A Research Article

Correlation between CSF Glucose Level and Outcome on Adult Patients with Meningitis

Submitted to fulfill the Assignment and Fit-out Requisite

In Passing Undergraduate Education Program

Faculty of Medicine

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2008

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HUBUNGAN ANTARA KADAR GLUKOSA LCS DAN OUTCOME PADA PASIEN DEWASA DENGAN MENINGITIS

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Abstrak

Latar Belakang: Meningitis adalah suatu respon inflamasi terhadap infeksi sel leptomeninges dan ruang subarachnoid. Derajat inflamasi dapat direfleksikan pada kadar glukosa LCS. Tujuan penelitian ini adalah untuk membuktikan bahwa terdapat hubungan antara kadar glukosa LCS dan outcome pada pasien meningitis.

Metode: Studi kohort retrospektif dilakukan dengan melihat catatan medik pasien meningitis yang dirawat di RSUP dr. Kariadi di Semarang dari Januari 2003 sampai Desember 2007. Data yang diambil termasuk kadar glukosa LCS, diklasifikasikan sebagai tinggi ($\geq$50 mg/dl) atau rendah (<50 mg/dl) dan outcome, diklasifikasikan sebagai buruk (didefinisikan oleh skor 1-4 pada Glasgow Outcome Scale saat pulang) atau baik (skor 5). Dalam penelitian ini meningitis dikaji secara global tanpa memilah berdasar jenis penyebabnya.

Hasil: 46 pasien meningitis dimasukkan dalam penelitian ini, 19.6% pulang dalam keadaan baik (rata-rata kadar glukosa LCS 54.33±22.26) dan 80.4% dalam keadaan buruk (rata-rata kadar glukosa LCS 45.57±27.00). Fisher's exact test menunjukkan bahwa tidak ada hubungan yang signifikan antara kadar glukosa LCS dengan outcome pasien meningitis (p=1.000).

Kesimpulan: Tidak ada hubungan yang signifikan antara kadar glukosa LCS dengan outcome pasien meningitis..

Kata kunci: Meningitis, kadar glukosa LCS

CORRELATION BETWEEN CSF GLUCOSE LEVEL AND OUTCOME ON ADULT PATIENTS WITH MENINGITIS

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Abstract

Background: *Meningitis is an inflammatory response to infection of leptomeningeal cells and subarachnoid space. The severity of the inflammation could be reflected on the CSF glucose level. The purpose of this study is to prove that there was a correlation between CSF glucose level and outcome on patients with meningitis.*

Method: *A cohort retrospective study conducted by reviewing medical records of patients with meningitis admitted at dr. Kariadi General Hospital in Semarang from January 2003 to December 2007. The data includes CSF glucose level, classified as high (≥50 mg/dl) or low (<50 mg/dl) and outcomes, classified as unfavorable (defined by a Glasgow Outcome Scale score of 1 to 4 points at discharge) or favorable (a score of 5). In this study meningitis was assesed globally and not separated based on the causative organism.*

Results: *46 meningitis patients were included in this study, 19.6% was discharged with favorable outcome (mean CSF glucose level 54.33±22.26) and 80.4% unfavorable outcome (mean CSF glucose level 45.57±27.00). Fisher's exact test showed that there was no significant correlation between CSF glucose level and outcomes (p=1.000).*

Conclusion: *There was no significant correlation between CSF glucose level and outcome on patients with meningitis.*

Keywords: *Meningitis, CSF glucose level*

INTRODUCTION

Meningitis is an inflammatory response to infection of leptomeningeal cells and subarachnoid space, resulting in the occurrence of meningeal symptoms (a clinical syndromes of headache, nuchal rigidity, photophobia) and an increased number of white blood cells in cerebrospinal fluid (CSF pleocytosis).[1,2,3] Meningitis was a fatal disease since it's recognition in 1805 until early 1900s. The introduction of antimicrobial therapy had improved the clinical outcome of this disease though the number was insignificant.[1,4,5] With modern antimicrobial therapy and the availability of sophisticated intensive care, meningitis is a more treatable disease.[1,6] Still, meningitis remains a serious threat to global health, causing an estimated annual 170.000 death worldwide. The case fatality rates remain at 5-10% in industrialized countries, and even higher in the developing world.[6]

