# Posterior lumbar interbody fusion

## A 2-year follow-up of 238 patients

Kevin Gill[1] and Scott L Blumenthal[2]

[1]Department of Orthopedic Surgery, Southwestern Medical Center, Dallas, and [2]Texas Back Institute–Plano, Texas 75235, U.S.A. Correspondence: K Gill, 5920 Forest Park Road LB 560, Dallas, Texas 75235, U.S.A.

Lumbar interbody fusion is a standard procedure in spinal surgery as practiced by subspecialists in orthopedics and neurosurgery. The interbody fusion allows for a normal anatomic relationship between the motion segment and neurological structures, restricts spinal motion, and prevents disc space collapse or development of degenerative changes that occur after discectomy. Interbody fusion also prevents recurrent disc herniation and may prevent painful nerve root irritation caused by postoperative perineural adhesion. Interbody fusion is successful since there is a large area of bone surface involved with an adequate blood supply obtained through the cancellous portion of the vertebral body. The fusion also approximates the center of motion in both the sagittal and coronal plane and centers compressive forces in the spine. In 1936 Mercer (3) was apparently the first to suggest that the "ideal operation for fusing the spine would be an interbody fusion, but the surgical difficulties encountered in performing such a feat would make the operation technically impossible." Posterior interbody fusion (PLIF) after lumbar disc removal was first reported by Jaslow (2) in 1946. However, it remains Ralph Cloward of Honolulu who reported and popularized the early treatment of patients with PLIF (1).

For the purpose of obtaining lumbar fusions the PLIF procedure was used in the treatment of 238 patients. We describe the clinical experience with PLIF including the indications and complications after a 2-year follow-up.

## Patients and methods

For a three year period beginning in July 1987, 238 patients underwent spinal fusion and instrumentation with the Wiltse Pedicle Screw Fixation System. This spinal fusion utilized the posterior lumbar interbody

Figure 1. Oblique view (left) of the lumbar spine showing placement of the bicortical iliac crest bone graft into the interbody space to accomplish a posterior lumbar interbody fusion. Posterior view (right) of the completed posterolateral and posterior interbody fusion along with pedicle screw instrumentation.

fusion technique from a unilateral approach with a lateral/bilateral fusion and pedicle screw fixation system (Figure 1). 175 were men and 63 were women. 225 patients were workers' compensation while 13 were private pay. The mean age was 39 (21–57) years. There was a minimum of follow-up for the review of 24 months. Indications for surgery included herniated degenerative disc in 94 patients (40%), degenerative disc disease in 78 patients (33%), postlaminectomy syndrome in 26 patients (11%), spondylolisthesis in 24 patients (10%), recurrent herniated disc in 12 patients (5%), and pseudarthrosis of a prior fusion in 4 patients (1%). 168 patients underwent single-level fusion, 69 underwent two-level fusion and one underwent a three-level fusion. Of the levels fused there were 18 patients fused at L3-4, 119 L4-5 levels fused, and 172 L5-S1 levels fused. 42 patients (18%) had prior surgery. The average disability prior to surgery was 1 year. The technique employed was a posterior lumbar interbody fusion and posterolateral fusion along with Wiltse pedicle screw instrumentation. All the patients had autograft placed in the posterolateral area. This included contact against the transverse process, the pars intra-articularis and the facet joints. 54 (23%) had allograft placed in the interbody space, while 184 patients (77%) had iliac crest autograft as the interbody graft material. All patients underwent an Oswestry pain questionnaire, visual analogue scale, and pain drawing. Prolo's (4) economic and functional rating scale was used to assist outcome at 24 months. Diagnostics included MRI scan in all cases and in those cases with degenerative disc disease where leg pain did not extend below the knee a CT discogram was performed as well. Fusion was determined by routine anteroposterior and lateral radiograph. Tomograms and dynamic flexion-extension radiographs were used in those cases where routine views were equivocal. 136 patients were smokers while 102 did not smoke. Statistics was performed by Binomial comparison.

