



VCAM-1 Level in Controlled and Uncontrolled Type 2 Diabetes Mellitus Patient

Nurahmi^{a*}, Mansyur Arif^b, Mochammad Hatta^c, Uleng Bahrund^d

^{a,b,c,d} *Medicine Faculty of Hasanuddin University, South Sulawesi, Indonesia*

Email: Emy_nurahmi@yahoo.com

Abstract

Hiperglycaemia could induce endothelial dysfunction and one of a biomarker of it is vascular cell adhesion molecule-1 (VCAM-1), this study aims to analyze VCAM-1 level based on glycated hemoglobin (HbA1c) Level in type 2 diabetes mellitus patient. It was an observational study with cross-sectional design, population of study were type 2 diabetes mellitus patient underwent examination and treatment in the Internal Medicine Section dr Wahidin Sudirohusodo Hospital, Hasanuddin University Hospital, Clinic and private Laboratory 123. Sample taken by purposive sampling were 160 patients. Laboratory examination was done in the Clinical Pathology Laboratory of dr Wahidin Sudirohusodo Hospital Makassar, Hasanuddin University, Prodia Clinic Laboratory and Biomolecular Laboratory of Medicine Faculty Hasanuddin University. Data presented as tables with frequency, percent, mean and deviation standard. Data Analysis using Mann-Whitney U test, mean difference was significance if probability value lower than 0.05. Patients were categorized as controlled and uncontrolled blood glucose levels based on HbA1c Level, if HbA1c <7%, it was categorized as controlled diabetes mellitus patient and if HbA1c >7%, it was categorized as uncontrolled diabetes mellitus patient. Results indicated that uncontrolled group (16.946 ng/ml) had higher VCAM-1 level compared to controlled group (19.080 ng/ml). Their differences were 2.134 ng/ml and it was significance statistically ($p=0.000$, $p<0.05$). Uncontrolled blood glucose level of type 2 diabetes mellitus patient will lead to increased VCAM-1 which will be a marker for endothelial failure and an increased risk of diabetes complications.

Keywords: HbA1c; Type 2 Diabetes; VCAM-1; Endothelial Dysfunction.

* Corresponding author.

1. Introduction

Endothelial dysfunction in diabetes mellitus increases the risk of complications such as cardiovascular disease because it contributes to the development of atherosclerosis [1, 2]. Prevention of endothelial dysfunction is the target of therapy, especially diabetes mellitus type 2 [3]. One of the causes is hyperglycemia induced by oxidative stress, balancing between nitric oxide (NO) and oxidative stress is needed [4, 5]. Uncontrolled diabetes induced endothelial dysfunction that can be marked by increased vascular cell adhesion molecule-1 (VCAM-1) and intercellular adhesion molecule-1 (ICAM-1) and this situation causes leukocyte adhesion to the endothelial surface, under normal conditions balancing of NO prevents this adhesion. [1]. Endothelial dysfunction may also lead to more severe hyperglycemia [6]. Glycemic control is a key to reduce mortality in diabetes mellitus and hyperglycemia can be monitored through glycated hemoglobin (HbA1c) measurements, HbA1c also a marker for complication and prognosis of diabetes [7]. It is recommended to monitor blood glucose level and indicated poor control of glycemic [8]. Uncontrolled diabetes can also be characterized by vascular adhesion molecule-1 (VCAM-1), it is expressed by endothelial cells and induced inflammation [9, 10]. This soluble adhesive molecule concentration is a predictor of cardiovascular risk even a study revealed that VCAM-1 is not associated with macrovascular disease [11, 12]. This study aims to analyze VCAM-1 level based on HbA1c Level in type 2 diabetes mellitus patient.

2. Material and Methods

This study was an observational study with cross-sectional design, population of study were type 2 diabetes mellitus patient underwent examination and treatment in the Internal Medicine Section dr. Wahidin Sudirohusodo Hospital, Hasanuddin University Hospital, Clinic and private Laboratory 123. Sample taken by purposive sampling were 160 patients. After getting ethical clearance from ethical commission of Medicine Faculty of Hasanuddin University, laboratory examination was done in the Clinical Pathology Laboratory of dr. Wahidin Sudirohusodo Hospital Makassar, Hasanuddin University, Prodia Clinic Laboratory and Biomolecular Laboratory of Medicine Faculty Hasanuddin University. Data presented as tables with frequency, percent, mean and deviation standard. Data Analysis using Mann-Whitney U test, mean difference was significant if probability value lower than 0.05.

3. Result

Patients were categorized as controlled and uncontrolled blood glucose levels based on HbA1c Level, if HbA1c <7%, it was categorized as controlled diabetes mellitus patient and if HbA1c >7%, it was categorized as uncontrolled diabetes mellitus patient.

Table 1: The Distribution of Subject Based On Controlled And Uncontrolled Blood Glucose Levels

Group	Frequency (n)	Percent (%)
Controlled (HbA1c < 7%)	80	50
Uncontrolled (HbA1c > 7%)	80	50
Total	160	100

Table 1 indicated that both controlled and uncontrolled diabetes mellitus group were 80 (50%) patients or frequency had same quantity.