If at all possible, treatment should be given to the patient when we have already confirmed the diagnosis of meningitis. The confirmation can be made through CSF or blood cultures,[1,7] but this procedure requires quite a long time. Even when the disease is diagnosed early and adequate therapy given, 5-10% of patients die, typically within 24-48 hours of onset of the symptoms[7] and 10-30% of survivors developed significant neurological sequelae.[6] Since meningitis can be considered as a medical emergency, we need to administer empiric antimicrobial treatment while waiting for the result of diagnostic test and should be changed later in accordance with the findings.[1] One of the best source of information on the patients condition is their cerebrospinal fluid. Lumbar puncture is usually done in almost every suspected meningitis case in order to examine the CSF. One of the most characteristic

abnormalities of CSF in patient with meningitis is a decreased glucose concentration (hypoglychorrhachia).[8,9]

There are several studies which proved that the decrease of CSF glucose levels is related to outcome of patient with meningitis. Recent study in Paraguay (Lovera & Arbo 2005) shows that mean CSF glucose levels in bacterial meningitis patients with unfavorable outcome were significantly lower than patients with favorable outcome (8.4 ± 15.3 mg/dl *vs.* 25.4 ± 25.6 mg/dl; *P* < 0.01). They also stated that patients with hypoglycorrhachia of <10 mg/dl at admission displayed stronger association with mortality.[10] Another study (van de Beek *et al* 2004) stated that a ratio of CSF glucose to blood glucose of less than 0.23 was present in 88% patients with acute bacterial meningitis.[11]

Several researches about this topic have been conducted throughout the world. But there hasn't been any specific study regarding the correlation between CSF glucose level and clinical outcome of patients with meningitis in Indonesia particularly in dr.Kariadi General Hospital. Through this research we expect to find the correlation between CSF glucose level at admission and patient's outcome when discharged.

RESEARCH METHOD

Cohort Retrospective study conducted by reviewing medical record of patients who were clinically diagnosed with meningitis admitted at dr. Kariadi General Hospital in Semarang from January 2003 to December 2007. Sample of this research are all reachable population who were admitted at neurology ward, got lumbar punctured and got the CSF tested. The exclusion criteria are patients with diseases

that would influence the clinical outcome of meningitis such as HIV/AIDS and patients with diseases that would influence blood glucose level such as diabetes. Here we asses all type of meningitis globally without separation based on causative organism.

The data collected from the medical records are CSF glucose level, blood glucose level and patients outcome. The glucose level was categorized into high level ($\geq$50 mg/dl) and low level (<50 mg/dl). At discharge, all patients underwent a neurologic examination performed by a neurologist, and the outcome was graded according to the Glasgow Outcome Scale. A score of 1 on this scale indicates death; a score of 2, a vegetative state (the patient is unable to interact with the environment and exhibits no obvious cortical function); a score of 3, severe disability (the patient is unable to live independently due to mental or physical disability or both); a score of 4, moderate disability (the patient is capable of living independently but unable to return to work or school, the disabilities include varying degrees of dysphasia, hemiparesis, or ataxia as well as intellectual and memory deficits and personality changes); and a score of 5, mild or no disability (the patient is able to return to work or school even though there may be a minor neurological or psychological deficits).[12,13] A favorable outcome was defined as a score of 5, and an unfavorable outcome as a score of 1 to 4.[11] The Glasgow Outcome Scale is a well-validated instrument with good inter observer agreement. The data was analyzed using Fisher's exact test performed by SPSS 15.0 program.

RESULT

There are 126 patients with meningitis admitted at neurology ward dr. Kariadi General Hospital from January 2003 to December 2007, only 46 patients who fulfilled the inclusion criteria were included in this study.

Table 1. Patient's Outcome score	
Score on Glasgow Outcome Scale	Number of Patients
1 (death)	15 (32.6%)
2 (vegetative state)	0 (0%)
3 (severe disability)	9 (19.6%)
4 (moderate disability)	13 (28.2%)
5 (mild or no disability)	9 (19.6%)

From table 1 we can see that there are 15 patients scored 1, 9 patients scored 3, 13 patients scored 4 and 9 patients scored 5 on Glasgow Outcome Scale. Based on the criteria, 9 patients are classified as patients with favorable outcome (GOS score of 5) and 37 patients as patients with unfavorable outcome (GOS score of 1-4).

