Appropriateness of Blood Glucose Measurement after Occurrence of Hypoglycemia in Type 2 Diabetes Mellitus Patients Undergoing Insulin Therapy

Yoon Jeong Kim[1], Ji Yoon Choi[2*], Kum Rae Kim[3]

[1] RN, Nursing Department Kangbuk Samsung Hospital, Republic of Korea
[2] HN, PhD, Nursing Department of Kangbuk Samsung Hospital, Republic of Korea
[3] Manager, Nursing Department of Kangbuk Samsung Hospital, Republic of Korea
03181, 29 Saemunan-ro, Jongno-gu, Seoul, Korea
roybrain1@naver.com

Abstract. This study is based on pre and post time difference design in one group to determine if 15 minutes blood glucose check is the most suitable time for type 2 diabetes patients on insulin therapy when they are checked in 15 minutes, 30 minutes and 45 minutes with a selected glucose meter after taking 15grams of simple carbohydrates followed by hypoglycemia. The subjects of the study were 30 patients (15 men and 15 women) with Type 2 diabetes mellitus and who underwent insulin therapy on the endocrinology unit in a general hospital located in Seoul. During hypoglycemia (blood glucose level less than 70 mg/dL or after Whipple's triad), the subjects were instructed to drink 175 cc of orange juice, which contained 15g of simple carbohydrate (in accordance with the Clinical Practice Guideline of the Korean Diabetes Association, 2011). Then, the blood glucose levels of the subjects were measured with a selected blood glucose meter after 15 minutes, 30 minutes, and 45 minutes. The obtained values were compared to the same time drawing. When Type 2 diabetes patients with insulin therapy experienced hypoglycemia, they were instructed to take 15 g of simple carbohydrate. Then, their blood glucose levels were measured using a selected blood glucose meter after 15 minutes, 30 minutes, and 45 minutes. According to the results, the blood glucose level significantly increased at 15 minutes after taking simple carbohydrate (p=.001).The blood glucose level also significantly increased at 30 minutes after taking simple carbohydrate (p<.001). However, when the blood glucose levels were compared at 15 minutes (p=.001) and 30 minutes (p<.001) after taking simple carbohydrate, there was significant increase in blood glucose level at 30 minutes after taking simple carbohydrate. It is suggested that blood glucose test should be performed in 30 minutes instead of 15 minutes when type 2 diabetes patients with insulin therapy experience hypoglycemia and take 15 grams of carbohydrates.

Keywords: Insulin therapy, Diabetes mellitus type 2, Hypoglycemia, Blood glucose

---

* Corresponding Author

1   Introduction

According to a report by the World Health Organization, diabetes is a metabolic disease that cannot be completely treated. The global incidence rate of diabetes reached 4.0% in 1995 but it is expected to increase to 5.4% in 2025. In Korea, the incidence of diabetes was reported as 10% in 2009 [1]. The diabetes cases are poorly managed as evidenced by the high incidence and mortality rate that have steadily increased; likewise, effective blood glucose management has not been properly implemented. There has been noticeable increase in the number of elderly diabetes patients in accordance with the rapid increase in diabetes prevalence and increased life expectancy; thus, there has been increased demand for self-management and social support [2].

However, the insulin therapy for strict blood glucose control resulted to increased incidence of severe hypoglycemia. Hypoglycemia is the most common complication that occurs to patients receiving insulin therapy. More than 90% of the patients who are being treated with insulin reported hypoglycemia incidence. It is known that hypoglycemia symptoms occur once a week among patients with palliative insulin therapy, and twice a week among those with active insulin therapy [3]. Therefore, it is important for diabetes patients to receive education on the symptoms and management of hypoglycemia. Hypoglycemia correction and insulin therapy are very critical for hospitalized diabetics in order to manage blood glucose levels; the correction of hypoglycemia has great effect in terms of insulin treatment [4].

In Korea, it is recommended to measure again the blood glucose level at 15 minutes after taking 15 g of simple glucose during hypoglycemia (in accordance with the Clinical Practice Guideline of the Korean Diabetes Association, 2011). Nonetheless, there is no basis to measure blood glucose level again at 15 minutes after hypoglycemia occurrence so for this reason, the measurement of blood glucose level varies depending on hospital may be 15 minutes, 30 minutes, or 45 minutes.

Therefore, education on measurement time of blood glucose level after occurrence of hypoglycemia is not properly provided to diabetes patients. Thus, this study intended to examine the relationship between the recovery time of hypoglycemia and blood glucose measurement among Type 2 diabetes patients and to apply the findings for effective nursing practice.

2.   Method

2.1   Research Design

This study, based on one group pretest-posttest time difference design, examined the most suitable time to measure the blood glucose level of a Type 2 diabetes patient with insulin therapy after hypoglycemia.

