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CORRELATION ANALYSIS OF PREOPERATIVE CALSIUM SERUM LEVEL ON DEGENERATIVE DISC HERNIATION PATIENT TO POSTOPERATIVE FUSION OF POSTERIOR LUMBAR INTERBODY FUSION (PLIF)

Background: *Lumbar disc herniation occurs in 40% of the population in the US alone with peak incidence at the age of three or four decades, which are in the productive ages. This disorder is a non-traumatic cause of disability and the most common activity disorder and causing significant socio economic impacts. Calcium serum level can identify the successful of spinal fusion process which is understood influencing post operative outcome, thus it becomes a potential component to be studied. Operative management with fusion for lumbar disc herniation based on the study of previous researches provides a better outcome compared with non fusion surgery techniques. The goal of this study is to identify the correlation between preoperative calcium serum level to the successful of fusion post PLIF.*
Methods: *This study was a cross sectional study searching for correlations using the methods of collecting data retrospectively with consecutive sampling in 26 cases of degenerative lumbar disc herniation treated and performed fusion surgery (PLIF) at Neurosurgery Department of Dr. Hasan Sadikin Hospital, who then were followed up to 3 months; assessed the occurrence of fusion with dynamic lumbar X-ray during 1 January 2016 - 31 December 2016 period.*
Results: *Based on Spearman's correlation test, there is a statistically significant association between preoperative calcium serum level with postoperative fusion of PLIF (P=0,046<0,05), while for variables such as age and gender do not indicate a significant correlation. Of linear regression by combining multiple variables at once on the occurrence of fusion, the best result is to combine calcium serum level and age component that show moderate correlation with the value of R=0,455 dengan P=0,075.*
Conclusions: *Based on the data, there is a statistical significant correlation between preoperative calcium serum level to the successful fusion of degenerative lumbar disc herniation patient which was performed PLIF. These results are expected to be able to assist spine neurosurgeons in predicting the occurrence of fusion post PLIF and as a consideration in determining the best management for patients.*
Keywords: *Spinal fusion; Calcium serum; Degenerative lumbar disc herniation; Lumbar dynamic X-ray.*

Lower back pain is a common complaint, even based on recent epidemiological data in 2006 in the United States it is known that more than 26 million people with age ranges between 20-64 years have at least experienced lower back pain complaints with medical costs to 102 trillion US annually [1, 2, 3]. This disorder is the second most common cause of headache that makes a patient seek treatment and is the most common cause of non traumatic disability and disruption of activity and often has significant socioeconomic impacts [4, 5, 6]. Based on existing studies it is known and agreed that degenerative diseases of lumbar disc are the main cause of lower back pain in addition to trauma, infection or malignancy [7, 8, 9].

The next degenerative lumbar disc herniation, abbreviated as DLDH, is a sequel to the complex degenerative disease of the discus. DLDH diagnosis is difficult to enforce solely on the basis of history and physical examination, so imaging becomes absolute in diagnosis. Currently Magnetic Resonance Imaging (MRI) is the most important examination method and standardized diagnostics in helping clinicians to assess the degenerative changes of intervertebral discs [10, 11, 12].

Management of DLDH ranging from conservative management to operations with variations. Posterior Lumbar Interbody Fusion (PLIF) is one of a variety of fusion operations that is often performed and is very popular among neurosurgeons. Based on existing research, fusion surgery technique is one of the surgical techniques that provides better patient clinical outcome level and a smaller degree of operational difficulty when compared to other variations of technique. Agazzi and his colleagues in 1999 revealed that the fusion success of this technique reached 90%, their results were not far different with other studies discussing PLIF, with the success of fusion between 88-100% [7, 12, 13]. Despite the high level of fusion success, the technique of fusion and PLIF surgery is one of the major causes of failure and has a complication called fail back surgery or spinal failure, more specifically referred to as non-fusion or pseudoarthrosis with an incidence of 5% -35% . It is known that this complication occurs due to multifactorial including patient factors, surgery techniques and instrumentation used [14, 15, 9, 10].

