Anterior lumbar inter-body fusion with instrumentation compared with posterolateral fusion for low grade isthmic-spondylolisthesis

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INTRODUCTION

Spondylolisthesis is not an uncommon condition which presents with low back pain. The incidence in western countries is nearly 5-8% (5). There are no comparable data in our country. Though more common in males it is more symptomatic in females.
In the initial phase of the study those patients who required surgical treatment were operated by posterolateral fusion in situ with neural arch decompression. However for last 4 years they are being treated with instrumented stabilization and anterior lumbar body fusion by us.

In this prospective study the results of the two treatment modalities are compared and discussed.

SUBJECTS AND METHODS

All the patients with low back pain were initially screened with antero-posterior, lateral and flexion-extension radiographs of lumbo-sacral spine for spondylolisthesis or lysis. They were subjected to comprehensive clinical examination including that of spine, hips, sacro-iliac joints and abdomen. Radicular pain and neurological deficit if any were evaluated and in such patients MRI Scans or CT Scans were also done. Initially all except those with significant neurological deficit were treated conservatively for 6 months which included short periods of rest for 4 to 5 days durations and when required, rigid braces and life style modifications. If they did not improve they were offered surgery.

The following criteria were used for surgical management among the patients who consented for surgery.

- low grade isthmic spondylolisthesis (<50% slip)
- persistent or recurrent pain in lower back, buttocks and thighs with conservative treatment
- radicular signs and symptoms
- no history of previous spinal surgery

During early phase of our study surgical management done was in the form of postero-lateral fusion with removal of loose lamina and root decompression where required. The surgical exposure was done up to tips of transverse processes and fusion was done from L4 to S1 in all cases of listhesis. Facet joints were denuded and transverse processes decorticated. Autologous cancellous bone grafts were obtained from posterior iliac crest and occasionally from ribs (Fig. 1, 2).

Post operatively, the patients were provided with a lumbo-sacral brace as soon as they could ambulate. This was used for 5-6 weeks only. Progress of fusion mass was assessed by 12 weekly radiographs.

With the view to improve the functional outcome and early recovery we planned to bring in instrumented stabilization and fusion in our surgical management protocol. During last 4 years we have been doing posterior stabilization with pedicular screws and rod combinations followed by anterior lumbar interbody fusion (ALIF). ALIF was done in an attempt to treat disc degenerations, to create a stable construct and to increase fusion rates.

Posterior reduction prior to ALIF helps to restore sagittal alignment, decompresses the spinal canal effectively and maintains reduction.

By those patients who did not show radicular sign and symptoms, loose neural arch was not removed in view to avoid thecal scarring and no attempt at reduction of listhesis was done (Fig. 3, 4, 5, 6, 7).

Patients presenting with radicular pain were subjected to instrumented reduction mostly with Moss-Miami pedicular reduction technique and we instrumented one level above and below. Neural arch decompression as
well as root decompression was done where deemed necessary. Where reduction was not planned due to no root symptoms or where reduction came spontaneously, only one mobile segment was stabilized.

No gross attempt at posterior fusion was done except whatever grafts could be obtained from spinous processes were used for facet joint fusion. Transverse processes were not exposed. Where the neural arch had to be removed, we put the graft to bridge the gap between inferior articular process of the upper segment and superior articular process of the lower segment.

After about a week, a second stage anterior lumbar inter-body fusion was performed by a para-rectus longitudinal incision and extra-peritoneal exposure of L5-S1 or L4-L5 discs (Fig. 8, 9, 10, 11). After disc excision and creating a bleeding grating surface of end plates, tricortical shaped grafts obtained from iliac crest were impacted in the space. These grafts were obtained 5cm. away from anterior superior iliac spine and resultant gap in the crest was supported on the inner table by a proline mesh. We had done two stage operations in an attempt to reduce...
RESULTS

We recorded 263 symptomatic patients of Isthmic spondylolysis/lysis out of 4307 patients presenting with LBP and/or radicular pain in Out Patient Department as well as indoors during last 9 years. However this is not a representative sample of general population.

In the operated group, the patients were essentially in the age group between 31 to 50 years (Table I) and all the 48 patients except 2 were females.

In this series 20 were L4-L5 and 28 were L5–S1 listhesis cases. All were up to Grade 2 displacement and all were of Isthmic type. The mean follow-up of Postero-lateral fusion group of 27 patients was 7.25 years with maximum and minimum being 9 years and 5 years respectively.

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The mean follow-up of patients undergoing Instrumentation and Anterior Lumbar Inter-body fusion.

Assessment and follow-up was done at 12 weekly intervals.

In the follow up, AP and lateral view x-rays were done. On x-rays, we assessed the fusion mass and the maintenance of reduction. Radiological assessment of fusion mass in PLF group was done. In ALIF with instrumentation group, fixation and position of graft were assessed. Radiological assessment of fusion was done according to Bridwell and Lenke’s grading (13) in ALIF cases. PLF was assessed by defining continuous inter-transverse bony bridging (6). We also looked for any fracture of graft considering it to be failure of fusion. Relief of pain was assessed by Visual Analog scores. At the latest follow up, patients were asked to complete Oswestry low back pain questionnaires and any improvement in functional activity was recorded.

