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Post-discectomy syndrome treated with lumbar interbody fusion

Received: 14 September 2005 / Accepted: 8 November 2005 / Published online: 19 April 2006
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Abstract We studied 27 patients with post-discectomy syndrome. All patients had Lumbar Interbody Fusion with titanium cages and pedicle screw fixation either as Anterior (ALIF, $n=18$) or as Transforaminal Lumbar Interbody Fusion (TLIF, $n=9$). Follow-up ranged from 24 to 94 months. The clinical and radiological data were compared. The outcome was evaluated using the Oswestry low back pain disability score and the visual analogue pain intensity scale. Outcomes were similar for all patients regardless of surgical technique and showed a significant improvement at final follow-up.

Resumé Nous avons étudié 27 malades présentant un syndrome post-discectomie. Dix-huit malades ont été traités par une fusion vertébrale lombaire antérieure et neuf par une fusion transforaminale avec fixation par vis pédiculaire. Le suivi était de 24 à 94 mois. Les données clinique et radiologiques ont été comparées et le résultat évalué en utilisant les Scores d'Oswestry et l'échelle visuelle analogique pour la douleur. Le résultat était semblable pour tous les malades sans influence de la technique chirurgicale et a montré une amélioration significative au suivi final.

Introduction

Chronic low back pain due to post-discectomy syndrome (PDS) of the lumbar spine is a difficult spinal disorder that can be treated with fusion [1, 3, 5, 8]. Therefore, we studied patients suffering only from PDS with regard to outcome of anterior interbody fusion (ALIF) or transforaminal interbody fusion (TLIF) in an uncontrolled, non-randomised retrospective cohort using standard outcome questionnaires.

Materials and methods

Medical records of 27 patients at the same institution [2] were reviewed retrospectively. Two different lumbar interbody fusion techniques using titanium cages and posterior pedicle screw fixation were used between 1991 and 2002; thus, we divided patients into the ALIF group ($n=18$) and the TLIF group ($n=9$). There were 11 women and seven men in the ALIF group (mean age 39.9 years) and six women and three men in the TLIF group (mean age 60.7 years).

Indication for surgery

We selected only patients who had had previous discectomy with or without decompression and had had no other previous spinal surgery for fusion. All patients were suffering from intractable chronic low back pain and radicular symptoms that had failed conservative treatment for at least 6 months.

Radiological evaluation

Union was defined when there was posterior and/or anterior bony trabecular continuity, and nonunion was defined as a cage subsidence and screw or rod breakage in combination with lytic zones around the screws or cages.

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Table 1 Blood loss and surgical time for the two groups (*ALIF* anterior interbody fusion, *TLIF* transforaminal interbody fusion)

<i>n</i> =27	Mean blood loss	Mean surgical time
	1,240 ml	275 min (range 120–645 min)
ALIF group	1,500 ml (250–7,450 ml)	297 min (range 150–645 min)
TLIF group	775 ml (400–1,500 ml)	224 min (range 120–300 min)

Lack of bony bridging in front of the cage but without sinkage of the cage and without screw or rod breakage was defined as probable union.

Functional outcome measurement

The Oswestry low back pain disability score (ODS) and the visual analogue pain intensity scale (VAS) was recorded for all patients pre-operatively, post-operatively, and at follow-up. The mean follow-up was 48 months (range 24–94 months) in the ALIF group and 29 months (range 24–36 months) in the TLIF group. Employment details were recorded when patients returned for clinical follow-up.

Statistical methods

Statistical analysis was carried out with Microsoft Excel '97 (Redmond, WA, USA) and SPSS (version 10), applying the Wilcoxon test and the Mann-Whitney *U*-test with a significance level of 5% ($p < 0.05$).

Results

Clinical and radiological results

Blood loss and surgical time are indicated in Table 1. The intra-operative and post-operative complications were mostly approach-related, with two patients requiring suturing of the common iliac vein and three male patients in the ALIF group suffering from retrograde ejaculation. One patient needed revision of the posterior instrumentation because of a deep wound infection.

In the ALIF group, 15 out of 18 patients completed the radiological follow-up, and all nine patients in the TLIF group had complete radiological follow-up. Fusion was

successful in both groups with neither showing signs of screw breakage or cage subsidence on X-ray. Thus, there were no long-term complications requiring revision surgery, and we consider the fusion in the 24 patients as solid.

Pain and functional outcomes

The results of ODS and VAS are demonstrated in Table 2. ODS showed a significant ($p < 0.05$) improvement of 26 post-operatively and 24 at follow-up. The VAS for both groups (ALIF and TLIF) showed an improvement that is significant ($p < 0.05$), with a difference of 4.1 post-operatively and 3.3 at follow-up. In the ALIF group, the ODS showed a significant improvement of 27 post-operatively and 23 at follow-up. In the TLIF group, the ODS demonstrated a significant improvement of 23 post-operatively and 25 at follow-up.

The results of fusion length did not correlate with the outcomes of VAS and ODS and demonstrated no significant difference for pre-operative, post-operative, or follow-up values.