## Results

A solid fusion was obtained in 219 patients (92%), while pseudarthrosis was documented in 19 patients (8%) overall. Fusion rate of the interbody graft was 62% with the allograft and 85% with autograft in the interbody space. The fusion rate of the posterolateral component was 92%. The average blood loss was 180 mL for single-level fusion, 350 mL for a double-level fusion, and 500 mL for a triple-level fusion. The operative time averaged 81 minutes for single levels, 106 minutes for double-level fusions, and 165 minutes for triple-level fusions. 72 patients (30%) underwent hardware removal, an average of 7 months post fusion.

47 patients (20%) had no gainful occupation at follow-up. 48 patients (20%) were able to return to work, but not to the previous occupation. 88 patient (37%) were working at their previous occupation on a part time or limited status, and 45 patients (19%) were able to work at their previous occupation with no restrictions of any kind. From a functional point of view, 32 patients (13%) had mild to moderate level of low back pain or sciatica, while 61 patients (26%) had a low level of pain and were able to perform all activities except sports. 96 patients (40%) had no pain, but one or more recurrences of low back pain or sciatica during the follow-up. 49 patients (21%) had complete recovery with no recurrent episodes of low back pain, and were able to perform all previous sports or work activities. Smokers had a poorer outcome when comparing the economic and functional results. Only economic status was significant with $P < 0.05$; a greater proportion of patients with nonunion (45%) were economic status level 2 than patients who showed solid fusion (19%). 22 patients (9%) were greater than 30% over normal body weight. Their functional and economic results were not affected by their extra weight. Those patients did have a longer postoperative recovery period.

Complications included 7% overall infection rate. 13 patients (5%) had superficial infections, and 4 (2%) had deep wound infections. One patient developed a drop foot postoperatively, and one patient developed a dural leak which subsequently sealed with bed rest. 6 patients (3%) developed new onset leg pain postoperatively. In all cases, the leg pain had diminished at 24 months, however, four had occasional sciatic symptoms. Reexploration of the hardware was necessary in one patient for severe postoperative sciatica and no impingement from the bone graft or hardware was noted. Three patients had fracture of the screws, noted on radiographs. None of these patients were symptomatic and all underwent subsequent removal of the hardware, at their request. 20 patients were noted to have loosening of the S1 screw, 5 of the L5 screw, and one of the L4 screw. Two patients (1%) had retropulsion of the graft. One of these patients required revision with removal of the extruded portion of the graft. There was one case of thrombophlebitis. The average hospital stay was 4 days. There was one case of acute urinary retention where postoperative myelogram was found to be negative, and retention resolved in three days with standard care.

## Discussion

This technique of combining posterior lumbar interbody fusion with posterolateral fusion and pedicle screw instrumentation allows stabilization of the lumbosacral spine with a low complication rate. It would appear that this method of lumbar fusion is safe when used appropriately in experienced hands. In addition, it does appear efficacious in promoting osseous union and stability of the motion segment. 81% of patients were able to recover and return to some form of gainful employment, and 87% of patients had either no pain or a very low level of pain, and were able to function in a reasonable manner. We recommend this technique for those patients with severe incapacitating low back and leg pain that require surgical intervention. The high fusion rate and return to functional economic status give this procedure a place in lumbar surgery. PLIF restores the normal anatomical relationship between the motion segment and the neurological structures while preventing further degeneration of the segment. With the lack of spinal motion in the fused segment, neurologic tissue can be provide a safe healing environment. The greatest single advantage of PLIF is that it dynamically decompresses the entire nerve root by holding the vertebral bodies apart. It is however, a demanding surgical technique that requires a meticulous surgeon with a thorough knowledge of spinal anatomy to decompress and stabilize the spine. When the objectives of decompression and stabilization are met, we believe this method of fusion allows excellent stability and good functional results.

## References

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