



Case report

Discoplasty as a salvage technique for pseudoarthrosis following multilevel TLIFs: A case report

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ABSTRACT

Background: Pseudoarthrosis, often defined as a failure to achieve osseous fusion by the 1-year post-operative time point. Despite its relatively high prevalence, there is still lack of clinical evidence on salvage options for lumbar pseudoarthrosis. Lumbar interbody fusion is generally accepted as a useful surgical treatment for patients with pseudoarthrosis. Several techniques are available to achieve stabilization of the lumbar spine including the anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF), transforaminal interbody fusion (TLIF), direct lateral interbody fusion, posterolateral only (intertransverse) fusion, and facet or pedicle screw/rod placement. We present a case report of discoplasty as a salvage option for pseudoarthrosis following lumbar fusion surgery using multilevel TLIFs.

Method: This study is a case report. A female patient, 79 year old, came with recurrent backpain at the lumbar area that got worse during the past 3 months. She underwent posterior lumbar fusion surgery of L3-S1 by pedicle screw and transforaminal interbody fusion at the level of L3-S1. Three years later she experienced another episode of back pain and underwent pedicle screws removal to improve her pain. Two years later complaint reappeared. The pain was rated 7/10 in standing position and improved to 5/10 with resting in horizontal position. We followed up this patient for 1 month after surgery.

Result: After surgery, VAS score was decreased from 7/10 into 1/10 in standing position and patient was able to stand and walk using a walker. Postoperatively plain radiograph was performed and there was no complication. In a month follow up, the VAS score was 1/10 with ODI score reduces significantly from 38% to 4% showing only minimal disability.

Conclusion: Salvage discoplasty for pseudoarthrosis following posterior lumbar fusion surgery is rarely reported, but it appears to be viable option aside from ALIF that results in significant improvement in clinical outcomes. Discoplasty offers a less invasive solution in elderly patients which significantly reduces the symptoms and improves the quality of life of the affected patients.

1. Introduction

Lumbar interbody fusion is generally accepted as a useful surgical treatment for patients with spondylolisthesis, degenerative disk disease, recurrent disk herniation, infection, traumatic injury, spinal deformity, and neoplasia. The fusion method using posterior approach has been most widely used [1]. Several techniques are available to achieve stabilization of the lumbar spine including the anterior lumbar interbody fusion (ALIF), posterior lumbar interbody fusion (PLIF), transforaminal interbody fusion (TLIF), direct lateral interbody fusion, posterolateral only (intertransverse) fusion, and facet or pedicle screw/rod placement

[2].

The most important surgical goal in fusion surgery is bone fusion. However, if spinal intervertebral fusion fails and symptoms develop in patients, salvage surgery is needed [3]. Non-union rates in all types of lumbar fusions have been reported in the 0% to 40% range. With modern techniques such as interbody fusions, pedicle screw fixation, and bone graft substitutes, non-union rates are typically in the 0% to 10% range [4]. In a cohort study, multilevel of posterolateral stabilization has been associated with higher risk in developing non-union compared to single level fusion [5].

Pseudoarthrosis, often defined as a failure to achieve osseous fusion

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by the 1-year post-operative time point [6]. Pseudoarthrosis usually determined by the presence of persistent motion and absence of mature traversing bony trabeculae between the vertebral bodies used. It often needs revision surgery, with the rates for reoperation have been reported from 6% to 36% [7]. Heggeness and Esses classified posterolateral lumbar pseudoarthrosis into 4 different patterns, including: atrophic, transverse, single and complex. The transverse type is the most common, where there is a horizontal discontinuity despite remodelled bone [2]. The result of revisions procedures have historically been relatively poor, with rates of recurrent pseudoarthrosis is 35–50% and clinical failure observed in as many as 40 to 70% of cases. A variety of factors have been shown to influence pseudoarthrosis, including smoking, metabolic disorders, surgical instrumentation and location of fusion [8]. The type of surgical procedure, approach and technique used also influences the final clinical and technical outcome. The following are local factors for pseudoarthrosis: (1) previous surgery (scar formation, and lack of adequate vascularity), (2) motion (instability), (3) autogenous bone graft, (4) surgical technique and (5) number of level fused [7]. Despite its relatively high prevalence, there is still lack of clinical evidence on salvage options for lumbar pseudoarthrosis. We presented discoplasty as a salvage option for pseudoarthrosis following lumbar fusion surgery using multilevel TLIFs. This case report has been reported in line with the SCARE Criteria [9].