For 21 of the 27 patients, the employment details were available pre- and post-operatively. In the ALIF group prior to surgery, two patients were housewives and 12 were employed in full-time jobs. After surgery, six patients had returned to work at the time of the follow-up. The mean age of the workers was 36 years (range 26–47 years). The other six patients failed to return to their former jobs and became social benefit “pensioners” with a mean age of 40 years (range 27–53 years). In the TLIF group, one patient was a pensioner, three were housewives, and three had worked pre-operatively. One of the three patients (age 49 years) returned to work after surgery, and the other two (mean age of 49 years) became social benefit “pensioners.” Thus, eight patients out of 15 who were employed prior to surgery had become social benefit “pensioners,” and seven had returned to work at the time of follow-up. The mean ODS for the seven patients who were working at follow-up was 60 pre-operatively, 26 post-operatively, and 27 at follow-up. The ODS for the eight social benefit “pensioners” at follow-up was 49 pre-operatively and 39 post-operatively, and at follow-up it had increased to a mean of 46.

Table 2 Mean values of the Oswestry low back pain disability score (ODS) and the visual analogue pain intensity scale (VAS) for the two groups (*ALIF* anterior interbody fusion, *TLIF* transforaminal interbody fusion)

Score outcomes	Mean ODS			Mean VAS		
	Pre-operative	Post-operative	Follow-up	Pre-operative	Post-operative	Follow-up
All patients	59.69	33.64	35.12	8.5	4.4	5.21
ALIF group	58.10	30.57	34.18	8.55	4.13	5.25
TLIF group	62.88	39.77	37	8.37	4.81	5.12

Discussion

Factors that could affect outcomes of lumbar interbody fusion are numerous [1–4, 7–9, 18]. In patients suffering from chronic low back pain related to a post-discectomy syndrome, a good clinical and functional outcome after lumbar interbody fusion is particularly difficult to achieve, and our results can only confirm that the functional outcome is independent of the fusion technique. In our group of patients, the success rate could be demonstrated by only three factors: radiological fusion, results of ODS and VAS, and working status. The results of the scores were the only objective measures because they were studied in a prospective fashion. Further limitations of our study are the small group size; the group was very heterogeneous regarding age and gender, and patients were not randomised. We are well aware that on plain radiographs an anterior solid bony fusion cannot be established reliably [16, 21]. However, we believe that fusion rate was acceptable in 90%, because the instrumentation would have failed after such a long follow-up of more than 2 years up to 5 years had there been non-union.

Fritzell et al. [9] confirmed that fusion technique does not influence the functional outcome, but they concluded that 360° fusion offers the highest chance of fusion. In our group, all patients had either so-called 360° or 270° fusion, which is consistent with current literature stating that fusion techniques of the lumbar spine using posterior pedicle screw fixation and additional bone-filled metallic cages are likely to be effective in the operative treatment of low back pain [6, 8, 10–14, 17, 20].

The peri-operative complication rate lies within the rates described in the current literature [5, 7, 14, 17, 19] and confirms that with increasingly demanding technique, the complication rate increases. In the ALIF group, we found higher blood loss and persistent retrograde ejaculation in three male patients, but there were no surgery-related complications in the TLIF group. The anterior approach in ALIF, even if performed as mini-ALIF [15], increases surgical trauma, may cause injury to the great vessels, and may lead to retrograde ejaculation in men [7, 19]. Unilateral TLIF is supposed to represent a less invasive surgical alternative without requiring an anterior approach or a direct approach to the spinal canal as in posterior lumbar interbody fusion. A currently increasing number of papers reporting on TLIF results reflect that the technique is gaining in popularity, and the authors see TLIF as an excellent alternative to the above-mentioned combined procedures [6, 10–12, 20].

For patients suffering from PDS who very often have had several years of conservative treatment, we believe that lumbar interbody fusion with cages can be helpful, but clinical success, in our view, depends on the indication and not on the fusion technique, which often may not correlate [3, 5, 9, 14, 20] with clinical outcome. Our patients' outcomes were similar to those found by others [5, 9, 14] for patients with PDS. Surprisingly, our results of the outcome measures demonstrated a statistically significant improvement even 2 years after surgery. Despite these

results, it is possible that our results overestimate the potential benefit of ALIF or TLIF for PDS because our study lacks objective criteria.

Despite the encouraging results, only seven patients had returned to work at follow-up. No patient who was receiving disability assistance before surgery returned to work. Employment status might also have influenced the functional outcome results because employment status was only evaluated retrospectively. The poor results of the ODS and VAS in the group of social benefit pensioners suggest that factors other than a successful clinical and radiological fusion are responsible for the low outcome scores with respect to leg and back pain and for the low rate of re-employment.

Fusion is a common procedure for treating chronic low back pain [1–10, 12–14, 17, 20]. It appears that differences in outcome are related to factors including indication for surgery and socioeconomic issues. We agree with several other authors [2, 4] that there is a need for a better definition of indications and for a uniform system of outcomes that contains a core of critical demographic, peri-operative, and post-surgical information to support the idea of fusion for treating chronic low back pain.

