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Combined anterior interbody fusion and posterior pedicle screw fixation in patients with degenerative lumbar disc disease

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Abstract We reviewed 47 consecutive patients with degenerative lumbar disc disease. All patients were treated by anterior interbody fusion using an autogenous iliac bone graft in combination with posterior pedicle fixation but without a posterior fusion. There were 32 men and 15 women with a mean age of 44 (range 23–56) years. One third (n=15) of the patients had previous surgery. We saw complications in six patients including two with vascular injury. The mean follow-up was 2.2 years. Seventy-two per cent of the cases had a satisfactory clinical outcome, and the overall fusion rate was 97%.

Résumé Nous avons examiné 47 malades consécutifs présentant une Maladie du Disque Lombaire Dégénératif. Tous les malades ont été traités par fusion corporéale antérieure utilisant une greffe iliaque autogène combinée avec une fixation pédiculaire postérieure mais sans une fusion postérieure. Il y avait 32 hommes et 15 femmes, avec un âge moyen de 44 ans (23–56 ans). Un tiers (n=15) des malades avaient déjà été opéré. Il y a eu des complications chez six malades, en incluant deux malades avec blessure vasculaire. Le suivi moyen était de 2,2 années. 72% des cas avaient un résultat clinique satisfaisant, et le taux de la fusion total était de 97%.

Introduction

Spinal fusion is an accepted method of treatment in patients with severe chronic disabling low back pain thought to arise from an unstable or mechanically deranged segment [1]. Various fusion techniques have been described with various reports on fusion rates; therefore, a clear-cut recommendation for the most reliable method of fusion is still not available. Instrumented posterolateral fusion is an accepted method of spinal fusion [10, 17]; however, persistence of discogenic pain albeit solid posterior fusion has been previously reported [15].

Weinstein et al. reported that the outer third of the annulus of the vertebral disc has nociceptive capability, and this could account for the discogenic back pain attributable to internal disc disruption [16]. One of the merits of anterior interbody fusion is to eliminate this source of pain. A stand-alone anterior fusion lacks stabilisation of the graft and leads to high failure rates [5]. Several authors have described success with combined anterior and posterior fusion [4, 9, 11] in cases of chronic back pain, including failed back surgery, but there are few reports on combined anterior interbody fusion and posterior pedicle screw fixation without posterior fusion. While the use of rigid posterior fixation is essential to provide the required mechanical stability for graft incorporation, there is no need for attempting posterolateral grafting, as this graft will be deprived from the proper mechanical forces with subsequent resorption when using a simultaneous anterior interbody graft [4]. The purpose of this study was to evaluate the clinical and radiological results of combined anterior interbody fusion using a tricortical autogenous iliac bone graft with posterior pedicle screw fixation but without a posterior fusion in patients with symptoms secondary to degenerative lumbar disc disease.

Materials and methods

This is a retrospective study of 47 consecutive patients who underwent combined anterior interbody fusion using a tricortical autogenous iliac bone graft with posterior pedicle screw fixation but without a posterior fusion in the period between 1996 and 2000. There were 32 patients with primary degenerative disc disease, and 15 patients had previous surgery of whom 11 had previous discecto-

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my, two had previous laminectomy, one had previous chemonucleolysis and one had a failed posterolateral fusion. All patients presented with chronic back pain, and 14 patients also had leg pain that had failed to respond to a minimum of 6 months of conservative treatment.

There were 32 men and 15 women with a mean age of 44 (range 23–56) years. At the time of surgery, 22 patients were still working, 21 were not working with a mean absence from work of 20.8 (range 9–28) months, and four were in receipt of financial benefits for reported invalidity. Fourteen patients reported their back problems were work related, nine had ongoing medicolegal claims, and one had a history of psychiatric illness. All underwent a full clinical examination and plain X-rays of the lumbar spine and had a pre-operative MRI scan to decide on the levels of fusion and to assess nerve root compression.