With the rapid advances in current engineering and instrumentation operations has reduced the incidence of pseudoarthrosis but this remains a threat to the spine neurosurgeons. Patients factors such as

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age, sex and metabolic conditions are known to have an influence on the success of fusion [16, 6, 8]. Serum calcium levels have outcome from DLDH surgery, but none of the studies are known to discuss the association of serum calcium levels with the success of fusion from PLIF surgery or other types of fusion surgery in cases of DLDH [17, 6, 8].

It is hoped that by knowing the relationship between serum calcium preoperative levels of patients on the success of post-PLIF fusion in DLDH patients can provide information to the patient about the possibility of postoperative pseudoarthrosis and assist the spine neurosurgeon in deciding optimal surgery to the patient [18, 19, 20].

The goal of major spine fusion surgery is the clinical improvement of the patient and the occurrence of fusion of the spine with postoperative abnormalities. Postoperative spinal fusion assessment was performed by performing 3 months postoperative serial control imaging [21, 22, 23].

In relation to the above description, the researcher is interested to know whether there is any relationship between these preoperative factors in the success of fusion of DLDH operation. The purpose of this study is to determine the level of preoperative serum calcium DLDH patients to the occurrence of post-PLIF fusion, to identify the correlation of serum calcium preoperative level as predictors of post-PLIF fusion success, and the correlation of age and sex factor as predictors of post-PLIF fusion success.

Data Source and Variables Studied

The study subjects were all adult patients, aged 30-80 years, with Degenerative Lumbar Disc Herniation (DLDH) requiring Posterior Lumbar Interbody Fusion (PLIF) and had agreed to screen for preoperative calcium serum levels followed by follow-up.

The inclusion criteria used were all adult DLDH patients, aged 30-80 years with clinical and radiological features of appropriate preoperative MRI and conservative therapeutic failure for 6 months so that PLIF performed at Dr. Hasan Sadikin Hospital, Bandung, checked preoperative serum calcium level, conducted preoperative X-ray examination and dynamic X-ray 3 months postoperatively, conducted a fusion success assessment on X-ray dynamics 3 months post-operation using the criteria Brantigan Steffee. Fusion was declared successful when including the criteria of Brantigan Steffee grade 4 and 5.

The exclusion criteria used were patients with congenital abnormalities, patients with infectious diseases, tumors, trauma and metabolism of the spine, patient had previous spine surgery done and patients who refuse to be sampled research.

Study Design and Statistical Analysis

The research design used was a correlative analysis of the correlation of patient preoperative characteristics to the occurrence of postoperative fusion, by looking at the occurrence of 3 months postoperative spinal fusion, in patients with DLDH (Figure 1).

The independent variables in this study were age, sex, serum calcium levels. The dependent variable of this study is the occurrence of postoperative fusion by assessing lumbar dynamic photographs.

All patients included in the inclusion criteria were included in the study. All patients who had been diagnosed with DLDH followed started admission to exit the hospital. All patients were observed until the patient was discharged from the hospital and assessed based on outcome of surgery up to 3 months postoperative range.

The selection of subjects was conducted systematically, sampling technique with the determination of the sample based on the sequence of consecutive population members according to the patient who fulfilled the inclusion criteria until the sample number was reached.