This retrospective comparison of two different fusion techniques for treating chronic low back pain in patients suffering from PDS lacks important details; for instance, we did not compare conservative and operative treatment of chronic low back pain due to PDS. Instead, we only studied the outcome after fusion in a heterogeneous group of patients with no correlation of factors such as smoking or legal issues. Nevertheless, the outcome showed a significant improvement in the ODS and VAS compared with pre-operative results in patients who only had previous discectomies.

Therefore, we conclude that lumbar interbody fusion using posterior pedicle screws and anterior support with cages can be an option in the treatment of chronic low back pain caused by PDS.

References

1. Andersen T, Christensen FB, Hansen ES, Buenger CE (2003) Pain 5 years after instrumented and non-instrumented posterolateral lumbar spinal fusion. *Eur Spine J* 12:393–399
2. Bono CM, Lee CK (2004) Critical analysis of trends in fusion for degenerative disc disease over the past 20 years. *Spine* 29:455–463
3. Christensen FB, Hansen ES, Eiskjaer SP (2002) Circumferential lumbar spinal fusion with Brantigan cage versus posterolateral fusion with titanium Cotrel-Dubousset instrumentation: a prospective, randomized clinical study of 146 patients. *Spine* 27:2674–2683
4. Deyo RA, Gray DT, Kreuter, W, Mirza S, Brook MI (2005) United States trends in lumbar fusion surgery for degenerative conditions. *Spine* 30:1441–1445
5. Duggal N, Mendiondo I, Pares HR, Jhavar BS, Das K, Kenny KJ, Dickman CA (2004) Anterior lumbar interbody fusion for treatment of failed back surgery syndrome: an outcome analysis. *Neurosurgery* 54:636–644

6. Freeman BJ, Licina P, Mehdiian SH (2000) Posterior lumbar interbody fusion combined with instrumented postero-lateral fusion: 5-year results in 60 patients. *Eur Spine J* 9:42–46
7. Fritzell P, Haegg O, Nordwall A (2003) Complications in lumbar fusion surgery for chronic low back pain: a comparison of three surgical techniques used in a prospective randomized study. *Eur Spine J* 12:178–189
8. Fritzell P, Haegg O, Wessberg P, Nordwall A (2001) Lumbar fusion versus nonsurgical treatment for chronic low back pain: a multicentre randomized controlled trial from the Swedish lumbar spine study group. *Spine* 26:2521–2532
9. Fritzell P, Haegg O, Wessberg P, Nordwall A (2002) Chronic low back pain and fusion: a comparison of three surgical techniques. *Spine* 27:1131–1141
10. Hackenberg L, Bullmann V, Schneider M, Halm H, Liljenqvist U (2005) Transforaminal lumbar interbody fusion: a safe technique with satisfactory three to five year results. *Eur Spine J* 14(6):551–558 Aug
11. Harms J, Jeszensky D (1998) The unilateral transforaminal approach for posterior lumbar interbody fusion. *Orthop Traumatol* 6:88–99
12. Humphreys SC, Hodges SD, Patwardhan AG, Eck JC, Murphy RB, Covington LA (2001) Comparison of posterior and transforaminal approaches to lumbar interbody fusion. *Spine* 26:567–571
13. Lowe TG, Tahernia AD, O'Brien MF, Smith DA (2002) Unilateral transforaminal posterior lumbar interbody fusion (TLIF): indications, technique and two-year results. *J Spinal Disord Tech* 15:31–38
14. Madan SS, Boeree NR (2003) Comparison of instrumented anterior interbody fusion with instrumented circumferential lumbar fusion. *Eur Spine J* 12:567–575
15. Mayer HM (2000) The ALIF concept. *Eur Spine J* 9:35–43
16. McAfee C (1999) Interbody fusion cages in reconstructive operations on the spine. *J Bone Joint Surgery Am* 81:859–880
17. Niemeyer T, Bovingloh AS, Halm H, Liljenqvist U (2004) Results after anterior-posterior lumbar spinal fusion: 2–5 years follow-up. *Int Orthop* 28:298–302
18. Niskanen RO (2002) The Oswestry low back pain disability questionnaire. A two-year follow-up of spine surgery patients. *Scand J Surg* 91:208–211
19. Sasso RC, Burkus JK, LeHuec JC (2003) Retrograde ejaculation after anterior lumbar interbody fusion. *Spine* 28: 1023–1026
20. Schofferman J, Slosar P, Reynolds J, Golthwaite N, Koestler M (2001) A prospective randomized comparison of 270 degrees fusion to 360 degrees fusion (circumferential fusions). *Spine* 26:E207–E212
21. Shah R, Mohammed S, Saifuddin A, Taylor B (2003) Comparison of plain radiographs with CT scan to evaluate interbody fusion following the use of titanium interbody cages and transpedicular instrumentation. *Eur Spine J* 12:387–385