All surgery was performed by the senior author (DC). In a one-stage anteroposterior procedure that consisted of left-anterior paramedian retroperitoneal approach, the intervertebral disc was excised, end plate preparation was achieved by curetting the cartilaginous layer down to punctate bony bleeding with careful preservation of the subchondral bone, the disc space height was measured, bone graft was harvested from the iliac crest through a separate incision and two blocks of tricortical iliac crest were finally inserted into the prepared disc space. The patient was then turned prone for the posterior procedure, which was done through a mid-line sub-periosteal approach; the pedicle screw fixation was accomplished with special attention to preserve the facet joint capsules, as posterior fusion was not contemplated. All patients were mobilised in a thoracic lumbar sacral orthosis for 12 weeks. One-level fusion was performed in 24 patients (n=24), two-level fusion in 22 (n=44) and three-level fusion in one (n=3) with a total of 71 segment-level fusion (n=71). Nerve root decompression was performed in nine patients.

Clinical evaluation was performed using the scale described by Stauffer and Coventry [12]. A good-to-excellent result was defined as 76–100% pain relief, return to previous employment status and no or only slight restriction of activity. A fair result was defined as 26–75% pain relief, return to work with limitations and mildly limited activities. A poor result included an outcome of less than 25% pain relief, no return to work and greatly limited activities. On this basis, the post-operative results were graded as poor, fair and good to excellent. Fusion was considered solid when there was bony trabecular continuity with lack of distinction between the graft and the end plate and no shift or breakage of the instrumentation. Patients were seen routinely at 3, 6, 9 and 11 months and then yearly following surgery. Minimum post-operative follow-up was 2 years; mean follow-up was 2.2 (range 2–3.3) years.

Results

There were 34 patients with good-to-excellent results, ten with fair results and three with poor results. Considering excellent and good results to be satisfactory, 34 patients were judged to have a satisfactory clinical outcome. Those patients undergoing a primary procedure had a 75% good-to-excellent result, where as those undergoing a revision surgery had a 67% good-to-excellent result. In patients with on-going medicolegal claims, six of nine had good-to-excellent clinical outcome, one fair and two poor. The patient with the history of psychiatric illness had a good outcome. Prior to surgery, 21 patients were not working. Following the fusion procedure, 13 out of 21 were back to work. Forty-five patients achieved a solid fusion and two had a non-union. The overall fusion rate by the level was 97%, 69 out of 71 segment levels fused had a solid fusion and two levels had a non-union.

Complications were seen in six patients. Intra-operative complications included two vascular injuries: one patient had avulsion of the iliolumbar vein and the other had an injury to the common iliac vein that was repaired. Both cases had an eventual recovery with no post-operative sequelae. There were no neurological problems. Post-operatively, two patients developed superficial wound infections that resolved with antibiotics, one had an injury of the lateral cutaneous nerve of the thigh with no functional compromise, and one had a transient cold foot that resolved spontaneously.

Discussion

The hypothesis behind fusion surgery in patients with chronic back pain is that a degenerated mobile segment acts as a pain generator. Consequently, if motion is eliminated, it is expected that patients will experience improvement in both pain and disability. Currently, there is no way to be certain which structure or structures are responsible for pain, but the main incriminated structures are the facet joints, the intervertebral disc, or a combination of both. Fritzel et al. [2] postulated that it would be possible to reduce pain and decrease disability through the stabilising effect of a fusion regardless of the origin of the pain; they also concluded that restoring a patient with chronic lumbar back pain to normalcy is beyond the expectation of surgical fusion, regardless of the technique used.

In our patients, the same operative technique was used in all cases without difficulty and with no neurological complications. The previously reported serious complications associated with anterior lumbar surgery, namely vascular injury and retrograde ejaculation, are considered as a major drawback to this procedure. Two vascular injuries were seen in this study with successful intraoperative repair and no post-operative sequelae. Retrograde ejaculation was not reported in any of the cases included in this study. This study has clearly shown that the anterior retroperitoneal lumbar exposure is a safe procedure

provided that a meticulous approach is strictly adopted. Overall results were 34 patients (72%) with satisfactory, excellent or good clinical results, and they all showed solid radiological union (Figs. 1, 2). Thirteen patients (28%) had unsatisfactory, fair or poor clinical results. The two patients with non-union had also unsatisfactory clinical results. In the remaining 11 patients who reported themselves as having a less satisfactory outcome despite a solid fusion, five had previous spinal surgery, three had ongoing medicolegal claims and three were in receipt of financial benefits for reported invalidity. Patient selection, therefore, would appear to be an important factor if the clinical result is to match the radiological outcome.

