Effects of Counseling and Implementation of Clinical Pathway on Diabetic Patients Hospitalized with Hypoglycemia

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Objectives: *A prospective randomized controlled study was conducted to examine the effects of counseling and implementation of clinical pathway on type 2 diabetic patients hospitalized with hypoglycemia.*
Material and Method: *Thirty- three cases received counseling and clinical pathway for treatment of hypoglycemia (study group) and another 32 cases received conventional treatment for hypoglycemia (control group) in Taksin Hospital between July and December 2005.*
Results: *Both groups have similar age, sex, and mean serum glucose on admission. There were also no differences between the two groups in terms of number of patients with chronic diabetic complications, acute concurrent illness and pattern of hypoglycemic drugs used for treatment. Average length of hospital stay of the study group was significantly lower than that of the control group (3.94 1.03 vs 6.38 4.05; p = 0.0005). There were also a significant decrease in the mean number of capillary blood glucose tests performed in the study group compared to the control group (10.03 5.04 vs 12.34 5.96; p = 0.048). Subsequent readmissions with recurrent hypoglycemia at 1 and 3 months interval after being discharged from the hospital decreased significantly in the study group (6.06 % vs 34.38 %; p = 0.036). While there was considerable reduction in mean medical cost in the study group, it did not reached a statistically significant difference when compared with the control group (2,743.58 1,473.04 vs 3,687 3,110.82; p = 0.06).*
Conclusion: *Counseling and implementation of clinical pathway on type 2 diabetic patients hospitalized with hypoglycemia can reduce the length of hospital stay and decrease readmission rates of recurrent hypoglycemia. This results in considerable health and economic benefits.*

Keywords: *Counseling, Clinical pathway, Type 2 diabetes mellitus, Hypoglycemia, Length of hospital stay*

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Hypoglycemia is a common medical emergency and a common cause of hospitalization in type 2 diabetes[1]. Patients usually present with neuroglycopenic symptoms such as sweating, fainting, palpitation, loss of consciousness or convulsion[2]. According to the United Kingdom Prospective Diabetes Study in type 2 diabetic patients, at 10- year follow up, the annual incidence of patients experiencing at least 1 hypoglycemic event was 11.0% with chlorpropamide, 17.7% with glibenclamide and 36.5% with insulin[3]. In type 1 diabetic patients, the annual incidence increased to 62% in patients who received intensive insulin treatment[4]. Although the relative incidence of hypoglycemia in type 2 diabetic patients appears to be lower than that in patients with type 1[3,4], severe hypoglycemic episodes can be more protracted and associated with greater morbidity and mortality when induced by sulfonylureas[5], particularly in older diabetic patients. During the past several years, it has become apparent that adults with diabetes were six times more likely to be hospitalized than those without diabetes[6], and nearly two thirds of the $ 44 billion in direct medical costs related to diabetes was for inpatient care. An improvement of diabetic care to lessen the development of diabetic complications can reduce these costs[7].

Until recently, clinical pathway guidelines have emerged as one of the new initiatives intended to

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safely reduce length of hospital stay and costs while maintaining or even improving the quality of care[8-10]. Similarly, Levetan et al[11] demonstrated the importance of diabetic education on their patients' acute medical status and long-term well-being, and the value of a multidisciplinary approach to diabetic management. Patients seen by the diabetic care team had a significantly lower length of stay than patients seen by an individual consultant or primary physician.

After establishing the clinical pathway as guideline for the management of hypoglycemia in diabetic patients and the documents for counseling of related issues by the medical patient care team in Taksin Hospital from April to May in 2004, a pilot study was done to evaluate the efficiency of this clinical pathway and outcome of counseling. After having satisfactory results from the pilot study, this prospective randomized trial was undertaken to determine the effects of counseling and implementation of clinical pathway on hypoglycemic diabetic patients compared with conventional treatment and to evaluate the result in terms of length of hospital stay, medical costs and number of readmissions with recurrent hypoglycemia.

