, sex, and BMI did not differ significantly between the two study groups (P>0.05), whereas they included cases with Meyerding class I and class II.[3] On the contrary, our study included cases with grade III and IV spondylolisthesis and two cases of spondyloptosis.

When it comes to the operative data, both groups showed more or less equal amount of blood loss and operative time in our study. The mean amount of blood loss was 239 and 242 ml for both groups, respectively, while operative time taken for both groups was 190.58 and 180.75 minutes, respectively.

In the study conducted by Martiniani et al.[12] the mean operative time for the reduction group was 216 minutes and mean intraoperative volume of blood loss was 330 ml, while in situ fusion group experienced a mean operative time of 165 minutes and mean blood loss of 210 ml.

In 2002, Kawakami et al.[9] performed a study in patients with degenerative spondylolisthesis who underwent surgical fusion and they reported improvement in the early clinical outcomes. The lordosis of the fused segments increased. Moreover, the position of the plumb line in front of the sacrum was <35 mm.

As described by some author,[13] the PI is an important anatomic parameter that describes the shape of the pelvis and affects the sagittal spinopelvic alignment through influencing the spine and pelvis configuration. PI is calculated by adding two position-dependent variables together, SS and PT, and both parameters determine the pelvic orientation in the sagittal plane. This mathematical correlation between the three parameters (PI, SS, and PT) could be utilized to explain that the spatial position of the pelvis and the spine in the standing position is greatly determined by the morphology of the pelvis.

In a recent study,[12] the sagittal alignment of the spine was analyzed in patients with high-grade spondylolisthesis and they were classified into two separate groups termed as ''balanced'' and ''unbalanced'' pelvis. Compared to the control population, the balanced group had similar PT and SS, but they had higher PI. On the other hand, the unbalanced group had high PT and a low SS that made the sagittal spinal alignment different from the balanced and the control groups. These findings suggested that the reduction techniques could be of a great importance in unbalanced pelvis patients.[6] Furthermore, the incidence of pain is increased in cases with excessive PT.

The outcomes of ideal surgery should include restoration of normal anatomy with reducing the extent of functional disability and this is achieved by performing the shortest possible fusion to completely correct the local deformity. Complete reduction of L5/S1 slippage with segmental lordosis restoration and sacral position correction (restoration of the normal values of PT) allows restoration of the normal sagittal alignment. This also decreases the probability of adjacent disc degeneration through normalization of the load distribution in the surrounding segments.[12]

In this study, the reduction group showed more changes regarding the deformities present. PT showed a significant reduction after surgery (40 down to 32, P=0.024), whereas SS showed a significant increase (36 up to 48, P=0.012). On the other hand, neither PI of the reduction group nor in situ fusion indices experienced significant changes after surgery (P>0.05).

Changes in SS and PT are considered relatively small when considered at the level of the entire cohort; however, when comparing two individual surgical subgroups, these changes revealed a statistically significant difference. PT, SS, and grade were compared at the last follow-up and they did not reveal any significant change in the six patients treated with ''in situ'' fusion; however, in the 10 patients treated with correction of the deformity, there was a significant change compared to the preoperative value. Generally speaking, sacral slope has increased significantly after surgery (from 36 to 47, P<0.01), whereas pelvic tilt has decreased significantly (from 41 to 30, P<0.01).[12]

According to the findings of another study,[14] the patients with unbalanced pelvis need the reduction of the deformity technique, but this was not necessary in cases with balanced pelvis as they only need surgical fusion without correction. The main purpose of reducing surgical intervention is to decrease the incidence of iatrogenic injuries that have been reported to occur in 10%–25% of the cases.[7,23] For example, injury to L5 nerve is the most reported iatrogenic neurological deficit associated with reduction.[4,15]

In our study, the reduction group showed a significantly higher complication rate regarding L5 nerve palsy (2 cases vs. 0 cases in the other group, P=0.037). On the other hand, superficial wound infection occurred only in one case in each group (P=0.746).

Martiniani et al.[12] has also reported that there was 1 superficial wound infection and two patients had signs of a L5 root lesion after surgery. One of these two patients required further decompression of L5 roots.

It has been found in studies performed on cadaver studies that the strain on L5 nerve does not follow a linear pattern.[19] If the reduction process of a 100% slippage is divided into two halves, the first half of the reduction forms only 29% of the total strain, while the second half of the reduction process includes the remaining 71% of strain. In the same study, improvement of the lumbosacral kyphosis markedly reduced the tension at the L5 nerve demonstrating the benefits of correcting sagittal balance.[2]

Posterior approach without reduction by using of pedicle screw fixation had been performed in a study conducted by Boachie-Adjei et al.[1] in six cases to improve lumbosacral kyphosis. At the final step of follow-up, in all cases, complete fusion and improvement of slip angle were achieved, and there were no neurological injuries. The correction of the kyphotic deformity, as

suggested by the authors, should be the main goal of the intervention without reduction as opposed to the slippage percentage. Such studies reveal the benefit of prioritizing lumbosacral kyphosis correction over translational reduction.

The prone position in those patients may indirectly decrease the anterolisthesis, so reduction is not always necessary.[16] A larger retrospective study was conducted by Scheer on 282 patients with degenerative spondylolisthesis who underwent fixation with and without a reduction. Higher fusion rate (84.5% vs. 70.8%) and increased EBL (280.2 vs. 212.6 cc) were observed in the group who underwent the reduction. However, the group with reduction did not reveal any significant difference regarding the length of hospital stay, intraoperative complications, and postoperative complication rates as compared to the group without reduction.[23]

In our study, grade I fusion was detected in 5 and 3 cases in the study groups, respectively (55.55% and 42.85%), while grade II was detected in 2 cases in each group (22.22% and 28.57%). Grades III and IV were represented in one case in each group. The majority of patients' satisfaction scores were ranging between excellent and good for both groups (77.78% vs. 71.42%, resp.). For the fair and unchanged satisfaction scores, one case reported each grade in each group. Fusion grading and patient satisfaction did not show any significant difference in that study.