Table 2. Patient's Characteristic on CSF Glucose Level and Outcome		
CSF Glucose Level	Outcome	
	Favorable	Unfavorable
High (≥50 mg/dl)	4 (8.7%)	16 (34.8%)
Low (<50 mg/dl)	5 (10.9%)	21 (45.7%)

Based on the data presented on table 2, we can see that there were 9 patients with favorable outcome (19.6%) and 37 patients with unfavorable outcome (80.4%).

The number of patients with low CSF glucose level is generally higher than patients with high CSF glucose level in either patients with favorable outcome or unfavorable outcome (10.9% *vs.* 8.7% and 45.7% *vs.* 34.8%).

Table 3. Mean CSF Glucose Level Based On Outcome	
Outcome	CSF Glucose Level
Favorable	54.33±22.26 mg/dl
Unfavorable	45.57±27.00 mg/dl

From table 3 we can see that mean CSF glucose level for patients with favorable outcome (54.33±22.26 mg/dl) is higher than patients with unfavorable outcome (45.57±27.00 mg/dl). However, the Fisher's exact test conducted on the data resulted in $p=1.000$ ($p>0.05$) suggesting that there are no significant correlation between CSF Glucose Level and Patient's outcome.

DISCUSSION

Previous study in Paraguay (Lovera & Arbo 2005) shows that mean CSF glucose levels in bacterial meningitis patients with unfavorable outcome were significantly lower than patients with favorable outcome (8.4 ± 15.3 mg/dl *vs.* 25.4 ± 25.6 mg/dl; $P < 0.01$). They also stated that patients with hypoglycorrhachia of <10 mg/dl at admission displayed stronger association with mortality.[10] Our study also showed that patients with unfavorable outcome showed lower mean SCF Glucose level than patients with favorable outcome although it's not significant (45.57±27.00 *vs.* 54.33±22.26 mg/dl, $p=1.000$).

The Fisher's exact test result shows that in our study there was no significant correlation between CSF Glucose levels and outcome on patients with meningitis. This result might be due to insufficient number of samples because there are limited numbers of meningitis patients admitted to dr. Kariadi General Hospital and also even less number of patients that undergo lumbar puncture.

There are also many other factors that influence the initial CSF Glucose level at admission. Different causative organism also plays a major role in CSF glucose alteration.[10] In this study we include all kinds of meningitis patients generally instead of separating it based on the causative organism due to the limited number of patients and unclear meningitis classifications on the medical records. As for the patient's outcome, there are many influencing factors that aren't included in this study and also the subjectivity when scoring the outcome since we only do the study based on the limited data on patient's medical record and only one person did the Glasgow Outcome Scale scoring.

CONCLUSION AND SUGGESTION

Although the mean CSF glucose level on patients with unfavorable outcome was lower then patients with favorable outcome, there was no significant correlation between CSF glucose levels at admission and outcome at discharge on patients with meningitis.

This observational study still has many weaknesses. Further research regarding this subject need to be conducted with more samples and would be better if done separately for each kinds of meningitis based on the causative organism.

ACKNOWLEDGEMENT

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Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
LCS Glucose * GOS Score	46	97.9%	1	2.1%	47	100.0%

LCS Glucose * GOS Score Crosstabulation

			GOS Score		Total
			buruk	baik	
LCS Glucose	rendah	Count	21	5	26
		% of Total	45.7%	10.9%	56.5%
	tinggi	Count	16	4	20
		% of Total	34.8%	8.7%	43.5%
Total		Count	37	9	46
		% of Total	80.4%	19.6%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.004ᵇ	1	.948		
Continuity Correctionᵃ	.000	1	1.000		
Likelihood Ratio	.004	1	.948		
Fisher's Exact Test				1.000	.617
Linear-by-Linear Association	.004	1	.949		
N of Valid Cases	46				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3.91.

Risk Estimate

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for LCS Glucose (rendah / tinggi)	1.050	.242	4.552
For cohort GOS Score = buruk	1.010	.757	1.347
For cohort GOS Score = baik	.962	.296	3.124
N of Valid Cases	46		

Means

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
LCS Glucose * GOS Score	46	97.9%	1	2.1%	47	100.0%

Report

LCS Glucose

GOS Score	Mean	N	Std. Deviation	Minimum	Maximum
buruk	45.57	37	27.004	3	112
baik	54.33	9	22.260	32	85
Total	47.28	46	26.150	3	112