

ORIGINAL RESEARCH

OUTCOMES OF A SINGLE LEVEL TLIF WITH A LOCAL MORSELIZED IMPACTED BONE TRANSPLANT VERSUS A CAGE WITH A LOCAL BONE GRAFT

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ABSTRACT

Background: When degenerative spinal illnesses result in neuropathic backache, nerve root decompression with instrumented interbody fusion is the preferred treatment for these groups of patients.

Methods: A hospital-based, comparative, retrospective analysis of patients who had transforaminal lumbar interbody fusion (TLIF) with either a cage with bone graft or a stand-alone autologous morselized bone graft was conducted. The clinical and radiological outcomes of these two interbody fusion procedures were evaluated to see if there was a meaningful difference. A total of 20 patients with lumbar canal stenosis and degenerative grade 1/2 spondylolisthesis who had failed conservative management were operated on using the TLIF approach and were evaluated for postoperative improvement in the Oswestry disability index (ODI) and interbody fusion on imaging at 6 months and 1 year after surgery. Each patient's vertebral level of surgical intervention, intra-operative blood loss, and operation duration, as well as any complications, were noted.

Results: There was no significant difference in clinical or radiological result between the two modalities of interbody fusion in our study. Although the group that received morselized bone graft with cage had a somewhat better clinical outcome at 6 months, there was no meaningful difference in ODI at 1 year.

Conclusions: Based on the findings of this study, we can infer that both procedures have similar clinical and radiological outcomes, as well as similar patient satisfaction, and can be used interchangeably for interbody fusion depending on the surgeon's and patient's preferences.

Keywords: Transforaminal lumbar interbody fusion, Morselized bone graft, Cage, Oswestry disability index

INTRODUCTION

Degenerative spinal illnesses have become more common as people get older. Previously referred to as an ageing disease, its prevalence is rapidly growing in younger persons. Degenerative disc disease, spinal stenosis, degenerative spinal scoliosis, facet joint arthritis, and spondylolisthesis are all part of its spectrum [1]. Patients most typically report with backache, radicular pain, and stiffness, resulting in varying degrees of morbidity and being one of the most common causes of disability. Conservative management, such as physiotherapy, analgesics, and lifestyle changes, is usually recommended as the first line of treatment. Patients with symptomatic spondylolisthesis and spinal canal stenosis should have surgery [2,3].

The goal of surgery in degenerative spine disease is nerve root decompression with or without substantial bone fusion. For the treatment of degenerative lumbar spine disease, instrumented lumbar fusion has become a popular surgical procedure [4]. It stabilises the uncomfortable motion segment and may give indirect neural decompression. The success of the procedure is dependent on correct neural decompression, instrumentation, bone graft, and disc space preparation. In the literature, several surgical techniques for approaches, instrumentation, graft material, and lumbar fusion location are reported [5]. Lumbar interbody fusion procedures include oblique lumbar interbody fusion/anterior to psoas (OLIF/ATP), minimally invasive transforaminal lumbar interbody fusion (MILTIF), transforaminal lumbar interbody fusion (TLIF), lateral lumbar interbody fusion (LLIF), posterior lumbar interbody fusion (PLIF), and anterior lumbar interbody fusion (ALLIF) (ALIF) [6].

TLIF is the most extensively used method, first proposed by Harms and Rolinger in 1982 [6]. We compared the clinical, functional, and radiological results of TLIF with stand-alone morselized impacted bone graft versus TLIF with cage and bone graft in retrospective research. There is literature addressing the benefits and drawbacks of TLIF with cage and bone graft, as well as only morselized bone graft, however there is little literature comparing the two [7, 8, 9, 10].

METHODS

PATIENT SELECTION

We investigated 20 patients treated with TLIF at a tertiary care government hospital in Bhubaneswar within a year, with an average follow-up of 12 months. Ten patients (group 1) had TLIF with local morselized bone transplant with cage, while the remaining ten patients received TLIF with local morselized bone graft without cage (group 2). Severe spinal canal stenosis (based on pre-operative MRI showing more than two-thirds reduction in AP diameter of canal and walking distance of less than 100m based on self-paced walking test [SPWT] records), grade 1/2 listhesis, and failure of conservative management were the inclusion criteria for our study. It is possible for degenerative listhesis and lumbar canal stenosis to coexist.