Material and Method

Patients and procedures

This randomized trial was conducted at Taksin Hospital between July and December 2005. During this period 65 type 2 diabetic patients hospitalized with hypoglycemia were asked to participate in the present study, and those who gave informed written consent were enrolled. The present study was carried out after the approval of the Ethical Committee of the Bangkok Metropolitan. The inclusion criteria were 1) hospitalized diabetic patients with serum glucose on admission below 50 mg/dl and recovery of symptoms and signs of hypoglycemia after normalization of serum glucose[12,13]. 2) patients agreed to cooperate in the present study and could be followed up at 1 and 3 months after being discharged from the hospital. The exclusion criteria were 1) hypoglycemia from other causes that did not relate to the hypoglycemic drugs therapy. 2) critically ill patients such as severe sepsis with shock or those who required endotracheal intubation and artificial ventilation. After history taking and physical examination when patients were found to be eligible for recruitment, the patients were allocated into two groups which were assigned by simple randomization. For the study group, the diabetic patients received treatments according to the clinical pathway for hypoglycemia which consists of 3 essential components: evaluation of patients' status by assessment and investigation, initiation of appropriate treatment of hypoglycemia in the first 3 consecutive days of hospitalization and education or counseling with discharge plan (see appendix). In the control group, the diabetic patients received conventional treatment of hypoglycemia consisting of injection of 50% glucose 50 cc (v) immediately, then followed by 5-10% dextrose in normal saline solution (v) drip until patients could eat and drink normally. To prevent recurrent hypoglycemia during hospitalization, the author monitored the patients' blood glucose by using Capillary Blood Glucose (CBG) tests as indicated in the clinical pathway. In case of acute concurrent illness as complications during hospitalization, length of hospital stays could be flexibly extended beyond that of the clinical pathway based upon judgement of the physicians. All decisions regarding discharge were made by the physicians. Criteria for discharge included stable control of serum glucose, improvement of hypoglycemic symptoms and control of other concurrent medical complications.

Throughout the study, the nurse educator provided comprehensive educational services to each patient and his or her family in the study group according to the documents for counseling previously provided. Education included the essential skills to manage the diabetes at home, including insulin injections, home glucose monitoring if available, recognition of hypo- and hyperglycemic symptoms. Nutrition counseling to the patients and their families concerning the importance of the quantity, quality, and the timing of food intake were also provided. Before hospital discharge, each patient in both groups was given appointments for the follow-up at 1 and 3 months respectively to receive serum glucose monitoring and health examination.

Based on the authors' pilot study, the calculated variance of patient's length of hospital stay was 27.3. Meanwhile, the means of length of stay for the study group was 2.9 days and the control group was 6.8 days. With regard to a type 1 error of 0.05 and a power of 80%, the calculated number of patients required in each group was 30. Data analysis comparing demographics, chronic diabetic complications, acute concurrent illnesses and patterns of hypoglycemic drug treatment between the two groups was performed using chi-square test. Comparison of mean values between groups was performed using the Student's t-test. A p-value of less than 0.05 was judged statistically significant.

Definition

The diagnosis of diabetes mellitus was established according to the American Diabetes Association criteria[14]. Chronic renal failure was defined as persistent azotemia (serum creatinine > 2 mg/dl and urea nitrogen > 40 mg/dl) of more than 3 months. The definitions of hypertention, coronary heart disease and cerebrovascular disease were described elsewhere[15].

Results

During the study period, 65 type 2 diabetic patients hospitalized with hypoglycemia participated in the present study. Thirty-three were randomly selected in the study group while the other 32 were in the control group. Demographic and clinical data of the patients are demonstrated in Table 1. There were no significant differences in age and sex distribution, mean serum glucose on admission, chronic diabetic complication, acute concurrent illness and patterns of hypoglycemic drug treatment between the two groups. Most of the patients were female and elderly with a mean age of 64.5 ± 10.8 for the study group and 64.4 ± 11.6 years for the control group.