The two cases of non-union were both seen in patients diagnosed with primary degenerative disc disease; one patient had a single-level (L4/5) fusion, and the other patient had a double-level (L4-S1) fusion. In the patient with the L4/5 fusion level, non-union was confirmed by computerised tomography. The patient underwent an anterior revision surgery using a tricortical iliac bone graft; the final clinical and radiological outcome was not available to review. In the patient with L4-S1 fusion, non-union was felt to occur at the L5/S1 level evidenced by breakage of the pedicle screws at this level. It was difficult to confirm the non-union by computerised tomography. The patient underwent a posterior revision surgery; intra-operatively, there were hardly any movements at the L5/S1 level, so the decision was to do an alar-transverse non-instrumented fusion. At the final follow-up, solid posterior fusion was achieved with a good clinical outcome.

Tandon et al. [14] showed that return to work was influenced by social factors. They reported that patients off work for more than 1 year did not return to work. We have shown clearly in this series that spinal fusion can help patients to return to work, as 13 out of 21 patients who were not working prior to surgery were able to return to a full-time job. The remaining eight patients who were not able to return to work have been absent from work for more than 1 year.

Fig. 1 Preoperative MRI, showing single level disc degeneration at L5/S1

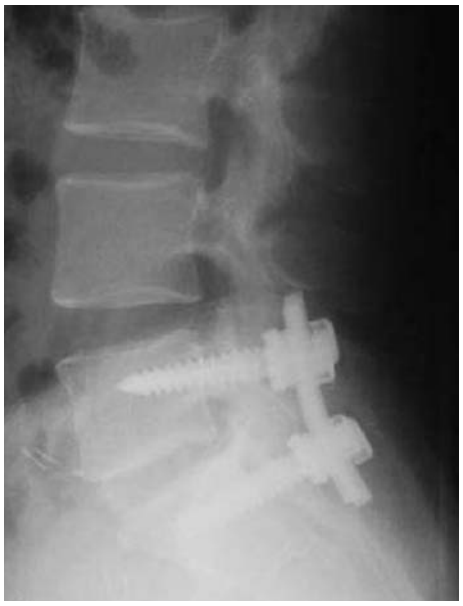

Fig. 2 Post-operative lateral view X-rays showing a solid fusion at L5/S1 level

Fujimaki et al. [3] advocated anterior interbody fusion as a salvage procedure on the basis of better vascular bed and mechanical support in the anterior column of the spine. A scar from a previous posterior surgery will lead to a poor vascular bed for the bone graft and contributed to failure of the graft incorporation with the host bone if a revision posterior fusion was attempted [6, 13]. In this study, the 15 patients who had previous spinal surgery all had a solid fusion, including the patient with a previous failed fusion. However, there was a lack of correlation between the radiological and the clinical outcome, as five patients remained with their pre-operative symptoms and were judged to have a fair-to-poor outcome.

The lack of correlation between radiological and clinical outcomes still remains a problem following a spinal fusion for low back pain. This might be attributed to many factors, including our lack of knowledge about all possible sources of pain generators in the lumbar spine and chronicity of the back pain and other issues like compensations, previous spinal surgery, psychosocial factors and the duration of absence from work.

The authors believe that the clinical and radiological results reported in this study compare very favourably with the best reported in the literature [7, 8]. The combined anterior and posterior approach to the lumbar spine appears to be ideal, the anterior interbody fusion improves the dynamics of the lumbar spine, restores lumbar lordosis and removes the source of pain and pedicle screws provide the required stability and rigid fixation until solid fusion is achieved.

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