A plain AP and lateral radiograph, as well as an MRI, were performed to identify the affected motion segment and to assess the orientation and width of the vertebral pedicle. In our study, the exclusion criteria were multilevel involvement, severe osteoporosis, spinal infection, and

previous spinal surgery. For inclusion in the trial, all patients provided written and informed permission.

ASSESSMENT

Plain AP and lateral radiographs were taken preoperatively, immediately postoperatively, and at 1.5, 6, and 12 months post-operatively. Radiographs were examined for signs of interbody fusion, screw loosening, cage position, and disc height maintenance. The pedicle screw-rod system was found to be structurally sound. A radiolucency of 1 mm or greater at the bone screw surface was defined as screw loosening, and a radiolucency of 1 mm or greater around the cage was described as cage loosening [7]. A CT scan was utilised to examine bone fusion, and each case was rated at 1 year post-operatively using the fusion criteria given by Brantigan et al [8]. A CT scan was also performed to check for disc height maintenance and implant loosening, fracture, or subsidence. The radiological evaluation was performed by a single radiologist who was not aware of the clinical outcome. Pain and disability were assessed pre-operatively, six months afterwards, and one year later. At each appointment, pain was quantified using a VAS score. The time it took to return to normal physical activity after using pain relievers was recorded. The Oswestry disability index (ODI) was included in patient evaluation questionnaires and was used to evaluate clinical improvements and daily functional outcomes during patient follow-up. The ODI was computed before surgery, six months later, and one year later.

Each case's intraoperative blood loss, surgery length, postoperative problems, and hospital stay duration were all recorded. SPSS software version 25 was used for statistical analysis of pertinent data. The Mann Whitney test was used to compare the results of groups 1 and 2.

RESULTS

DEMOGRAPHIC DATA

The male:female ratio in the first group (cage with bone graft) was 3:2 and 7:3 in the second group (morselized bone graft only). The average age of the patients in Group 1 was 47.3 years (39-61 years) and 52.4 years (34-63 years) in Group 2. In both groups, the most prevalent level involved in patients was L4-L5 (Table).

Table: Demographic data and outcome in group 1 and group 2

Variable	Group 1	Group 2
Average age	47.3 years	52.4years
Sex distribution		
Males	6	7
Females	4	3
Level involved		
L4-L5	7	7
L5-S1	3	3
Grade of listhesis		
Grade I	8	7
Grade II	2	3
Average intraoperative time	141 minutes	122minutes

Average blood loss	371.5 ml	308ml
Grade of fusion achieved at 1 year follow up		
Grade 3	1	Nil
Grade 4	1	3
Grade 5	8	7
ODI pre-operative	53.6	53.8
ODI at 6 months	22.8	26
ODI at 12 months	21	22.8

RADIOLOGICAL OUTCOME

Plain radiographs revealed that all patients' disc heights were stable, with no indication of screw loosening. In all groups, all but two instances attained grade 5 complete bone fusion. There were no signs of implant fracture or subsidence. On CT, 8 of 10 cage with bone graft cases (group 1) had complete union, with 1 patient each having grade 3 and grade 4 fusion. Seven morselized bone grafts had complete fusion, while three had grade 4 fusion. At 12 months of follow-up, disc height was maintained in both groups with no signs of clinically significant collapse.

CLINICAL OUTCOME

At 6 months post-operative follow-up, the Oswestry disability index showed that cases with cage with bone graft improved more than instances with morselized bone graft, but the difference was statistically insignificant ($p>0.05$). However, after a year of follow-up, both groups improved equally in ODI. At the 1-year follow-up, all patients' VAS scores had decreased.