2. Case presentation

A 79-year-old female patient presented with recurrent backpain at the lumbar area that got worse during the past 3 months. The patient came as an inpatient in RSCM hospital Jakarta, Indonesia in 2021. She had a history of back pain and leg pain since 2016 and underwent posterior lumbar fusion surgery of L3-S1 by pedicle screw and transforaminal interbody fusion at the level of L3-S1. After three years of surgery, she experienced another episode of back pain and underwent pedicle screws removal, leaving only 3-levels of TLIF. 2 years after pedicle screw removal, the complaint reappeared. The patient then went to our centre with a complain of backpain that radiated to left buttock area.

The patient then underwent physical examination. On inspection, there was no sign of inflammation on the previous surgical scar. There was midline tenderness at the level of L3-L4 with referred pain to the left buttock and using the visual analogue scale (VAS), the pain was rated 7/10 in standing position and improved to 5/10 with resting in horizontal position. The range of motion (ROM) of the lower back was limited due to pain. There was no complain of weakness, nor decreased of sensory function. ODI score was evaluated preoperatively with moderate disability result. Patient had a history of type 2 diabetes since more than 10 years ago and routinely consume medication.

Laboratory and radiological examination was performed in the patients. Laboratory test showed an increase of blood glucose level (221 mg/dL), with no other abnormal findings. Computed Tomography (CT) has developed into the preferred method in assessing interbody fusion. Pre-operative CT was performed to see whether the lumbar fusion had been achieved after 5 years of surgery. As seen in Fig. 1, the CT showed that the cages were still in place, but there was sign of non-union at the level of L3-L4 with massive callus formation that was the cause of recurrent pain after the previous surgeries.

Discoplasty was performed under sedation, with patient in prone position above 2 rolls in order to increase lumbar lordosis and disc space height. Under fluoroscopic vision, cannulated needle was placed at L3-L4 intervertebral disc, and polymethylmethacrylate (PMMA) was slowly injected through the cannula (Fig. 2). Discoplasty was done by experienced orthopaedic surgeon in our hospital. During the injection, there was no sign of PMMA leakage into the canal, nor foraminal space. Intraoperatively, no cement-related complication found. After the procedure, patient was encouraged to stand and walk as soon as possible, and patient was discharged on the same day.



Fig. 1. Preoperative CT.

Postoperatively plain radiograph was performed and there was no complication (Fig. 3). Patient also showed gradual improvement in term of pain. The pain degree using VAS score was decreased from 7/10 into 1/10 in standing position, and after the surgery patient was able to stand and walk using a walker. During post-operative care the patient's haemodynamic was good, and she was discharged on the same day with significant pain relieve. Patient was allowed to ambulate in full weight bearing using assistive device to maintain balance for a week and continue to walk without any support. In a month follow up, the VAS score was 1/10 with ODI score reduces significantly from 38% to 4% showing only minimal disability. Patient also reported her satisfaction regarding her pain improvement postoperatively.

3. Discussion

Pseudoarthrosis, or non-union of a fusion may occur following lumbar spine surgery due to various factors including modifiable patient behaviours, medication use, and systemic diseases [10]. Other small series have identified risk factors for pseudoarthrosis including smoking, diabetes, steroid use, and younger age. Previous studies have specifically identified insulin dependent diabetes mellitus as a risk factor for pre-operative complication and non-union in patients undergoing posterior instrumented fusion. They detected significant reduction in bone mineral density, bone volume, structural mechanical index, and trabecular thickness. A significant increase in IL-1 β , IL-5, IL-10, TNF- α and KC/GRO (CXCL1) levels were detected locally in the fusion beds of IDDM, also in blood samples of animal models which showed that the elevated cytokine levels may be rather a result of systemic cytokine dysregulation than a local response only [11]. In our case, patient had a history of diabetes in the past 10 years with insulin treatment that contributed as a risk factor in developing a non-union lumbar fusion.

Osteoporosis is a comorbidity that remains a significant risk factor for unsuccessful outcome of spine surgery. Patients with osteoporosis have been associated with increase in comorbidities, and at a greater risk for fusion construct failure and pseudoarthrosis [12]. Surgeon must identify patients at risk for osteoporosis and initiate medical