Table 1. Demographic data and clinical characteristics of hypoglycemic diabetic patients

Characteristics	Study group (n = 33)	Control group (n = 32)	p value
Sex (% of males)	21.2	25	0.717
Mean age (yr)	64.5 ±10.8	64.4 ±11.6	0.484
Mean serum glucose on admission (mg/dl)	33.1 ± 8.2	30.9 ±10.4	0.173
Chronic diabetic complication (% of patients)			
Hypertension	75.8	68.8	0.528
Chronic renal failure	12.1	25.0	0.181
Coronary heart disease	6.1	18.8	0.120
Cerebrovascular disease	15.2	18.8	0.699
Acute concurrent illness(% of patients)	5 (15.2)	7 (21.9)	0.586
Urinary tract infection	2	4	
Foot ulcer	1	1	
Acute gastroenteritis	1	-	
Congestive heart failure	-	1	
Pneumonia	-	1	
Alcohol abuse	1	-	
Hypoglycemic drug (% of patients)			
insulin	21.2	25.0	0.665
sulfonylureas	78.8	70.0	0.424
biguanides	69.7	66.7	0.796

Data reported as mean ± standard deviation or percentage of patients. Some patients with chronic diabetic complication had more than one complicating chronic illness. In the hypoglycemic drug category, some patients received more than one class of drugs

Table 2. Comparison of average length of hospital stay, cost, number of capillary blood glucose tests and recurrent hypoglycemic events between the study and control group

Measurements	Study group (n = 33)	Control group (n = 32)	p value
ALOS* (d) mean ± SD	3.94 ± 1.03	6.38 ± 4.05	0.0005
Mean cost (Baht)	2,743.58 ±1,473.04	3,687.00 ± 3,110.82	0.06
Mean number of capillary blood glucose tests	10.03 ± 5.04	12.34 ± 5.96	0.048
Readmission with recurrent hypoglycemia	2 (6.06 %)	11 (34.38 %)	0.0365

ALOS * = Average length of hospital stay

Table 2 shows that the ALOS for the study groups was 3.94 ± 1.03 days and the ALOS of the control group was 6.38 ± 4.05 days. The ALOS for the study group was 38% lower than that of the control group (p = 0.0005). The mean costs were 2,743.58 ± 1,473.04 Baht in the study group and 3,687 ± 3,110.82 Baht in the control group. The mean costs for the study group were 25.6% lower than that of the control group, however this difference didn't show statistical significance (p = 0.06). The mean number of capillary blood glucose tests was 10.03 ± 5.04 in the study group and 12.34 ± 5.96 in the control group. The study group value was 18.7% lower than that of the control group (p = 0.04). The readmission rate of patients with recurrent hypoglycemia was 6.06% in the study group and 34.38% in the control group. There was an 82.4% decrease of the readmission rates for recurrent hypoglycemia in the study group compared to that of the control group (p = 0.03).

Discussion

Recently, strong effort to reduce health care expense has led many health care organizations to seek strategies to reduce resource utilization while maintaining the quality of care. Among the most popular methods intended to meet this challenge are clinical pathways. Clinical pathways are management plans that display goals for patients and provide the corresponding ideal sequence and timing of actions to achieve those goals with optimal efficiency[8-10].

According to the above data, it was confirmed in the present study that the implementation of clinical pathway significantly decreased the average length of hospital stay and the mean number of capillary blood glucose tests performed in diabetic patients hospitalized with hypoglycemia, whereas the mean costs reduction nearly reached a statistically significant difference. It should be noted that the hospital readmission rates with recurrent hypoglycemia was also significantly decreased in patients receiving diabetic counseling. The result in the present study confirms the findings of Levetan et al[11] and Mazzuca et al[16] that intensive diabetic education may have had a dramatic impact not only on patients' acute medical status, but also their long-term well-being and diabetic control. In this regard, it is essential to be able to recognize the early signs and symptoms of hypoglycemia in order to prevent and treat them. This can be achieved only through educating the patients and their relatives about the mechanisms of action, how to use and side effects of hypoglycemic agents.

