



Posterolateral versus interbody fusion in isthmic spondylolisthesis : functional results in 52 cases with a minimum follow-up of 6 years

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Posterolateral fusion has long been considered the “gold standard” technique for surgical treatment of adult spondylolisthesis. Superior results have subsequently been reported with interbody fusion with cages and posterior instrumentation. The goal of this prospective study was to compare the two techniques regarding their clinical outcomes and fusion rates. Fifty-two patients with isthmic spondylolisthesis were operated by the same surgeon. One group (25 patients) had decompression and posterolateral fusion (PLF) with a pedicle screw system ; patients in the other group were treated by decompression, posterior interbody fusion (PLIF) and a pedicle screw system. The two groups were similar with respect to grade of slipping, age, and activity. Seventy-seven percent of the patients had a good or very good result with PLIF and 68% with posterolateral fusion. However, there was no statistical difference in cases with low grade slipping, whereas the difference was significant for cases with high grade slipping. The fusion rate was 93% with PLIF and 68% with PLF, but without any significant incidence on the functional outcome. Based on these findings, we now use posterior interbody fusion for high grade spondylolisthesis which requires reduction or if the disc space is still high. When the slip grade is low, or the disc space is narrow, we prefer posterolateral fusion.

INTRODUCTION

Cloward's technique (5) and its modification by Lerat *et al* (11) are efficient and safe techniques for

lumbar fusion in spondylolisthesis. In 1990, Brantigan *et al* (4) proposed a new surgical technique using intersomatic carbon cages, which has given safe and reproducible results. However, these techniques must be compared with the classical posterolateral fusion. The goal of this study was to analyse two series of fusion with regard to functional results.

MATERIAL AND METHODS

We made a prospective non-randomised study of 52 patients with spondylolisthesis, all operated by the same surgeon. All patients were reviewed with radiographs by an independent observer. The minimum follow-up was 6 years.

The indications for fusion were in cases with combined severe low back pain and radicular pain, after failure of physical and medical treatment.

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There were two groups. In the first group of 25 patients, the root and dural decompression was made by the Gill technique followed by a posterolateral fusion using a rigid Cotrel Dubousset construct and autologous bone chips from the resected laminae. There were 14 male and 11 female patients, with a mean age of 42.4 years (range : 14 to 63 years). The slipping was grade I in 12 cases, grade II in 7 cases and grade III in 6 cases.

In the second group of 27 patients, root and dural sac decompression was conducted with the Gill technique followed by fusion using a rigid Steffee plates system and intersomatic Brantigan carbon cages filled with autologous graft from the laminectomy. The sex ratio was 14 males to 11 females, the mean age was 39.5 years (14 to 56 years). The slipping grade was I in 14 cases, II in 9 cases and III in 4 cases.

Functional results were evaluated based on the Beaujon score (table I) (9), taking into account low back pain, sciatica (at rest and at work), walking capacity, drugs, neurological deficit, quality of life. We had to modify the score, because the walking distance was not recorded in all cases. The maximal possible score was 17. We studied the relative gain (post-op score – pre-op score)/17 – pre-op score), the result regarding low back pain (LBP), rest sciatica, work sciatica, working capacity (level and delay).

The score is : – > 70% gain : very good result
 – 40 to 70% gain : good result
 – 10 to 40% gain : poor result
 – < 10% gain : failure

The quality of fusion was analysed on sagittal and frontal radiographs. This was very easy in cases with a radiolucent cage. In cases with a posterolateral graft, we considered that fusion was complete if it was visible on the frontal view or if a spontaneous anterior bridge had occurred.

The statistical study used the chi squared test. Statistical significance was set at 5%.

RESULTS

No patients were lost to follow-up with a minimum of 6 years (75 to 100 months).

Complications

There were no intra-operative complications such as bleeding or nerve root injury.

In one case, introduction of the cage was impossible because the canal was too narrow.

Complications were noted during the postoperative period :

In the posterolateral fusion group (PLF), one patient had an epidural haematoma with neurological deficit, 15 days after the operation, related to the anticoagulant treatment. He presented complete recovery after an emergency decompressive procedure. In 8 cases, persisting low back pain required hardware removal. Two patients needed operations for a disc herniation above the fusion level.