The statistical analysis used in this research is parametric correlation analysis (Pearson's) if normal data is followed by nonparametric analysis (Spearman's) and / or linear regression analysis to find correlation between multiple free variable and dependent variable. Statistical analysis using SPSS for window version 23. Meaning is determined based on value of P, that is $< 0,05$ and confidence interval (CI) equal to 95%.
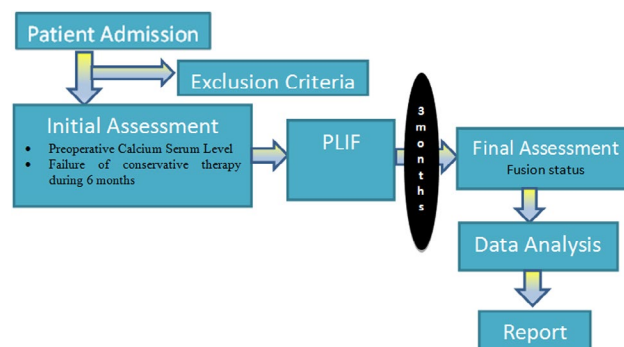

Figure 1 - Design of Study

The study was conducted in Department of Neurosurgery Dr. Hasan Sadikin Hospital, Bandung / Faculty of Medicine, Padjajaran University on January 1, 2016 until December 31, 2016 with the subject of research DLDH patients who meet the criteria of inclusion and exclusion.

Table 1 shows the total number of subjects as 26 patients with female research subjects more dominant than men 8 people (30.76%) and women 18 people (69.24%). The highest number of DLDH patients were 61-70 years old with 11 people (42,32%) with the highest level in L4-L5 as many as 17 cases (42,32%) and only 1 case (3,86%) on L1-L2. In the examination of preoperative serum calcium level, subjects with serum calcium $< 8,5$mg / dL were 8 people (30,77%) and serum calcium level 8,5 mg / dL were 18 persons (69,23%) (Table 2). Post-fusion surgery occurred in 18 cases (69.23%) and non-fusion 8 cases (30.77%).

Table 1

Characteristic of Lumbar Disc Herniation Patients

Variables		Frequency (n=26)	Percentage (%)
Sex	Male	8	30,76%
	Female	18	69,24%
Age	41-50	3	11,53%
	51-60	9	34,61%
	61-70	11	42,32%
	71-80	3	11,54%
Pathological Level	L1-L2	1	3,86%
	L3-L4	4	15,38%
	L4-L5	17	65,38%
	L5-S1	4	15,38%
Preoperative Calcium Serum Level	<8,5 mg/dL (Hypocalcemia)	8	30,77%
	8,5 mg/dL (Normocalcemia)	18	69,23%
Fusion Status	Yes	18	69,23%
		8	30,77%

Table 2

Crosstab Calcium Level Preoperative, Age and Sex to Fusion

Variables of Study		Fusion Status	
		Yes	No
Preoperative Calcium Serum Level	<8,5 mg/dL (Hypocalcemia)	2	6
	8,5 mg/dL (Normocalcemia)	16	2
Sex	Male	5	3
	Female	13	5
Gender	41-50	9	1
	51-60	6	1
	61-70	2	3
	71-80	1	3
Total		18	8

The first stage in statistical data processing is the normality test of the variable of research data using Kolmogorov-Smirnov test and Shapiro-Wilk test (Table 3). With the variable normality test, it was found that the sample of the study was abnormally distributed (Significance <0.05), so the Spearman's correlation statistic test was then used.

Table 3

Normality Test Variable Research

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistics	df	Sig.	Statistics	df	Sig
Fusion Status	0,429	26	0,000	0,590	26	0,000
Gender	0,449	26	0,000	0,565	26	0,000
Age	0,229	26	0,002	0,882	26	0,008
Calcium Serum Level	0,419	26	0,000	0,676	26	0,000

After analysis of non-parametric correlation (Spearman's), it can be seen the value of correlation coefficient as Table 4 (Analysis done independent variables to the dependent variable), then concluded as Table 5.

