ORIGINAL ARTICLE

Assessment with Oswestry disability index in surgically treated patients with lumbar spondylolisthesis: experience in 96 patients

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Abstract

Objectives: To assess the outcome of surgical treatment in spondylolisthesis of lumbosacral region using Oswestry disability Index.

Methods: The quasi-experimental study was conducted at the Combined Military Hospital, Rawalpindi from 2006 to 2013 and comprised surgically treated patients with spondylolisthesis. The patients with degenerative and isthmic types with follow-up of at least two years were included. A performa was designed for each patient and records were kept in a custom-built database. Oswestry disability index was used as the assessment tool and assessment was done pre-operatively, at 1, 3 and 6 months and then at 1 year and 2 years.

Results: There were 96 patients with mean pre-op Oswestry disability index score of 81.06% (range 42.22-100, SD ±11.99). L5-S1 was affected in 44 (45.83%) patients, L4-L5 in 30 (31.25%), L4-5-S1 in 7 (7.29%) and multi or high level was found in the rest of the cases. One level was involved in 77 (80.2%), 2 in 11 (11.45%), 3 in 7 (7.29%) and 4 in 1 (1.04%). The slip grade as per Meyerding grades was 1 in 31 (32.29%), II in 39 (40.62%), III in 19 (19.79%), IV in 5 (5.2%) and 2 (2.08%) had spondyloptosis. Mean follow-up was 42 months (range 24-63). Mean Oswestry disability score at 1 month was 38.51% (range 11- 62.22%, SD ±11.75); at 6 months 10.02% (range 0-40%, SD ±6.99); at 1 year 4.62% (range 0-24%, SD ±5.36) and at 2 years 4.21% (range 0-15%, SD ±4.2).

Conclusion: Surgical treatment of spondylolisthesis gives excellent long-term result in most patients.

Keywords: Spondylolisthesis, Spondylolysis, Pedicle screw fixation, Posterior lumbar inter body fusion. (JPMA 65: S-166 (Suppl. 3); 2015)

Introduction

Spondylolisthesis is forward slipping of vertebra above in relation to its lower one. This was classified on an anatomic basis by Wiltse and Rothman into dysplastic, isthmic, degenerative, traumatic, pathologic and iatrogenic.[1] The degree of forward slip is measured by quartiles of anteroposterior (AP) diameter of vertebra below with Meyerding grades into I, II, II, IV and V or spondyloptosis.[2] Meyerding grade I and II are also called low-grade and 3, 4 or 5 are high-grade slips.[3] On clinical examination, lumbar hyperlordosis, flexed knee position, tight hamstrings and paraspinal muscle spasm are examined. The new physical examination test for spondylolisthesis and instability are low midline sill test and interspinous gap change tests. The low midline sill sign is helpful in diagnosing spondylolisthesis with 81.3% sensitivity and 89.1% specificity and interspinous gap change tests are effective for the detection of instability.[4] Isthmic type 2 is most common in young population. The aetiology is uncertain and causation appears to be multifactorial.[5] The degenerative (type III) is most common in older age group results from degenerative changes in spine. The incidence of spondylolisthesis is 5-6% in white males and 2-3% in females, most common level is lumbo-sacral junction (L5-S1) in 82%, lumbar 4-5(L4-5) in 11%, lumbar 3-4 (L3-4) 0.5% and Lumbar 2-3 (L2-3) 0.5% cases.[6] Spondylolysis represents a weakness or stress fracture in pars inter-articularis that can progress to spondylolisthesis especially in childern.[7,8]

The forces acting at lumbosacral junction are determined by pelvic incidence (PI); high PI is associated with slippage as these results in high shear forces at lumbo-sacral junction. In L5-S1 spondylolisthesis, it has been demonstrated that an abnormal sacro-pelvic orientation can disturb sagittal balance of the spine.[9] The high PI incidence is a factor of lumbar isthmic spondylolysis and it has an influence on the slip progression in patients with L5 , but not on the slip progression at L4.[10] The disc vacuum phenomenon is not equal to instability in a vacuum disc and should be considered by a combination of dynamic radiographs.[11] The factors related to the disability are important in standing and can be studied using axially loaded (standing) magnetic resonance imaging (MRI).[12]