In the PLIF group, we observed in one case sexual impotence without bladder problems, which decreased over the ensuing three months. This patient had a normal function at follow-up.

There was one mechanical failure in a grade III spondylolisthesis with a too short single level instrumentation.

Functional results

We obtained 77% very good or good results with PLIF and 68% with PLF. The difference is not significant with the numbers of cases available.

In the PLIF group, there was a small degradation of the result between one year and the maximal follow-up ; this was not noted in the PLF group.

We did not note any significant difference between the two groups with respect to low back pain, rest and work sciatica. (tables I, II, III). The result regarding lumbalgia improved from one year to the maximum follow-up.

The result is different if we take into account the grade of slipping. In grade II or III, we observed good or very good results in 83% of cases with PLIF, versus 49% in cases with PLF.

Return to work at the same level was achieved earlier and in a higher proportion of cases in the PLIF group (60% at 8 months) than in the PLF group (55% at 10 months).

Radiological results

The fusion rate was better following PLIF (93%) than following PLF (68%), but we were not able to

Table I. — Baujon Score for spinal stenosis

		1	2	3	4
Walking	< 100 m	100-500 m	> 500 m	No Limitation	
Rest sciatica	Continuous	Crisis	Moderate	None	
Effort sciatica	Continuous	Moderate	None		
Back Pain	Continuous	Crisis	Moderate	None	
Neurological status	Major deficit		Moderate		None
Medications	OMS 3	OMS 2	None		
Quality of life	Impossible			Normal	

Table II

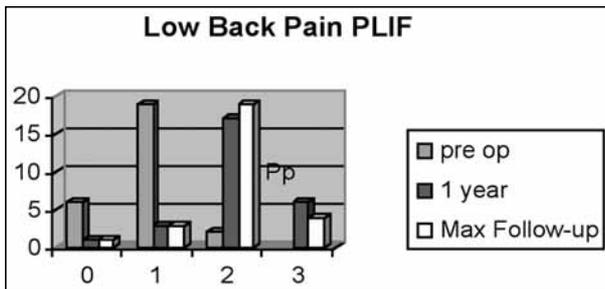
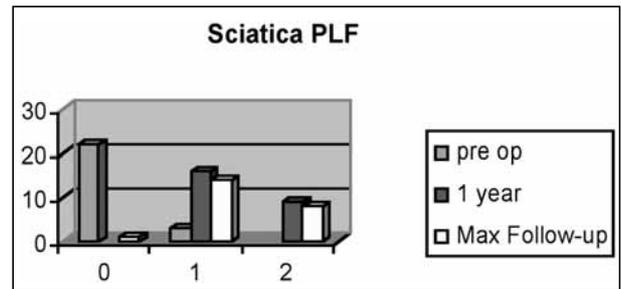
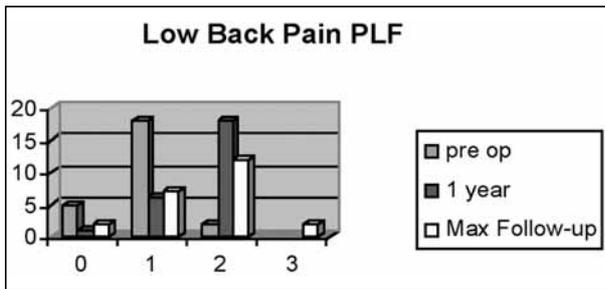
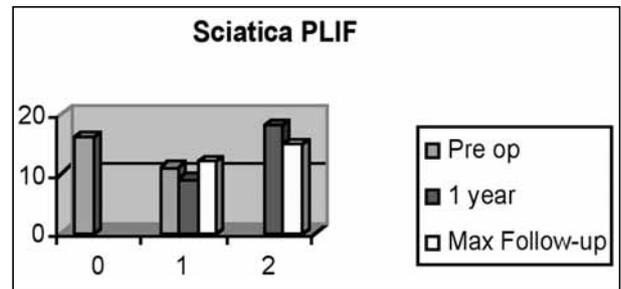


Table III



demonstrate a significant difference between the clinical outcomes.