Table 4

Spearman's Statistics Age, Sex and Calcium Preoperative Levels of Fusion

		Fusion Status	
Spearman's rho	Age	Correlation Coefficient	-0,286
		Sig. (2-tailed)	0,166
		N	26
	Gender	Correlation Coefficient	0,145
		Sig. (2-tailed)	0,489
		N	26
	Preoperative Calcium Serum Level	Correlation Coefficient	-0,406*
		Sig. (2-tailed)	0,044
		N	26

Table 5

Summary of Spearman's Non Parametric Correlation Test

Independent Variables	Dependent Variable		
Age	FUSION	-0,286	0,166
Gender		0,145	0,489
Calcium Serum Level		-0,406	0,044

Based on the Table 6 when Spearman's test is done it can be seen whether or not the correlation of each variable to the fusion process except in the variable serum calcium levels preoperative seen significant correlation (-0,0406) (P < 0.05 with P 0.044).

Table 6

Linear Regression Test Free Variables To Fusion

Independent Variable	Dependent Variable		
Age	FUSION	0,475	0,253
Gender			
Calcium Serum Level			

In the Table 7 using the linear regression test on the combined free variables then connected with fusion shows when all independent variables are combined and searched for correlation with fusion showing that there is no relation between them. The strongest correlation between the independent variables was that when the serum and age serum concentration variables combined and then correlated with fusion showed correlation with 0.457 correlation (P = 0.076) showed that there was moderate correlation between the two variables of calcium and age serum levels as well as the presence or absence postoperative fusion.

Table 7
Linear Regression Test Serum Calcium and Age To Fusion

Independent Variable	Dependent Variable		
Age		0,457	0,076
Calcium Serum Level	FUSION		

However, this study has many limitations, among others: Having limitation of sample size, variation of sample and time limitation of follow up post operation. Therefore larger and varied samples as well as further follow-up period are expected to avoid a better calculation bias and outcomes.

This study showed a signif cant straight-line correlation between preoperative calcium serum level and the occurrence of postoperative fusion. The preoperative hypocalcemia status has the potential to cause a statistically signif cant fusion failure compared to preoperative normocalcemia status.

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РЕЗЮМЕ

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КОРРЕЛЯЦИОННЫЙ АНАЛИЗ ПРЕДВАРИТЕЛЬНОГО УРОВНЯ КАЛЬЦИЯ У ПАЦИЕНТА С ДЕГЕНЕРАТИВНОЙ ГРЫЖЕЙ ПОЯСНИЧНОГО ДИСКА В ПОСЛЕОПЕРАЦИОННОМ ПЕРИОДЕ ЗАДНЕГО ПОЯСНИЧНОГО МЕЖТЕЛЕВОГО СПОНДИЛОДЕЗА (PLIF)

Описание: **Результаты:**
                                           40%   ,
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                                                          R = 0,455 dengan P = 0,075.
            ,   **Выводы:**   ,
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                            .   ,
Методы:
                                    (PLIF)   -
        ,   .
3   **Ключевые   слова:**   ,
                            1   ,
2016   31   2016   .   .

ТҮЙІНДЕМЕ

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Жұлын нейрохирургиясы, перифериялық жүйке жүйесі және ауыру бөлімшесі, Нейрохирургия департаменті, Медицина факультеті, Панджажаран университеті - Хасан Садикин атындағы аурухана, Бандунг қ., Индонезия

БЕЛ ДИСКІСІНІҢ ДЕГЕНЕРАТИВТІ ЖАРЫҒЫ БАР НАУҚАСТАҒЫ КАЛЬЦИЙДІҢ АЛДЫН АЛА ДЕҢГЕЙІН БЕЛДІҢ АРТҚЫ ДЕНЕАРАЛЫҚ СПОНДИЛОДЕЗІНІҢ ОТАДАН КЕЙІНГІ КЕЗЕҢІНДЕ КОРРЕЛЯЦИЯЛЫҚ ТАЛДАУ

Сипаттамасы:

Нәтижелері:

40%-

$(P = 0.046 < 0.05)$

$R = 0,455$ dengan $P = 0,075$

Қорытынды:

Әдістері:

(PLIF)

2016   1   2016

31

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Негізгі сөздер: