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KORELASI *FUSION RATE* TERHADAP *FUNCTIONAL OUTCOME* PASIEN *LUMBAR SPINAL STENOSIS* PASCA PLIF

CORRELATION OF FUSION RATE ON LUMBAR SPINAL STENOSIS POST PLIF WITH FUNCTIONAL OUTCOME

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ABSTRAK

Penatalaksanaan lumbar spinal stenosis dengan instabilitas yaitu dengan laminektomi dekompresi, stabilisasi posterior dan Posterior Lumbar Interbody Fusion (PLIF). Derajat fusi dapat ditentukan dengan pemeriksaan CT-scan post operatif. Tujuan penelitian ini adalah untuk menilai disabilitas dan skor fungsional pada pasien LSS menggunakan skor Oswestry Disability Index (ODI). Penelitian ini merupakan penelitian analisis observasional pada 18 pasien LSS yang telah dilakukan operasi instrumentasi PLIF. Pasien diminta mengisi kuesioner ODI dan dilakukan evaluasi CT Scan, kemudian dilakukan uji korelasi data yang didapat. Penelitian ini menunjukkan adanya korelasi yang signifikan antara derajat fusi dengan ODI. Koefisien korelasi antara derajat fusi dengan ODI didapatkan 0,904 dengan nilai signifikansi 0,00 (p<0,05). Derajat fusi post operasi dari gambaran CT Scan memiliki korelasi yang signifikan terhadap derajat disabilitas menggunakan skor ODI.

Kata Kunci: *Lumbar Spinal Stenosis, Fusion Rate, PLIF, ODI*

ABSTRACT

Managements of lumbar spinal stenosis with instability are decompression laminectomy, posterior stabilization and PLIF (Posterior Lumbar Interbody Fusion). The degree of fusion can be determined by CT scan post -operatively. The aim of this study is to assess disability and functional scores in LSS patients can use the Oswestry Disability Index (ODI). This study was an observational analysis study in 18 LSS patients who had PLIF instrumentation surgery. Patients were asked to fill in the ODI questionnaire and were evaluated for CT Scan, then the correlation data were obtained. This study shows a significant correlation between the degree of fusion and ODI. The correlation coefficient between the degree of fusion and ODI is 0.904 with a significance value of 0.00 (p <0.05). The degree of postoperative fusion of CT scans has a significant correlation to the degree of disability using the ODI score.

Keywords: *Lumbar Spinal Stenosis, Fusion Rate, PLIF, ODI*

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INTRODUCTION

Degenerative diseases of the lumbar spine are a significant cause of disability in the world. Lumbar spinal stenosis is one of the degenerative causes of the lumbar in which vertebral foramina or spinal canal narrowing occurs at one or several spinal levels of the lumbar region (Garfin et al., 2018). Symptoms of Lumbar spinal stenosis are neurogenic claudication including pain, hypoesthesia and paresthesia on the posterolateral side of the lower limb and thigh during prolonged walking or activity with the position of the extension body, where these symptoms reduce the function and level of activity in general. (Barret-Tuck *et al*., 2017; Wong *et al*., 2008) Parts of the vertebra that contribute to the symptoms of stenosis include facet, uncinatus, hypertrophy of the ligamentum flavum, posterior longitudinal ligament, corpus vertebra (osteophyte), intervertebral disc, and epidural fat until spondylolisthesis can occur. (Garfin *et al*., 2018)

From 266 billion people around the world, 3.63% are diagnosed with lumbar degenerative spine disease. Most incidents in Europe are 5.7%; 5668 per 100,000) and the lowest in Africa (2.4%). While the highest incidence of LSS in Europe was 2.2% (2191 per 100,000), the lowest in Africa (935 per 100,000). Southeast Asia incidence of lumbar degenerative spine disease as much as 3.57%. Ai_min Wu *et al*. stated that more than 200,000 elderlies were suffered from LSS and LSS as the most common cause of spine surgery in patients aged> 65 years. (Ravindra *et al*., 2018; Wu *et al*., 2017)

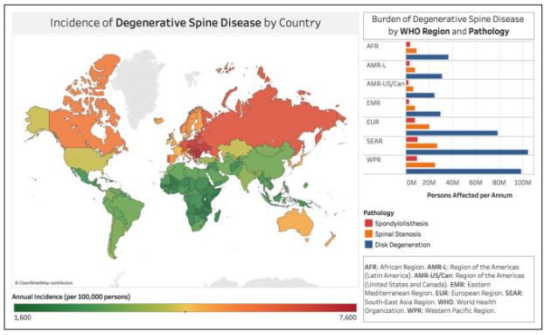

Fig.1 Low Back Pain / Degenerative Spine Disease incidence in the world (Ravindra *et al*., 2018).

Kirkaldy-Willis classifiy degenerative processes into 3 phases: dysfunction, instability, stabilization. In the first phase there is a loss of normal disc function when the degenerative process begins. Then followed by a period of relative instability in the degeneration process in which episodes of intermittent pain occur. In this phase of instability abnormal movements can be seen on radiographic images. The last phase is stabilization, where the spinal segment has reached a new balance due to loss of height

and compression of the disc. In this phase the patient has reduced the pain episode. (Behrbalk *et al*., 2013; Garfin *et al*., 2018; Lee *et al.*, 2015; Wong *et al*., 2008).

Disc degeneration is the initial process of spinal degeneration. As the age goes on, the disc composition changes. Collagen increases and demarcation between the nucleus and annulus becomes less clear. The concentration of chondroitin sulfate decreases, the ratio of keratin sulfate to chondroitin sulfate increases. Because keratin sulfate is less hydrophilic, disc dehydration occurs. Normally the annulus contains 60% collagen type II and 40% collagen type I, so type II collagen dominates. Type I collagen is associated with reduced water content compared to type II. As age goes on there is an increase in type I collagen, disc hydration decreases. Nucleus pulposus consists of 85% water, where the annulus contains 78% water. The disc degeneration of water content drops to 70%. Discus loses the ability to maintain load. (Behrbalk *et al*., 2013; Garfin *et al*., 2018; Lee *et al.*, 2015; Wong *et al*., 2008).

Spinal fusion is defined as the occurrence of bony union between the 2 vertebral bodies after surgical manipulation. Mechanical stability after fusion is expected to prevent the progression of deformity. Surgery or various manipulations to do spinal fusion are developed to treat scoliosis, kyphosis, fracture, dislocation, spondylolisthesis, and intervertebral disc diseases. The choice of graft for spinal fusion can be autologous cancellous bone, autologous cortical bone graft, allograft, xenograft, synthetic bone graft. Autologous cancellous bone is a "gold standard" graft material because it has 3 properties: osteogenic bone and marrow cell, collagen osteoconduction matrix, mineral and protein matrix, and a spectrum of osteoinduction proteins present in it. (Garfin *et al*., 2018; Behrbalk *et al.*, 2013; Barret-Tuck *et al*., 2017; Tan *et al*., 2007),

Lumbar corpus fusion can be through the anterior or posterior approach. Interbody fusion through posterior or known posterior lumbar interbody fusion / PLIF is at risk of injury to the cauda equine and nerve root when inserting implants because sufficient retraction is required. Implants are needed in sizes that large enough to replace the disc but not too large to avoid excessive retraction of the neurological elements. Transforaminal cage or what is known as fusion / TLIF transforaminal

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interbody during installation through exiting and transversing nerve root is needed so that the risk is lighter than PLIF. Both the PLIF or TLIF installation procedure are destabilized by the posterior structure of the tension band, so that posterior stabilization is required. (Garfin *et al*., 2018; Tan *et al*., 2007; Talia *et al*., 2015)

Bony union in the procedure of lumbar fusion can be evaluated by CT scan, in Tan *et al.*'s study for evaluation of fusion with CT scan divided into 4 grade, there are: grade I (Complete fusion), Grade II (Partial Fusion), Grade III (Unipolar pseudoarthrosis), Grade IV (Bipolar Pseudoarthrosis) (Tan *et al*., 2007).

The Oswestry Disability Index (ODI) is one of a tool for interviewing patients to assess disability in the lumbar spinal stenosis (LSS). The percentage of disability is grouped into: 0% until 20% are mild disability, 21% until 40% are moderate disability, 41% until 60% severe disability, 61% until 80% are crippled (with help), and 81% until 100% are bedridden (Brodke *et al*., 2017; Mehra *et al*., 2008).

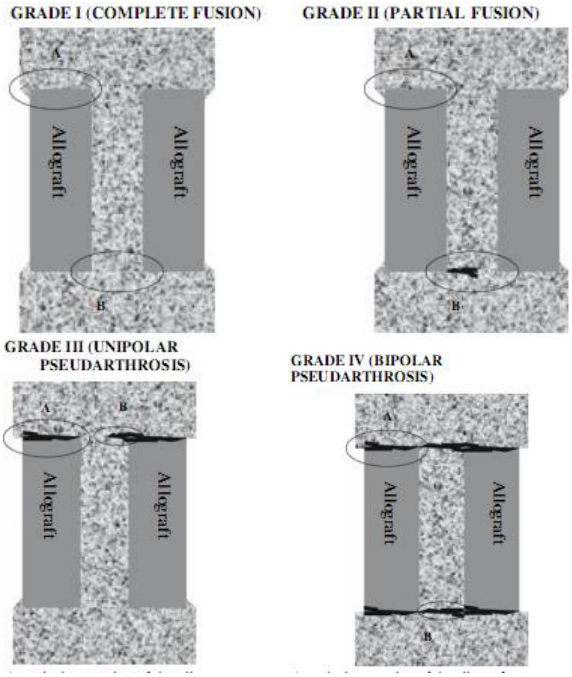

Fig.2 Classification of anterior fusion based on CT-Scan. Grade I Cortical union allograft and central autograft trabecular continuity at the end of the graft. Grade II The cortical allograft and incomplete union or absent trabecular incorporation of central autograft. Grade III cortical allograft and incomplete non union or absent trabecular incorporation of central autograft. Grade IV cortical non union allograft and central central autograft discontinuity both on both sides / ends (Tan G.H., 2007).

METHOD

This is a cross-sectional study of posterior lumbar interbody fusion (PLIF) on Lumbar 4th- Sacrum Vertebra, patients had been done PLIF over than 9 months evaluated on Lumbar CT scan and disability score using Oswestry Disability Index. The author takes a population from Prof. Dr. R. Soeharso Orthopaedic Hospital and Dr. Muwardi General Hospital in Surakarta. Subject was selected by simple random sampling.

RESULT AND DISCUSSION

In the results of the study it was found that the age of lumbar spinal stenosis patients who performed decompression laminectomy, posterior stabilization and PLIF between the ages of 46-65 years with an average age of 55.6 + 5.2 years. While these patients with male sex were 6 people, and female sex patients were 12 people.

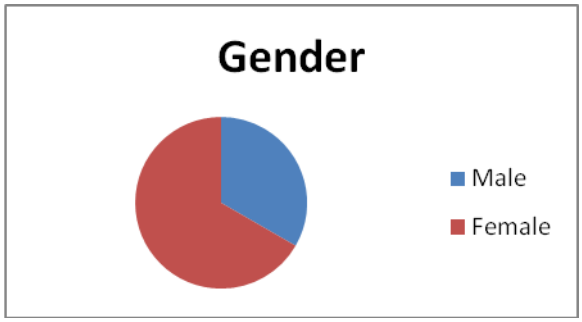

Fig 3. Ratio Male:Female on LSS was treated by decompression laminectomy, posterior stabilization and PLIF.

The post period of PLIF surgery is 9-21 months with the results of fusion degrees from 1-4. From the PLIF operation period, it was found that 3 patients had not occurred fusion, 10 patients had partial fusion and 5 complete fusion patients.

The results showed that patients who experienced complete fusion occurred in the PLIF period for more than 18 months, whereas partial fusion occurs in the PLIF period of 12-18 months, and in patients less than 11 months old pseudoarthrosis still occurs.