The treatment is conservative or operative and the choice of treatment depends upon patient symptoms correlated

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with imaging findings, because spondylolisthesis may be an incidental finding.[13] Conservative treatment is generally recommended in patients when there is no neurological deficit, pain is tolerable or of short duration, improvement by exercise program or by brace treatment and high patient co-morbidity. It is better in low-grade and less-mobile slips and once this fails the operative treatment is better regardless of spondylolisthesis grade, disc height or mobility.[14] When operative treatment is considered, options are osteosynthesis of the defect or spinal fusion with adjacent segment. The repair of the pars defect is a logical alternative to spinal fusion as it preserves the motion segment and prevents abnormal stresses at the adjacent levels.[15] Osteosynthesis of the pars inter-articularis can be achieved with Bucks fusion, hook fixation, and Morscher screw fixation,[16] sub-laminar wiring (Scott's operation) and bone grafting without instrumentation. The spinal fusion with adjacent segment can be achieved by anterior or posterior approaches or combined.[17] Furthermore lateral or axial approaches can also be used in extreme lumbar inter body fusion (XLIF) and axial lumbar inter body fusion (AXIA-LIF). The spine is approached posteriorly for posterolateral lumbar fusion (PLF),[18] posterior lumbar inter body fusion (PLIF),[19] transforaminal lumbar inter body fusion (TLIF).[20] Other methods are transpedicular transdiscal transcorporal screw fixation (TPTDTC) for high-grade spondylolisthesis and spondyloptosis[21] which can be combined with pedicle screw fixation in delta fixation configuration. Minimal invasive TLIF,[22] anterior lumbar inter body fusion (ALIF)[23] as standalone and vertebrectomy (Gaine's procedure) can also be done in selected cases. There is debate among surgeons regarding reduction of displaced vertebra, and fusion can be done without reduction[21] or with reduction.[24] PLIF provides satisfactory results in majority of low to moderate cases with some reduction. TPTDTC and delta fixation is a good procedure for severe slips among adult.[25] Bone grafting is done to enhance healing and to achieve union, and results are comparable if fusion is done with bone chips alone or with artificial cages but the cages provide better functional outcomes.[26] Spondylolisthesis surgery is cost-effective in the long term.[27]

The outcome can be assessed with Oswestry disability index (ODI) which is a valid and vigorous measure and has been used worldwide.[28] This has been translated to many language around the globe, including Urdu in Pakistan.[29] The current study was planned to assess the outcome of surgical treatment in spondylolisthesis of lumbo-sacral region.

Patients and Methods

This quasi-experimental study was conducted Combined Military Hospital (CMH), Rawalpindi, from 2006 to 2013 and comprised surgically treated patients with spondylolisthesis. All surgically treated patients suffering from degenerative or isthmic types of spondylolisthesis and follow-up of at least two years were included. The patients treated conservatively for any reason, lost during follow-up or died were excluded. The patients with infective, tumor and iatrogeic types were also excluded. A proforma was made for each patient and records were kept in a custom-built database. Consent for inclusion in the study was obtained from the patients and approval was obtained from institutional ethics board.

The anterior or posterior approaches were made depending upon the procedure chosen. The patients were anesthetised, turned prone over pillows or bolster for posterior approach. This was done in PLF, PILF, TLIF, TPTDTC and delta fusion. All pedicle screws were placed using anatomical land marks and confirmed under fluoroscopy for level and position. Anterior retroperitoneal approach in supine position was made for ALIF. Improvement in pain intensity, neurological status and union achieved after surgery were studied. Neurologic deficit was described as per the injury impairment scale of the American Spinal Association (AIS) (30). Union was assessed clinically, with functional radiography or thin slice 3D computer tomography (thin slice 3-D CT). ODI was used for assessment, which was done pre-operatively, and then at 1, 3 and 6 months, followed by 1year and 2 years.