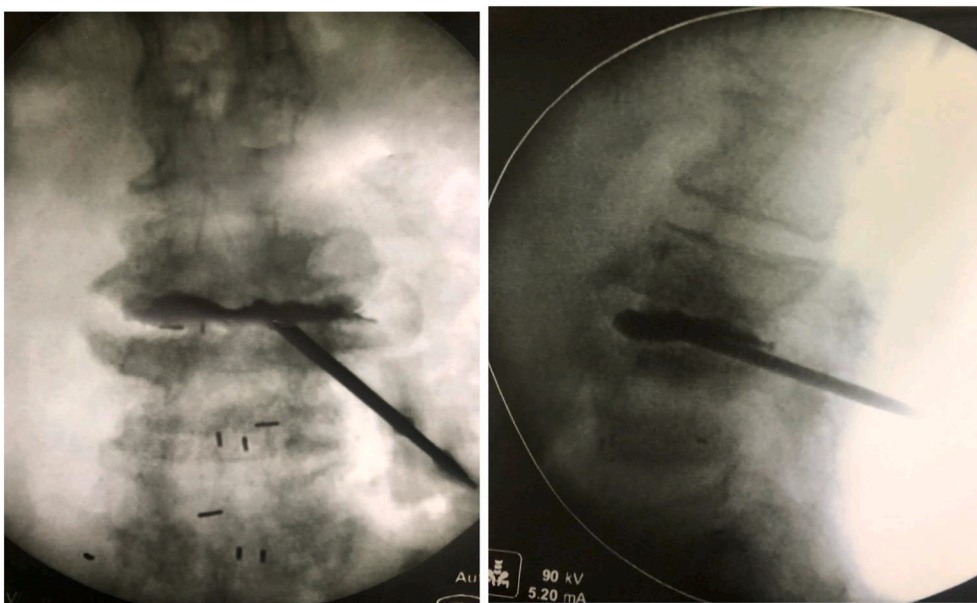


Fig. 2. PMMA injection.

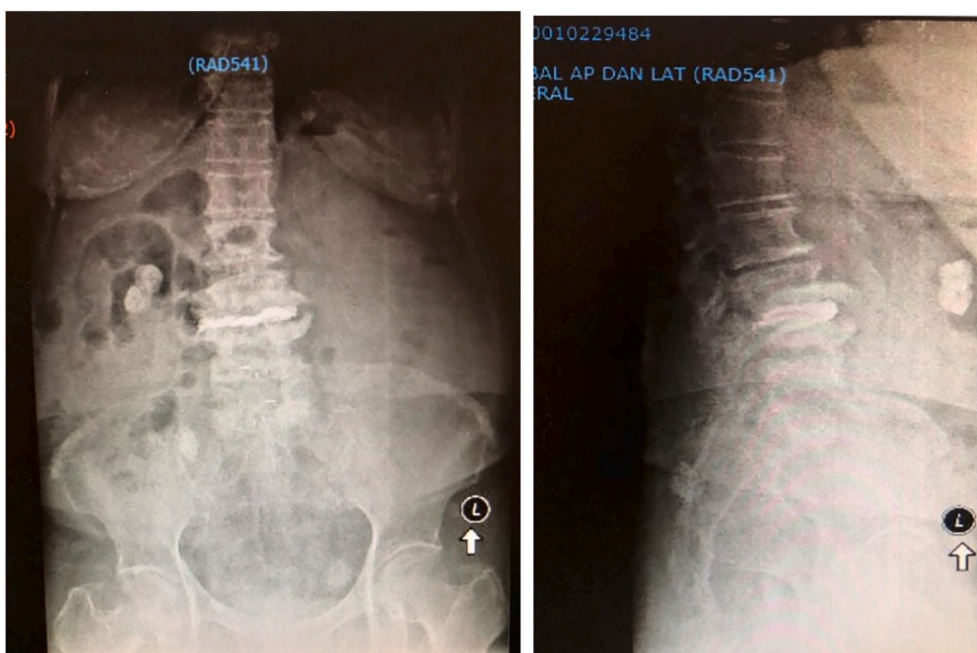


Fig. 3. Post-operative X-ray.

optimization before surgery. A recent survey of spine surgeons found that less than 45% perform bone density tests and only 12% order metabolic bone health panels prior to spine fusion in patients with suspicion of osteoporosis or osteomalacia [13]. Proper screening through DEXA scans, obtaining vitamin D levels of suspected osteoporosis patients, and the use of perioperative interventions in those undergoing multilevel fusions should be done to promote higher fusion rate [14].

The numbers of levels fused affects the pseudoarthrosis rate, with increased rate associated with increasing number of fusion levels. Cleveland et al. noted that the rate of pseudoarthrosis increased dramatically as the number of vertebral levels spanned by the fusion increased. Fusion rates of 90.3% for one level, 77.2% for two levels, and 65.2% for three levels have been reported for posterolateral lumbar

spinal fusion [15].

In a previous cohort study, there was a correlation between the number of levels fused and the risk for operative non-unions. The rates of pseudoarthrosis after lumbar spine fusion have ranged from 5% to 35%, with a significantly higher incidence in those spanning 3 or more spinal levels [16]. The overall 2-year crude probability of operative non-union was 1.08% (95% CI, 0.72–1.56), with 3-level and 4-level fusions showing 1.6 and 3.3 times operative non-union rates compared with 1-level PLF. They also noted trends for operative non-union to be greatest for L5-S1 at all level [5].