It is easier to assess fusion following PLIF.

In 25% of PLF cases, we observed spontaneous anterior interbody fusion at follow-up, particularly in cases with narrowing of the disk space.

DISCUSSION

Carbon and PEEK cages are well tolerated as shown in experimental studies ; we did not note any osteolysis or inflammatory reaction around the cages.

What is the benefit of PLIF ?

The analysis of literature on PLIF is difficult because different evaluation scales have been used by the authors. The Beaujon scale was mostly designed for spinal stenosis surgery, but we used it because it is very convenient. We did not use the pain scale for back and leg pain, nor a satisfaction score such as the Oswestry scale or SF 36.

The rate of functional success is 92% for Brantigan *et al* (4), 52% for Fayada *et al* (6) (but there is in these series a case mix of disc failure, instability and spondylolisthesis), 75% for Guigui *et al* (9) (62 cases of degenerative spondylolisthesis).

A recent prospective randomised study of PLF (2) showed a significant difference in functional results

between fusions with or without pedicular screws in isthmic spondylolisthesis.

A comparative study between PLIF and PLF by Madan and Boeree (12) showed that the clinical result was better with PLF for low grade spondylolisthesis (81% versus 69% for PLIF). Fusion and persistence of the correction was better with the PLIF technique. Kim and Lee (10) and Suk *et al* (15, 16) compared anterior lumbar interbody fusion (ALIF) with PLF. There was no statistically significant difference in clinical results but ALIF was more effective for fusion and prevention of reduction loss. Pradham *et al* (14) in a retrospective review of 122 patients, showed that the anterior approach gave less morbidity and less bleeding, but there was no statistical difference in clinical outcome.

Is the reduction of the spondylolisthesis useful for the clinical outcome ?

In grade III, reduction is useful to restaure a better sagittal balance. In these cases, the result is significantly better with PLIF. We think that the reduction creates an anterior disc distraction and the PLIF more efficiently stabilises this iatrogenic instability, which explains the better results achieved with PLIF. Similar observations have been made by different authors (13).

Is restauration of the disc and foraminal height useful ?

Goutallier *et al* (8), in 30 patients with an average follow-up of 4 years showed that anterior fusion without reduction gave good results.

In our series, PLIF provided a significant increase in the disc height but we have observed a deterioration of the result with respect to rest sciatica (paraesthesias) at follow-up.

This seems to be the result of vascular problems : during the surgical procedure, we used bipolar coagulation to prevent bleeding from the peridural veins around the root. A relative ischaemia could possibly explain the postoperative paraesthesias.

Is the fusion rate important ?

In ours series we did not try to correlate fusion rates and clinical results. In the literature, different points of view are expressed. For Thalgott *et al* (17) in 42 cases of adult spondylolisthesis treated with instrumented PLF without reduction, the fusion rate is correlated with clinical outcome.

Agazzi *et al* (1) in their series of 71 PLIF's showed 66% of success and a 90% fusion rate, but without a significant relationship between fusion and clinical outcome.

Is the 360° fusion necessary ?

In our PLIF group we only made anterior grafting without posterior fusion because firstly, the area available for grafting in PLF after decompression is very small and secondly, anterior cages give a strong stable fusion. We did not observe more complication and more clinical failures at follow-up than in the PLF group. No study has described any superiority for a 360° fusion versus isolated PLIF. In 2002, Freeman *et al* (7) reported 83% good and excellent outcomes and return to full-time employment in 50% of cases with PLIF+PLF.

In our series, spontaneous anterior fusion was noted in 25% of PLF cases at follow-up.

CONCLUSION

In accordance with the literature, PLIF gave in our experience similar clinical results but better fusion rates and better maintainance of reduction than PLF.

Based on the findings in this study, we have now modified our indications : for grade I spondylolisthesis, particularly in cases with a narrow disc, we choose PLF without decompression if there is no neurological deficit.

In cases where reduction is needed, or when the disc space is high, we prefer PLIF because it gives more security for stabilisation and fusion.

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