PER-OPERATIVE OUTCOME

The average surgical time for a cage with a bone transplant was 141 minutes, while it was 122 minutes for a morselized bone graft (Table). In cage with bone graft patients, the average per-operative blood loss was 371.5 ml. Those who received a morselized bone transplant had slightly reduced blood loss, averaging 308 ml. In any of the 20 cases, there was no clinically significant consequence. Two cases in the first group and one case in the second group each had a dural tear that was repaired intra-operatively and the patient was placed in the Tredelenburg position. There was no evidence of superficial or deep infection in any of the patients after surgery or during follow-up.

ODI SCORE ASSESSMENT

The mean pre-operative ODI in group 1 was 53.6 (SD8.527), while it was 53.8 in group 2 (SD7.39). At 6 months, there was no significant difference between the two groups, with a mean value of 22.8 (SD4.237) in group 1 and 26 (SD5.416) in group 2. At one year, the mean ODI value in group 1 was 21 (SD4.546) and 22.8 in group 2 (SD 3.55).

DISCUSSION

Degenerative lumbar spinal issues are widespread in the elderly population. The first line of treatment is conservative management. When conservative treatment fails, surgery is recommended. The goal of surgery is nerve root decompression, solid fusion, and disc space height restoration. Solid fusion improves functional outcomes and patient satisfaction [9]. Various fusion techniques are used, including posterolateral inter-transverse fusion, anterior inter-body fusion, and posterior interbody fusion. The most popular treatment procedures for lumbar spondylolisthesis are posterior interbody fusion and posterolateral fusion. According to research, PLIF has a higher percentage of fusion than lumbar posterolateral fusion (PLF) and may generate superior clinical outcomes [11, 12, 13]. We performed interbody fusion in all instances in our investigation. Interbody fusion techniques accessible include anterior, oblique, transforaminal, posterior, and minimally invasive lumbar interbody fusion. Prior research has shown that TLIF (transforaminal lumbar interbody fusion) has a better outcome in terms of operation duration, blood loss, and complication rates, and is thus our preferred procedure for all cases in this study [14, 15].

According to isolated investigations on patients of spondylolisthesis treated with interbody fusion with cage and bone graft, the cage improves lumbar lordosis and provides better disc height maintenance until bony fusion occurs due to structural integrity [15,16]. However, there is a risk of root injury, increased intra-operative blood loss, post-operative cage retropulsion or migration, immunological difficulties due to foreign body reactions, and a lower fusion rate due to a reduced accessible contact area for bony fusion [17, 18, 19, 20]. The placement of a cage in the interbody space may necessitate more facets being resected. Furthermore, the cage raises the cost of implants, resulting in larger surgery packages.

There is minimal comparative literature between solo bone graft and bone graft with cage, with inconsistent outcomes [21]. For example, Atil et al [22] discovered that improvement in VAS score and increase in disc height was superior in the cage group. Patil et al [23] discovered that the isolated bone transplant group had outstanding clinical and radiological outcomes. When adopting the cage technique, Yu et al [24] demonstrated that the intervertebral height can be better maintained. For PLIF, Arai et al [25] used an autologous ileum graft. In his study, 25-50 percent of the patients had fusion following intervertebral space collapse, whereas none of the PLIF patients with a cage had intervertebral space collapse.

We conducted a study to compare the clinical and radiological outcomes of solitary morselized bone graft against bone graft with cage in patients with spondylolisthesis and stenosis treated with TLIF surgery, who were separated into two groups based on patient preferences and financial situation [25]. There was no significant difference in clinical or radiological result between the two modalities of interbody fusion in our study. Although group 1 had a somewhat superior clinical outcome at 6 months, both groups had the same percentage of grade 5 fusion after 1 year.

CONCLUSION

At 1 year of follow-up, there was no statistically significant difference ($p > 0.05$) between the two groups based on ODI score. However, the use of a cage adds to the patient's financial burden, which is an important element to consider when doing TLIF surgery in a developing

nation. In conclusion, morselized bone grafts are as efficient as cage with bone graft in improving symptoms and have similar clinical results. Both are excellent methods for spinal fusion in single level TLIF surgery. The operating surgeon, the patient's financial situation, and hospital protocols may all influence the decision.

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