Atici et al. [17] comparing fusion rates and clinical outcomes of instrumented PLF alone with cage-augmented TLIF, and they found that adding TLIF cages to PLF yielded better ODI and VAS scores, but showed no difference in fusion rates. Another study by Marques et al. assessed

the risk factors of pseudoarthrosis in adult spine deformity surgery. Out of 524 patients included in the study, 65 patients developed pseudoarthrosis and 53 underwent revision surgery. Notably, 88% of pseudoarthrosis cases are associated with fusion length, osteotomy requirement, pelvic fixation and combined approach [18]. Hofler et al. [19] reported on multivariable analysis, patients with the posterior-only approach or combined approach were significantly less likely to develop pseudoarthrosis compared with patients with anterior only approach. Although in their study, the risk of pseudoarthrosis with 4–8 vertebrae fused was not significantly increased, patients with ≥ 9 vertebrae fused were more likely to experience pseudoarthrosis than were those only 2–3 vertebrae. In our case, patient previously had a 3-level of TLIFs which involving L5-S1 vertebrae that was combined with posterolateral fusion. Previously mentioned, fusion length increased the risk of pseudoarthrosis up until 1.6 times compared to 1-level PLF, and the involvement of L5-S1 may increase the risk even more.

Symptomatic pseudoarthrosis after lumbar spine fusion in elderly patient is associated with pain and reduction of the quality of life. Surgical revision through antero-posterior or posterior approach is associated with complications especially in multimorbid patients. Despite its relatively high prevalence, there is a lack of robust clinical evidence on salvage option for lumbar pseudoarthrosis. Several previous studies have reported ALIF as a useful and safe procedure for treating failed PLIF or TLIF with not only in radiographic improvements in bony fusion, but also in significant improvements in the patient's physical and mental experience of pain [1,2,6].

Discoplasty, another salvage procedure for pseudoarthrosis, on the other hand is rarely done for treating this problem. In 2018, Divani et al. reported a case of 63-year-old women who had multiple instrumented procedures to her lumbar spine with proximal junctional failure and performed salvage technique by injecting percutaneous cement into the disc space and vertebral body. It resulted in improvement of pain scores and walking distance postoperatively, and a lower degree of proximal junctional kyphosis. In patients with multiple comorbidities and very difficult deformities, the salvage technique could be used to prevent patient from being exposed to further high-risk revision operations [20]. Another case has been reported by Granville et al. which they used Cortoss bone cement to stabilize a non-union after interbody fusion. They performed a percutaneous lateral foraminal approach with an injection of bone cement into L4-L5 interspace of a 65-year-old male who had previous TLIF surgery with persistent deep low lumbar pain. At six months follow up, the patient had a 50% reduction in pain [21].

Alhashash et al. evaluated the results of discoplasty (percutaneous cement injection) in lumbar and thoraco-lumbar symptomatic pseudoarthrosis after posterior lumbar fusion in elderly (above 65), and at the end of follow up VAS improved significantly to 3.5 ± 2.3 ($p = 0.02$) and ODI improved to 16.3 ± 4.8 ($p = 0.001$) [22].

The rationale in performing discoplasty due to the advantage of minimally-invasive surgery that may fit in elderly patients, as with our patient. Also, it needs to be highlighted that the result was quite satisfying in short-term follow up. Immediately post operatively, the VAS revealed a significant reduction in pain compared with before the operation. At the short term follow up examination, we observed the ODI score was better after the procedure with only minimal disability.

4. Conclusions

Salvage discoplasty for pseudoarthrosis following posterior lumbar fusion surgery is rarely reported, but it appears to be viable option aside from ALIF that results in significant improvement in clinical outcomes. Discoplasty offers a less invasive solution in elderly patients which significantly reduces the symptoms and improves the quality of life of the affected patients. However, clinical analysis with long term follow-up is needed.

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Disclaimer

No patient or author details are included in the figures.

Informed consent

Informed consent had been acquired before the patient was operated.

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Ethical approval

Ethical approval was not required in the treatment of the patient in this report.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Harmantya Mahadhipta contributes to the study concept or design, data collection, analysis and interpretation, oversight and leadership responsibility for the research activity planning and execution, including mentorship external to the core team.

Ajiantoro contributes data collection, analysis, and interpretation.

Ronald Henry Tendean and Dwi Kartika Sari contribute to the study concept or design, data collection and writing the paper.

Registration of research studies

Does not need any registration.

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Declaration of competing interest

The authors declare that there is no conflict of interest.

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