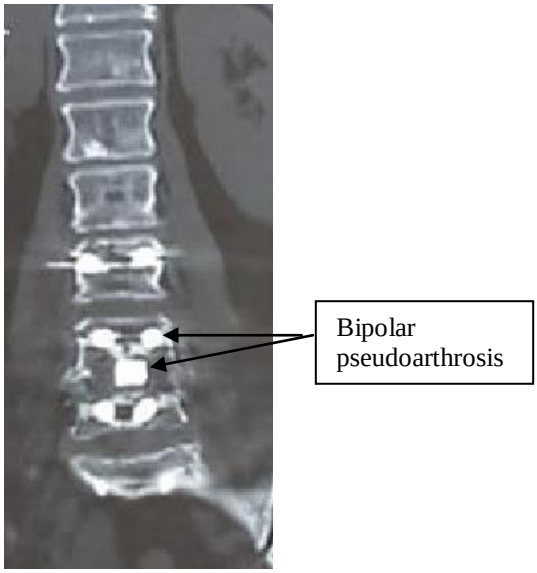

Fig 4. Evaluation Post Operation PLIF (Bipolar Pseudoathrosis).

Postoperative ODI from these patients was obtained between 28-44. While the ODI of patients before the operation was obtained between 54-64. There was a decrease in scores after an operation that showed functional improvement after surgery.

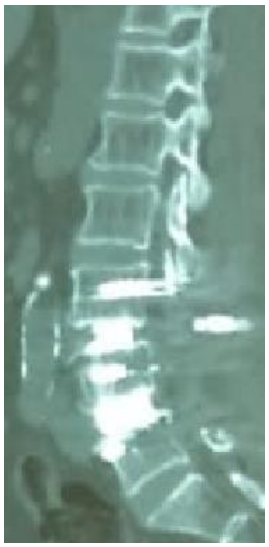

Fig 5. Evaluation post Operation PLIF Complete fusion (Grade 1).

Postoperative ODI in patients who have undergone complete fusion was obtained between 28-32, whereas postoperative ODI in patients who had partial fusion was found to be between 32-40, ODI in patients who had not occurred fusion or pseudoarthrosis was 42-44. Analysis of the relationship the effect of fusion degrees to postoperative ODI scores that have been tested for correlation in 18 patients was 0.094, with p value <0.01.

There are many factors that causes of the occurrence of different periods of fusion degrees between patients post PLIF surgery there are many factors. Both systemic factors and local factors influence the speed of spinal fusion. Regarding fusion / PLIF material can also affect fusion speed. In a previous study by Satyanarayana et al., It was concluded that patients who had been done PLIF fusion occurred on average in the 16-month postoperative period, whereas the results of this study found complete fusion occurred at 18 months postoperatively and there were partial patients. fusion at 18 months postoperatively. (Satyanarayana *et al*., 2015)

Systemic factors that influence spinal fusion are divided into positive and negative factors. Positive factors include insulin, insulin growth factor and other somatomedin, testosterone, estrogen, growth hormone, thyroxine, parathyroid, calcitonin, vitamin A, vitamin D, anabolic steroids, vitamin C, while negative factors include corticosteroids, vitamin A intoxication, deficiency vitamin D, vitamin D intoxication, anemia, iron deficiency, negative nitrogen balance, calcium deficiency, NSAIDs, adriamycin, methotrexate, rheumatoid arthritis, antidiuretic hormones of inappropriate syndrome, tobacco/ cigarettes, sepsis. Nutritional status influences clinical outcome post surgery in general. Identify nutritional deficits using anthropomorphic measurements, albumin, leukocyte count, skin antigen test, nitrogen balance. (Garfin *et al*., 2018)

Local factors also influence bone healing. Positive factors include: the extent of local tissue that is viable in the graft area, local source of stem cells (bone marrow, periosteum), osteoconduction scaffold (fibrin clot), mechanical stability, mechanical load, osteoblastic stem cell activation proliferations (PDGF, EGF), osteoinduction factors (BMP), angiogenesis factors (FGF, EGF, VEGF), electrical stimulation. Negative factors include: osteoporosis, radiation scar, tumor,

infection, bone wax, excessive movement or unstable bone graft / cage. (Garfin *et al.*, 2018).

CONCLUSION

The degree of postoperative fusion of CT scans has a significant correlation to the degree of disability using the ODI score.

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