Table 2: Mean Comparison of VCAM-1 Between Groups

Group	VCAM-1 Level (ng/ml) Mean±SD	Mean Differences (ng/ml)	P
Controlled (HbA1c < 7%)	16.946±17.120	2.134	0.000*
Uncontrolled (HbA1c > 7%)	19.080±29.019		

*Mann-Whitney U Test

Table 2 indicated that uncontrolled group (16.946 µg/l) had higher VCAM-1 level compared to controlled group (19.080 ng/ml). Their differences was 2.134 ng/ml and it was significance statistically (p=0.000, p<0.05).

4. Discussion

Result of studi indicated VCAM-1 was significantly higher in patients with type 2 diabetes mellitus who had an elevated HbA1c level of more than 7 percent (uncontrolled diabetes patient) compared with patients with HbA1c levels below 7 percent (Controlled diabetes patient). This increase indicates the presence of endothelial dysfunction which is an indication that there has been an imbalance in the regulation of the inflammatory process. The increase in VCAM-1 being one of the endothelial dysfunction biomarkers suggests that HbA1c levels that mark the control of blood glucose for diabetics should be of concern because of strong association between endothelial dysfunction and hyperglycaemia. This condition will increase the risk of major diabetes complications that need to be feared is cardiovascular due to the formation of plaque leading to atheosclerosis because leukocyte adhesion in the endothelium [9, 11]. In addition to cardiovascular disease, complications of diabetic retinopathy and nephropathy also pose a risk to increased hyperglycaemia-induced VCAM-1 [13, 14]. Hyperglycaemia increases the formation of advanced glycation end products (AGE) that trigger endothelial dysfunction due to NO imbalances [15]. This study corroborates the previous studies that VCAM-1 will increase in uncontrolled diabetes conditions

5. Conclusion

Uncontrolled blood glucose level of type 2 diabetes mellitus patient will lead to increased VCAM-1 which will be a marker for endothelial failure and an increased risk of diabetes complications.

References

- [1.] Tabit, C.E., et al., Endothelial dysfunction in diabetes mellitus: molecular mechanisms and clinical implications. Rev Endocr Metab Disord, 2010. **11**(1): p. 61-74.
- [2.] Tousoulis, D., A.M. Kampoli, and C. Stefanadis, Diabetes mellitus and vascular endothelial

dysfunction: current perspectives. *Curr Vasc Pharmacol*, 2012. **10**(1): p. 19-32.

- [3.] Basha, B., et al., Endothelial dysfunction in diabetes mellitus: possible involvement of endoplasmic reticulum stress? *Exp Diabetes Res*, 2012. **2012**: p. 481840.
- [4.] Capellini, V.K., et al., Diabetes and vascular disease: basic concepts of nitric oxide physiology, endothelial dysfunction, oxidative stress and therapeutic possibilities. *Curr Vasc Pharmacol*, 2010. **8**(4): p. 526-44.
- [5.] Cheang, W.S., et al., PPARdelta Is Required for Exercise to Attenuate Endoplasmic Reticulum Stress and Endothelial Dysfunction in Diabetic Mice. *Diabetes*, 2017. **66**(2): p. 519-528.
- [6.] Xu, J. and M.H. Zou, Molecular insights and therapeutic targets for diabetic endothelial dysfunction. *Circulation*, 2009. **120**(13): p. 1266-86.
- [7.] Sherwani, S.I., et al., Significance of HbA1c Test in Diagnosis and Prognosis of Diabetic Patients. *Biomark Insights*, 2016. **11**: p. 95-104.
- [8.] Ahmed, N., et al., Type 2 diabetes mellitus: how well controlled in our patients? *J Ayub Med Coll Abbottabad*, 2008. **20**(4): p. 70-2.
- [9.] Ruskowska-Ciastek, B., et al., Effect of uncontrolled hyperglycemia on levels of adhesion molecules in patients with diabetes mellitus type 2. *J Zhejiang Univ Sci B*, 2015. **16**(5): p. 355-61.
- [10.] Hocaoglu-Emre, F.S., et al., Vascular Cell Adhesion Molecule 1, Intercellular Adhesion Molecule 1, and Cluster of Differentiation 146 Levels in Patients with Type 2 Diabetes with Complications. *Endocrinol Metab (Seoul)*, 2017. **32**(1): p. 99-105.
- [11.] Clausen, P., et al., Plasma concentrations of VCAM-1 and ICAM-1 are elevated in patients with Type 1 diabetes mellitus with microalbuminuria and overt nephropathy. *Diabet Med*, 2000. **17**(9): p. 644-9.
- [12.] Jude, E.B., et al., Circulating cellular adhesion molecules ICAM-1, VCAM-1, P- and E-selectin in the prediction of cardiovascular disease in diabetes mellitus. *Eur J Intern Med*, 2002. **13**(3): p. 185-189.
- [13.] Duran-Salgado, M.B. and A.F. Rubio-Guerra, Diabetic nephropathy and inflammation. *World J Diabetes*, 2014. **5**(3): p. 393-8.
- [14.] Gustavsson, C., et al., Vascular cellular adhesion molecule-1 (VCAM-1) expression in mice retinal vessels is affected by both hyperglycemia and hyperlipidemia. *PLoS One*, 2010. **5**(9): p. e12699.
- [15.] Hartge, M.M., T. Unger, and U. Kintscher, The endothelium and vascular inflammation in diabetes. *Diab Vasc Dis Res*, 2007. **4**(2): p. 84-8.