Although there was a significant decrease in average length of stay from 6.38 ± 4.05 days in the control group to 3.94 ± 1.03 days in the study group, or a 38% reduction, the average length of stay in the study group was slightly longer compared to 2 days (range, 1-9 days) in the study by Ben-Ami et al[17]. The reasons for the longer hospitalization in the present study may due to more chronic diabetic complications and more acute concurrent illness in a substantial number of patients during hospitalization. Metchick et al[18] indicated that the additional hospital days in diabetic patients likely resulted from complications of diabetes or from the time required to achieve glycemic control before discharge. Moreover, failure to plan ahead from the time of admission for proper education and self- management and nutrition may have introduced further delays in discharge[11]. Therefore, the implications of educations on hypoglycemia and diabetes in the first day of admission, review and evaluation of the patients' knowledge in the third day of admission, as appeared in this clinical pathway implemented to the study group, had partially made their hospital stay shorter when compared to the control group.

The present study indicates that counseling and implementation of clinical pathway on diabetic patients hospitalized with hypoglycemia can reduce the length of hospital stay and decrease subsequent readmission rates of recurrent hypoglycemia significantly. It is also less expensive and reduces the number of unnecessary capillary blood glucose tests.

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Appendix

Clinical Pathway Hypoglycemia in Diabetic Patients

วันที่รับไว้ในโรงพยาบาล _____ วันที่จำหน่าย _____ รวม _____ วัน
แพทย์ _____ หอผู้ป่วย _____ ค่ารักษา _____ สิทธิ_____

	วันที่ 1	วันที่ 2	วันที่ 3
1. Expected outcomes ผลลัพธ์ที่คาดหวัง	# ปลอดภัยจากภาวะแทรกซ้อน เช่น..... ..... # ได้รับทราบข้อมูลการเจ็บป่วย / การรักษา	# ไม่มี recurrent hypoglycemia	# ไม่มี recurrent hypoglycemia # ผู้ป่วย / ญาติทราบวิธีการดูแลตนเองในเบื้องต้น
2. Assessment and Investigation การประเมิน และการตรวจทางห้องปฏิบัติการ	# CBG* ทุก 4- 8 hr. # BUN, Cr # LFT	# CBG* ทุก 12 hr. # ถ้าผู้ป่วยรับประทานอาหารได้ และ CBG ปกติ (100- 200 mg.%)	# CBG* OD เช้า # รับประทานอาหารได้ และ CBG ปกติ
3. Treatment การรักษา	# 50% Glucose 50 cc (v) # 10% D/NSS/2 1000 cc (v) 80-100 cc/hr. # หลังให้ 50% Glucose 50 cc แล้ว CBG ≤ 50 mg% และผู้ป่วยมีอาการหน้ามืด ใจสั่น ให้รายงานแพทย์ # ยาอื่น ๆ ที่จำเป็น	# เปลี่ยน (v) เป็น 5% D/NSS/2 (v) 80 cc/hr. # ยาอื่น ๆ ที่จำเป็น	# Off (v) ถ้า renal function # ปกติ : ให้ Metformin # ผิดปกติ : Insulin (sc) # ยาอื่น ๆ ที่จำเป็น
4. Nursing Care การพยาบาล	# Record V.S. ทุก 4-6 hr. # สังเกตอาการ hypoglycemia # ติดตามและรายงานผลทางห้องปฏิบัติการ	# Record V.S. ทุก 4-6 hr. # สังเกตอาการ hypoglycemia	# Record V.S. ทุก 8 hr. # สังเกตอาการ hypoglycemia
5. Education and Discharge plan การให้ความรู้ผู้ป่วยหรือญาติ และการวางแผนจำหน่าย	# ให้ความรู้เรื่อง hypoglycemia การดูแลรักษาเบื้องต้น # ให้ความรู้เรื่องโรคเบาหวานทั่วไป		# แนะนำขั้นตอนมาตรวจตามนัด # การรับประทานยาหลังกลับบ้าน # การทบทวนและประเมินความเข้าใจเรื่อง hypoglycemia

* CBG = Capillary blood glucose

ผลของการให้คำปรึกษาและการใช้แนวทางดูแลรักษาผู้ป่วยโรคเบาหวานที่รับไว้ในโรงพยาบาลด้วยภาวะน้ำตาลในเลือดต่ำ