Fig. 6. — Follow up radiograph lateral view of instrumentation and ALIF in L4-5 listhesis.

Fig. 7. — Follow up radiograph anteroposterior view of instrumentation and ALIF in L4-5 listhesis.
In instrumented cases, reduction was done by using pedicle reduction screws in 5 patients (20 percent) who had radicular pain symptoms extending into calf. In one patient Synthes sleeve reduction screw technique was used but reduction was lost.

Fusion was 2.85 years with longest follow-up of 4 years and minimum of 1.5 years.

In addition to these two groups we performed postero-lateral fusion with instrumentation in 2 cases at L5-S1 level.
Treatment cost was found to be higher with an average increase 117% in patients who undergone ALIF with instrumentation as compared to PLF group. This was because of two operative procedures, longer stay at the hospital and cost of the implants.

All the patients in both groups except those with posterolateral fusion with instrumentation failure showed improvement in pain relief. Average pain scores on visual analog scale (Table II) appeared to show faster recovery in ALIF with instrumentation group but this was not found to be statistically significant. At the latest follow up, average preoperative Oswestry disability index (ODI) of 30 (Range: 26-33) in PLF group was reduced to 12 (Range: 9-15). Average preoperative ODI of 32 (Range: 28-36) in ALIF group was reduced to 9 (Range: 7-13).

ANOVA tests showed that differences in ODI were not statistically significant.

The patients were females with sole occupation of being housewives except for 2 male patients. Among PLF group, all female patients and one male patient noticed some functional improvement due to pain relief. They started doing their day to day work without experiencing any pain. One male patient went on to retain his occupation of factory worker. However among ALIF with instrumentation group, all patients noticed functional improvement, 9 patients (43 percent) became pain free and started doing their same household work comfortably while 12 patients (57 percent) became fairly active and could do additional activities apart from their routine household work.

There was no metal failure or loosening of screws other than in one patient mentioned above. There were no nerve root deficits postoperatively. There were no sexual dysfunction / sympathetic chain injury in ALIF group. There was no visceral and vascular injury in our series. One patient of ALIF group had superficial surgical site infection which subsided with antibiotics.

**DISCUSSION**

Postero-lateral fusion in low grade listhesis provided satisfactory pain relief in this series and this has been reported extensively in literature as well.
Instrument breakage with this combination has been reported by Suda et al in 6 out of 101 patients and has been salvaged by ALIF (10). In the present series also we encountered two failures of posterior instrumentation which required to be salvaged by ALIF. Duggal et al (4) also found ALIF as a safe and effective procedure for failed back surgeries.

During PLF with Posterior instrumentation, bulk of instrumentation takes away part of space where fusion mass has to develop. Secondly, in the absence of anterior column stabilization, this doesn’t provide a biomechanically stable construct. Moreover, instrumentation protects the strain on whatever fusion mass develops, it doesn’t mature into strong bone as per Wolff’s law. When instrumentation gives way due to repeated stress, small posterolateral fusion mass doesn’t support leading to failure.

Suk et al (11) found no significant differences in 2 groups in terms of blood loss, pain relief, fusion and complication rate but ALIF with Pedicle Screw Instrumentation.
Fixation (PSF) superior to PLF with PSF in terms of prevention of reduction loss.

However in our hands, blood loss was significantly less with ALIF and PSF combination procedure. Visceral and vascular complication from ALIF have been described in a retrospective study on 60 patients by Rajaraman et al (7) in 38.3 percent. In our series, there were no ALIF related complications including sympathetic or sexual dysfunction. The reasons could be smaller series and essentially female patients.

In our opinion, Postero-lateral fusion requires wider and more traumatic exposure up to transverse processes involving more muscle stripping and blood loss requiring invariably blood transfusion.

In comparison limited posterior exposure barely up to facet joints facilitates less blood loss and also anterior retroperitoneal exposure of lumbar discs being in tissue planes causes little bleeding.

Instrumentation has added advantage also of restricting fusion requirement to single motion segment especially in L4-L5 listhesis. Moreover there is no need to provide any external brace in initial weeks.

For the sake of two procedures in ALIF group, length of stay and treatment cost of hospitalization was higher.

CONCLUSION

ALIF with Posterior instrumentation provides satisfactory pain relief with early recovery of function in low grade isthmic spondylolisthesis with added advantages of lower blood requirements and possible neural decompression when reduction is also included. The anterior column fusion provides sufficient stability to the construct so that instrumentation failures do not happen. ALIF can also be used as salvage procedure when there is a state of failure of stability associated with other surgical procedures. As our patient group is essentially of female patients, these remarks can be made for such patient population only.

REFERENCES