After taking 15 g of simple glucose, the subjects' blood carbohydrate levels were measured with a selected blood glucose meter at intervals of 15 minutes, 30 minutes, and 45 minutes prior to data collection, an approval was obtained from the Institute Review Board in K General Hospital located in Seoul.

The purpose of the study was fully explained to the subjects. They were informed about the details of voluntary participation and confidentiality of the study; those who understood and agreed to the details signed on the written consent.

2.2   Subjects

The subjects of the study were Type 2 diabetes mellitus patients who were hospitalized for insulin therapy at the Department of Endocrinology in a general hospital located in Seoul. The study was conducted from October 2, 2013 to March 15, 2014.

2.3   Research tool and Reliability

1) Hypoglycemia typically occurs when blood glucose is less than 70 mg/dL (in accordance with the Clinical Practice Guideline of the Korean Diabetes Association, 2011) and when the criteria for Whipple's triad are present.
2) When hypoglycemia occurred, 175 cc of orange juice containing 15 g of simple carbohydrate was given to the patient (in accordance with the Clinical Practice Guideline of the Korean Diabetes Association, 2011). His/her blood glucose level was measured after 15 minutes, 30 minutes, and 45 minutes using a selected blood glucose meter (ACCU-CHEK GO. Roche Korea Co., Ltd.) Provision of simple carbohydrate and measurement of blood glucose level were conducted by a nurse in-charge.
3) The blood glucose levels were compared depending on time.

2.4   Data Collection and Analysis

To obtain sample size, G-POWER 3.1.7 was used with the following settings: .8 for power of test; .5 for effective size; and .05 for significance level (Faul, Erdfelder, Lang & Buchner, 2007). In consideration of drop-out rate, 30 people were chosen as subjects, although 23 people was the effective sample size calculated. Eventually, all 30 people were included in the analysis due to zero drop-out rate. The collected data was analyzed by using PASW Statistics 18.
1) The general characteristics of the subjects were analyzed using frequency and percentage.
2) The comparison of measured blood glucose levels depending on time was made through repeated measurement of ANOVA.

3   Result

When Type 2 diabetes patients receiving insulin therapy experienced hypoglycemia, they were given 15 g of simple carbohydrate. Then, their blood glucose levels were measured at 15 minutes, 30 minutes, and 45 minutes using a

selected blood glucose meter. According to the results, the blood glucose levels at 15 minutes after taking simple carbohydrate (p=.001) were significantly increased.

The blood glucose levels at 30 minutes after taking simple carbohydrate (p<.001) were also significantly increased. However, when comparison was made on the blood glucose levels at 15 minutes (p=.001) and 30 minutes (p<.001) after taking simple carbohydrates, there was significant increase in blood glucose level at 30 minutes after taking simple carbohydrates.

4   Conclusion

This study had been designed with limited procedures due to skepticism among the nurses at the Endocrinology unit if 15 minute tests are proper for type 2 diabetes patients with insulin therapy after taking carbohydrates followed by hypoglycemia. There has been active research conducted on diabetics on the danger of hypoglycemia and food selection during hypoglycemia.

However, the Clinical Practice Guideline of the Korean Diabetes Association was the only resource or references regarding this topic as researches on blood glucose recovery time have not yet been conducted.

Particularly, medical professionals decide on the volume of rapid acting insulin administered to patients based on the blood glucose value obtained only at 15 minutes after introducing 15 g of simple carbohydrate (according to the Clinical Practice Guideline). Therefore, finding the proper time setting to check blood glucose test after taking simple carbohydrate followed by hypoglycemia is an important treatment for hypoglycemia. Moreover, it is should be emphasized that the significance of hypoglycemia treatment is not only essential for hospital patients, but in local communities where diabetic people receive insulin.

References

1. Korea Health Industry Development Institute, http:// www.kihase.re.kr, (2015)
2. Lee, B.W.: Pathobiology of Hypoglycemia in Type 2 Diabetes. Korean Clinical Diabetes, vol.9, no. 2, pp.100--106 (2008)
3. Choi, M.G., Ryn, O.H.: Sleep and Hypoglycemia. Korean Clinical Diabetes, vol. 9, no. 3, pp.79-84 (2008)
4. Ahn, K.J.: Clinical Impacts of Iatrogenic Hypoglycemia. Korean Clinical Diabetes, vol. 3, no. 1, pp.106-109 (2008)
5. Korea Diabetes Association, http://www.diabetes.or.kr/pro/publish/guide_2011
6. Diabetes Youth New Zealand and New Zealand Society for the Study of Diabetes. Camp Guidelines for Young People with Diabetes, (1995)
7. Lee, M.J., Yoo, E.K., Seo, S.J.: A Study on Willingness to Pay of Diabetic Patients for Nursing Intervention Using Telecommunication. International Journal of Bio-Science and Bio-Technology, vol. 6, no. 4, pp. 1-12 (2014)