Management of distal adjacent segment disease due to central subsidence of PLIF using local anesthetic transforaminal foraminotomy and lumbar discectomy

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1. Introduction

The incidence of ASD (adjacent segments disease) varies widely from 5.2%–100%; this wide range of incidence could be due to the different definitions, methodologies, and follow-up period in each study [1].

Park et al. [3] defined adjacent segment diseases as any abnormal process in mobile segments adjacent to spinal fusion. Disc degeneration was the most common etiology observed among those abnormal processes, other pathology of ASD were spondylolysis, instability, facet joint degeneration, herniated disc, stenosis, sclerosis, and compression fracture.

There were several risk factors to the development of ASD. Such as age at the time of the primary surgery [4]. Incidence of segment instability adjacent to the spinal fusion was significantly higher in patients older than 55 years of age. In addition, they reported that the presence of even mild radiographic degeneration at L5–S1 disc was one of the risk factors. Pre-existing facet degeneration before lumbar fusion has been suggested as a risk factor of ASD incidence.

Generally, adjacent segment was thought to be the immediate next segment to the spinal fusion. Some articles insist that it was within two segments adjacent to the spinal fusion [1].

This case report was stated and written in line with the SCARE 2018 criteria [12].

2. Case report

We presented a case report of a male 55 y.o with distal Adjacent Segment Degeneration of the 1st–2nd lumbar spine and 5th lumbar–1st sacral spine in patient with Degenerative canal stenosis of the 2nd–5th lumbar spine Schizas and Lee moderate Modic 2 and spondylolisthesis of 4th–5th lumbar spine Meyerding 1 without neurologic deficit (Fig. 1).

For the brief history, on June 2015, the patient fell and his coccyx hit the ground. After the accident, patient felt pain in his back, left lower leg, and could not walk due to pain. The patient chose
conservative treatment for 3 years (physical therapy) but the pain did not improve.

On September 2018, the patient went for orthopaedic doctor, and he was assessed with 2nd–5th degenerative lumbar canal stenosis Frankie C, Spondylolisthesis of the 4th–5th lumbar spine Myerding I and performed laminotomy, decompression, stabilization and PLIF. After the procedure, the pain was improved from VAS 10 to 2. On December 2019, the patient was fell again after slipped on the ground, after the accident the patient felt pain (VAS 8) and planned for further investigation. On March 2020, the patient was assessed with cage migration, this result in collapsed height of adjacent vertebrae and implant central subsidence due to the collapse of end plate. This pathology become problematic as adjacent segment degeneration develops between 5th lumbar and 1st sacral. The patient complained of severe pain (VAS 8) around the hip and the right leg due to nerve root compression at the level of ASD, this symptom was consistent with the radiologic finding in MRI. The patient was reluctant to undergone 2nd open surgery and preferred to minimally invasive surgery. So on March 2020, we performed SNRB at the level between 5th lumbar and 1st sacral spine and CESI 2 months before, the pain was subsided (VAS 2) but it was not longer than 48 h after the procedure. For the recent problematic symptoms, on June 2020 we presented PELD and Foraminotomy of superior articular process of S1 to relieve the right nerve root compression as the clinical (pain and its radiation) and radiologic finding was consistent with right 5th lumbar and 1st sacral nerve root compression.

The lumbosacral segments were carefully examined by spine surgeon and radiologists with magnetic resonance imaging (MRI) to identify the location that trigger the pain. The surgery was done by spine surgeon. Data was presented from a patient who underwent single level unilateral endoscopic decompression at the level of the distal ASD.

Patient in the prone position in the operating table with the hip and knee flexed to avoid stretching to the lumbosacral plexus, lumbosacral lordosis was obliterated using a Wilson’s frame to increase the anteroposterior dimension of the foramen. Prepping and draping was performed in the operating field, after several levelling using K-wire and fluoroscopy, we defined the insertion point on the right side of the patient, 7 cm lateral to the midline at the level of L5–S1 disc space (Fig. 2).

![Fig. 1. Pre Operative radiologic evaluation.](image-url)
Patients received a local anesthesia with 10 cc of 0.5% lidocaine. We started a posterolateral work approach via the intervertebral foramen step by step, parts of the bone on the ventral and the cuspidate articular process were abraded by drilling with diamond-headed high-speed burr with diameter of 3 mm. The intervertebral foramen was expanded to form a passageway L5–S1 foramen, and nerve-root was decompressed.

Discectomy of L5–S1 segment was performed with straight, up-going, and bendable graspers. After insertion, there were empty disc with degenerative disc, we performed inside out technique. In the inside-out technique, the cannula inserted into the disc just underneath the herniated nucleus pulposus and it is gradually back up while clearing the one third posterior of the annulus to evacuate the herniated degenerative disc by rotating the beveled cannula working channel and endoscope, a 360-degree visualization of the annulus and exiting and traversing nerve roots was possible. The technical success of the foraminotomy procedure was determined by the visualization of the exiting and traversing nerve root and visualizing the ball-probed dilator passing freely under the nerve and over the inferior pedicle (Figs. 3 and 4).