In the study conducted by Fan et al. it was reported that the spinal fusion rate was 91.67% (22/24) in the reduction group and 85.71% (18/21) in the in situ group (P=0.835). Moreover, the same study reported that patient satisfaction was excellent to good in 83.33% and 80.95% for both groups, respectively, and these values were slightly higher than our results.[3] This can be due to the fact that the latter study used the minimally invasive techniques which generally have a better postoperative course and patient satisfaction when compared to the traditional open surgery.

An Egyptian study[24] was conducted on 12 cases with grade 4 isthmic spondylolisthesis to report the clinical and radiological outcome of instrumented reduction and transforaminal lumbar interbody fusion (TLIF). There was a significant drop of back pain as evaluated by VAS (from 7.3 preoperatively to 2.2 postoperatively). At the last follow-up, ODI decreased from 41 to 12. Moreover, solid fusion was obtained in 75% with another 16.7% stable constructs without bridging bony fusion. This study concluded that instrumented surgical reduction and TLIF provide a safe and effective way of treating adult high-grade spondylolisthesis. On assessment of pain and disability at follow-up visits of our cases, it was evident that there was a significant improvement of both VAS and ODI scores at the last and 3-month follow-up visits when compared to the preoperative values (P<0.001).

In another study,[3] VAS and ODI showed no statistically significant difference between the 2 groups preoperatively, at the routine 3-month follow-up and at the last follow-up (P>0.05); however, comparison of both scores revealed a statistically significant difference between the different time points within the two groups (P<0.05).

Our retrospective study has several limitations. First, we failed to recall how the patients were selected for reduction as the surgeon did not apply a definite grouping criterion; this was due to inherent shortcomings of the retrospective setting. The selection of operation type was depending mainly on the surgeon's choice, but many authors have admitted that the surgeon's preference and experience might play a role. Regardless, the potential selection bias should be noticed when the data of this retrospective study are interpreted. Second, the 2-year duration of follow-up is considered a relatively short duration of follow-up. Certainly, it is recommended to keep following up the patients for longer duration. Finally, this study is considered a small-scale one, as it was conducted by a single surgeon at a single center. Further prospective and randomized control studies with larger populations are needed to elucidate these findings.

CONCLUSION

The present study showed that both reduction and in situ fusion techniques are effective surgical tools in improving clinical outcomes for patients with L5/S1 high-grade spondylolisthesis. Attempt of complete reduction carries a high risk of L5 nerve root injury. Partial reduction under complete L5 nerve root decompression and visualization is crucial in reducing risk of injury. However, reduction technique demonstrated superior deformity correction at the index level of spondylolisthesis.

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الملخص العربي

الرد الجراحي مقابل الإلتحام في الموقع لعلاج الإنزلاق الفقاري ذو الدرجة العالية

البيانات الخلفيه: التدخل الجراحي لعلاج الإنزلاق الفقاري ذو الدرجة العالية لا يزال يمثل تحديًا ويترافق ذلك مع إرتفاع معدلات المضاعفات لهؤلاء المرضي. هناك العديد من التقنيات الجراحية المتاحة للتثبيت والتصحيح الفقاري القطني التي تختلف في النهج والنتائج .الشاغل الرئيسي أثناء الجراحة هو إلغاء الضغط علي العنصر العصبي وتصحيح التشوه البؤري واستعادة أو الحفاظ على التوافق السهمي الشامل.

الغـرض: تقديم سلسلة من الحالات لمرضى يعانون من الإنزلاق الفقاري عالي الدرجه الذين عولجوا مع الرد والتثبيت ومقارنة النتائج مع طريقة الالتحام في الموقع.

تصميم الدراسه: تقييم سلسلة من الحالات بأثر رجعي من الناحبة السريرية والإشعاعية.

المرضـي والطـرق: جرى استعراض بأثر رجعي 16مريضا من الانزلاق الفقاري عالي الدرجه الذين خضعوا لعملية جراحية في الفترة بين مارس 2013 ومارس 2017 . تم تقييم نتائج ما قبل الجراحة وبعد العملية الجراحية للمرضى بما في ذلك (VAS) و(ODI) وأيضا تم جمع معدل المضاعفات بين الطريقتين الجراحيتين.

النتائج: أدرجنا 16 حالة في الدراسة الحالية. تم تقسيم المرضى إلى مجموعتين؛ وشملت مجموعة رد الانزلاق مع التثبيت تسعة مرضى بينما شملت المجموعة الالتحلم في الموقع سبعة. لم يكن هناك اختلاف كبير في التركيبة السكانية أو البيانات الإشعاعية بين المجموعات. أظهرت مجموعة رد الانزلاق زيادة كبيرة في الشلل L5 مقارنة بمجموعة الالتحام في الموقع , على الرغم من أن رد الفقرات أظهر تغييرات أكثر أهمية فيما يتعلق بتصحيح التشوه (PT و SS). كانت كلتا التقنيتين فعالتين في تخفيف الألم وتحسين الإعاقة في 3 أشهر .

الاستنتاج: أظهرت دراستنا أن كلا من تقنيات الرد والإلتحام في الموقع هي أدوات جراحية فعالة لتحسين النتائج السريرية لمرضى الإنزلاق الغضروفي الفقري عالي الدرجه. محاولة الرد كامله تحمل مخاطر عالية لإصابة جذر العصب L5 ويعد الرد الجزئي مع تخفيف الضغط الكامل لجذر العصب L5 أمرًا ضروريًا للحد من خطر اصابته.