ไพบูลย์ ค้ำพันธุ์

ผู้วิจัยได้ศึกษาผลของการให้คำปรึกษา และการใช้แนวทางดูแลรักษาผู้ป่วยโรคเบาหวานชนิดที่ 2 ที่รับไว้ในโรงพยาบาลด้วยภาวะน้ำตาลในเลือดต่ำ จำนวน 33 ราย (กลุ่มศึกษา) เปรียบเทียบกับอีก 32 ราย ที่ได้รับการรักษาตามปกติ (กลุ่มควบคุม) ในโรงพยาบาลตากสิน ตั้งแต่ กรกฎาคม - ธันวาคม พ.ศ. 2548 ผลการศึกษาพบว่า ผู้ป่วยเบาหวานทั้ง 2 กลุ่ม มีความคล้ายคลึงกันด้านอายุ เพศ ค่าเฉลี่ยของระดับน้ำตาลในเลือดขณะแรกรับไว้ในโรงพยาบาล โดยส่วนมากเป็นเพศหญิงและสูงอายุ ไม่มีความแตกต่างอย่างมีนัยสำคัญทางสถิติ ในเรื่องของจำนวนผู้ป่วยที่มีโรคแทรกซ้อนเรื้อรังต่าง ๆ จากโรคเบาหวาน จำนวนผู้ป่วยที่มีโรคแทรกซ้อนเฉียบพลันขณะรักษาตัวในโรงพยาบาล ตลอดจนวิธีการใช้ยาลดระดับน้ำตาลในเลือดในผู้ป่วยทั้ง 2 กลุ่ม ค่าเฉลี่ยของระยะเวลาพักรักษาตัวในโรงพยาบาลของกลุ่มศึกษา (3.94 $\pm$ 1.03 วัน) น้อยกว่ากลุ่มควบคุม (6.38 $\pm$ 4.05 วัน) อย่างมีนัยสำคัญทางสถิติโดยมีค่า p เท่ากับ 0.0005 ค่าเฉลี่ยของจำนวนครั้งของการเจาะเลือดเพื่อตรวจระดับน้ำตาลจากปลายนิ้ว ในระหว่างการรักษาในโรงพยาบาลของกลุ่มศึกษา (10.03 $\pm$ 5.04 ครั้ง) ต่ำกว่ากลุ่มควบคุม (12.34 $\pm$ 5.96 ครั้ง) อย่างมีนัยสำคัญทางสถิติ ($p = 0.048$) นอกจากนั้น อัตราการกลับเข้ารับการรักษาตัวซ้ำในโรงพยาบาลด้วยภาวะน้ำตาลในเลือดต่ำอีกหลังจำหน่ายผู้ป่วยออกจากโรงพยาบาลแล้ว 1 เดือน และ 3 เดือนตามลำดับในกลุ่มศึกษา (6.1%) ก็น้อยกว่ากลุ่มควบคุม (34.4%) อย่างมีนัยสำคัญทางสถิติ ($p = 0.036$) อย่างไรก็ตาม ค่าใช้จ่ายของการรักษาพยาบาลเฉลี่ยในกลุ่มศึกษา (2,743 .58 $\pm$ 1,473.04 บาท) น้อยกว่ากลุ่มควบคุม (3,687 $\pm$ 3,110.82 บาท) อย่างไม่มีนัยสำคัญทางสถิติ ($p = 0.06$) โดยสรุป การให้คำปรึกษาแนะนำและการใช้แนวทางดูแลรักษาผู้ป่วยเบาหวานที่รับไว้ในโรงพยาบาลด้วยภาวะน้ำตาลในเลือดต่ำ สามารถลดระยะเวลาพักรักษาตัวในโรงพยาบาล ลดอัตราการกลับเข้ารับการรักษาในโรงพยาบาลซ้ำด้วยภาวะน้ำตาลในเลือดต่ำหลังจำหน่ายออกจากโรงพยาบาลแล้ว 1 เดือน และ 3 เดือน ตามลำดับ ได้ดีกว่าการรักษาแบบปกติ เป็นผลให้ลดค่าใช้จ่ายด้านการรักษาพยาบาลและเพิ่มคุณภาพชีวิตของผู้ป่วยเบาหวาน