After adequate degenerative disc decompression and foraminotomy of the ventral aspect of superior articular process of the sacrum using a high-speed drill, the patient was asked about his radicular symptom whether the pain relieve or not before ter-
minating the procedure. The radicular symptom was compared
between pre and post intervention on the same (prone) position
as the patient on the operating table. We found that the pain was
improved from VAS score 8 to 4. The working channel and scope
were removed and the wound was closed with a single interrupted
suture and an adhesive bandage.

Postoperative improvements of clinical symptoms and radiog-
raphy were evaluated on 3rd day, 2nd weeks and 3rd month follow
up to the patient, the pain and functional outcome were assessed by
VAS Score and The Oswestry Disability Index (ODI). ODI was impor-
tant for measuring degree of disability and estimating quality of life
in a person with low back pain. Radiologic follow up includes X-ray

Fig. 3. Intra Operative device placement.

Fig. 4. Intra operative endoscopic view.
Fig. 5. Post Operative radiographic evaluation.
examination of lumbar instability with Flexion-Extension Position of anterior/posterior and lateral position film, and MRI.

Pre-operative VAS score was 8, while the ODI score was 74%. After the patient had PELD and foraminotomy, there was a significant pain relieve (VAS score 4) and ODI score was 68%. However, the pain was still persist and it was dramatically reduced on the 2nd weeks from 4 to 2 and so the ODI score from 68% to 46%.

We perform radiologic evaluation of the flexion extension plain X ray, CT and MRI at the level of the previously diagnosed distal ASD at 27 days after the procedure, we found that the segment is stable, no anterior and posterior translation, and the right superior articular process of S1 level is cut (Fig. 5).

3. Discussion

Spinal fusion increases the stress on the non-operated adjacent motion segments and puts the patients at risk for developing adjacent segment disease (ASD). ASD refers to the presentation of new symptoms referable to cranial or caudal motion segment after spinal fusion [5].

Adjacent segment pathology after lumbar spine fusion surgery is likely the result from stress concentration and hypermobility at the junction of the mobile and fused segments. Iatrogenic disruption of the soft tissue and ligamentous structures may promote instability and accelerate degenerative processes at adjacent segments. With time, these forces can lead to premature degeneration of the facet joints. As the facet degenerate, translation of the adjacent segment may occur and produce spondylolisthesis. The chronic segmental stress concentration and hypermobility can lead to facet hypertrophy and thickening of the ligamentum flavum. Collectively, these changes result in compression of the neural elements and the common clinical symptoms of Adjacent Segment Pathology, including back pain, radiculopathy, and neurogenic claudication [2].

Radiographic ASD is relatively common long-term finding associated with instrumented lumbar fusion. However, radiographic evidence of ASD does not necessarily correlate with a poor outcome. Study by Gun Choi et al. suggest that advanced age, anterior lumbar interbody fusion, and the restoration of the preoperative standing lumbar lordosis may have a protective effect against the development of ASD [11].

Traditional treatment for ASD is to perform a secondary surgery (repeated open surgery), including the bone graft fusion and inter nal fixation of lumbar posterior vertebral lamina decompression (such as posterior lumbar interbody fusion or PLIF) [6].

However, repeated open surgery of internal fixation has been associated with complications, such as tissue scarring and adjacent segment degeneration caused with further damage to the vertebral shift and can reduce the repeated damage to the posterior and paraspinal structures [7].

ASD does not always require surgery [8]. Here we present a local anesthetic transfenoral foraminotomy with excision of the S1 superior articular process and lumbar discectomy for the treatment of symptomatic ASD, which was operated through intact tissue. The advantage of PELD has been studied, including pain relief, less damage to ligamentous structures, faster rehabilitation, and shorter hospital stay [9]. However, further study of long-term outcome of this procedure need to be done. Short-term clinical outcome (6 months to 1 year follow up) of Endoscopic minimally invasive surgical treatment for radiculopathy that results from ASD was temporarily beneficial and it was consistent with our patient clinical outcome as indicated by VAS and ODI score. However, ASD is a progressive problem and long-term outcome of endoscopic treatment is only temporarily beneficial as it has 33% failure rate within 2 years [10].

4. Conclusion

Combined PELD and foraminotomy for ASD treatment is effective, short clinical outcome in 3rd days, 2nd weeks and 3 months show an improvement in VAS and ODI score as quantitative measurement for pain relieve and functional outcome respectively, the radiologic follow up evaluation show a stable segment. However, long-term outcome need further investigation as ASD pathology are progressive over the time.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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Ethical approval

The informed consent form was declared that patient data or samples will be used for educational or research purposes. Our institutional review board also do not provide an ethical approval in the form of case report.

Consent

We have obtained all patient’s consent and had the statement included in the consent section in the manuscript. We also do not include any of the patients name or the institution.

Author contribution

Yudha Mathan Sakti conceived the study. Akbar Mafaza, Zikrîna Abyanti Lanodiyu and Galih Prasetya Sakadewa, drafted the manuscript and critically revised the manuscript by Rahadyan Magetasari for important intellectual content. Akbar Mafaza, Zikrîna Abyanti Lanodiyu and Galih Prasetya Sakadewa facilitated all project-related tasks.

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