Results

There were 96 patients with 56 women and 40 men. There were 10 patients in 3rd decade of age, 14 in 4th, 28 in 5th, 20 in 6th, 13 in 7th, 10 in 8th and 1 in 9th decade. Mean pre- op ODI was 81.06% (range 42.22-100%, SD ±11.99). L5-S1 was affected in 44 (45.83%), L4-L5 in 30 (31.25%),

Table: Pre-operative Oswestry disability index (ODI) score and its improvement.

ODI	Pre operative %	At 1st month %	At 6 months %	At 1 year %	At 2 years %
Mean	81.06	38.51	10.02	4.62	4.21
Maximum	100.00	62.22	40.00	24.00	15.00
Minimum	42.22	11.10	00	00	00

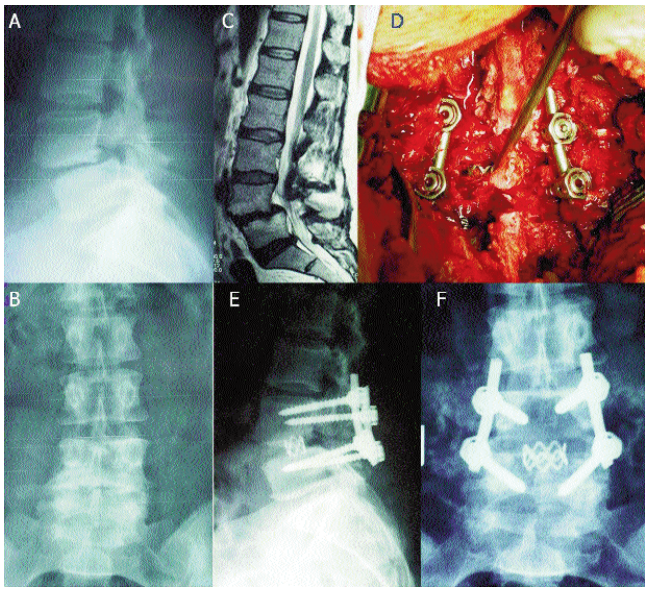

Figure-1: Low-grade degenerative spondylolisthesis treated with posterior lumbar inter body fusion (PLIF).

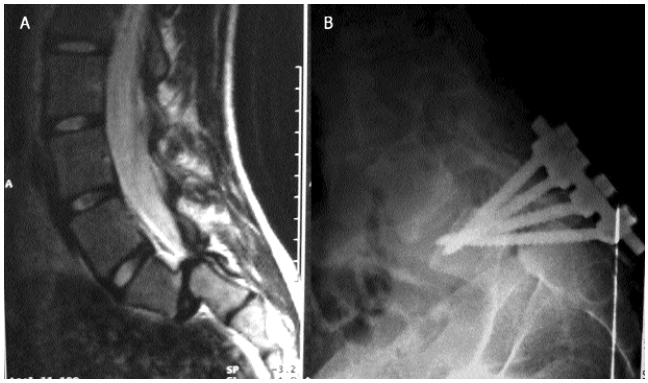

Figure-2: High-grade spondylolisthesis treated with delta fixation with transpedicular transdiscal transcorporal (TPTDTC) screws.

L4-5-S1 in 7 (7.29%) and multi or high level was found in the rest of cases. One level was involved in 77 (80.2%), 2 in 11 (11.45%), 3 in 7 (7.29%) and 4 in 1 (1.02%).Slip grade using Meyerding grades was 1 in 31 (32.29%), II in 39 (40.62%), III in 19 (19.79%), IV spondylolisthesis in 5 (5.2%) and 2 (2.08%) had spondyloptosis. Posterior approach was made in 93 (96.87%) patients, anterior in 2 (2.08%) and in 1(1.04%) patient combined anterior with posterior approach was done. PLIF was done in 53 (55.2%) patients, PLF in 21 (21.87%), TLIF in 3 (3.12%), TPTDTC in 10 (10.41%), delta fixation in 3 (3.12%) and ALIF in 2 (2.08%). Pedicle screw fixation was done in 86 ((89.58%) cases, Arbeitsegmeinschaft fur Osteosynthesefragen (AO) fixator internae in 8 (8.33%) and 4.5 mm screw in 2 92.08%). Mean operating time was 4 hours in 40 (41.66%), 3 hours in 35 (36.45%) and 2 hours in 21 (21.87%) patients. Mean follow-up was 42 months (range 24-63 months.

Mean ODI at 1 month was 38.51% (range 11.1-62.22%, SD ±11.75), at 6 months 10.02% (range 0-40%, SD ±6.99), at 1 year was 4.62% (range 0-24%, SD ±5.36) and at 2 years 4.21% (range 0-15%, SD ±4.2) (Table). There was mean ODI improvement 42.84 % at 1 month, 70.86 % at 6 month, 76.44% at 1 year and 76.85% at 2 years.

There were 9 (9.37%) major complications: 2 (2.08%) implants failure, 2 (2.08%) cage displacements, 3(3.12%) wound infections and 2 (2.08%) neurologic status deteriorations. These patients were re-operated and implant removal, cage repositioning to decompress cauda equina and debridements were done respectively. There were 3 (3.12%) dural tears representing minor complications which were sutured and healed with conservative protocol. There was also transient root weakness in 5 (5.2%) cases that recovered uneventfully.

Discussion

The treatment of spondylolisthesis is conservative or surgical. The patient selection is very important and attention to the proper indications must be considered for appropriate surgical treatment as slips do occur in asymptomatic population.[13] Compared with patients who are treated non-operatively, patients in whom degenerative spondylolisthesis and associated spinal stenosis are treated surgically to maintain substantially greater pain relief and improvement in function for longer period.[31] In the present study there was mean improvement of ODI of 76.85% after 2 years.

Posterolateral pedicle screw-rod fixation has improved rates of arthrodesis compared to traditional in situ fusions.[32] In the present study pedicle screws were used in 87 (90.62%), fixator internee in 7 ((7.29%) and trans-laminar facet in 2 (2.08%) patients. There is some reduction with pedicle screw and circumferential fusion at L5-S1, achieved entirely through a posterior approach or through separate anterior and posterior approaches.[3] PILF provides spondylodesis with decompression of the canal and 360-degree fusion with single posterior approach. In the present study PLIF was done in 53 (55.20%) patients and attained some reduction during posterior only 360-degree fusion (Figure-1). The dislodgement of cages anteriorly and posteriorly have been reported (33). Some 47 PLIF cages were placed, in 2 cases cages dislodged into canal resulting in acute cauda equine that was operated urgently and patients recovered uneventfully. PLIF provides good fusion rate with some reduction but cage migrations and lower fusion rates compared to ALIF are

documented.[34]

Evidence to date indicates that grade II or higher slips requiring decompression should be fused.[35] High-grade spondylolisthesis can be fused with or without reduction of the spondylolisthesis; during reduction the exiting nerve root is at danger. High-grade slips can be treated with fusion without reduction of the spondylolisthesis, by two cancellous bone screws inserted bilaterally through the pedicles of the lower vertebra into the body of the upper slipped vertebra.[21] TPTDTC screw fixation in 10 patients with high-grade slips and Delta fixation in 3 were done in the present study (Figure-2).

Modern-day treatment of high-grade spondylolisthesis usually involves some reduction of the spondylolisthesis along with pedicle screw instrumentation and circumferential fusion at L5-S1, achieved entirely through a posterior approach or through separate anterior and posterior approaches.[3] We did ALIF in 2 cases and with combined posterior fusion in 1 case.

Conclusion

Surgical treatment of spondylolisthesis gives excellent long-term result in most patients. Young patients with spondylolysis are treated with osteosynthesis and sparing of motion segment. PLIF provides satisfactory results in majority of low-grade slips with some reduction. TPTDTC and delta fixation is a good procedure for high-grade slips among adult but exiting and traversing nerve roots must be identified to avoid injury.

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