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Research Article

Analysis of the Effect of Continuous Nursing Practice on Case Management of Intensive-Stage Diabetes Patients

Yiyi Deng[1], Qingling Chen[1], Xueyan Liu[1]*, Peiru Zhou[1], Jiewei Huang[1], Yan Liu[1], Meili Tang[1] and Fengjiao Li[2]

[1]Department of Endocrinology, The First Affiliated Hospital of Jinan University, Guangzhou, China

[2]Departemt of nursing, Hulunbuir Institute of Vocational Technology, Hulunbuir, China

***Corresponding Author:** Xueyan Liu, Department of Endocrinology, The First Affiliated Hospital of Jinan University, Guangzhou, China.

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Abstract

Objective: To identify the effects and related factors of extended nursing management for (1) newly diagnosed diabetes patients, (2) patients admitted with acute complications from diabetes mellitus, and (3) patients with glycated hemoglobin (HbA1c) levels of ≥9.0%, to suggest adjustments to the case continuation care plan.

Methods: This study adopted a cohort design. Convenience sampling was used to select diabetes patients hospitalized between October 2017 and March 2019 for the control group, and between April 2019 and September 2019 for the study group. Patients in the control group received routine nursing management, these in the study group were visited by a case manager within 48 hours of admission, the diabetes case management record data sheet was established, and a care plan was constructed according to the evaluation results. One telephone call or WeChat voice conversation (which can be carried out any time and any place) follow-up occurred 1, 4, and 12 weeks after discharge from the hospital (the number of follow-up visits was increased according to the needs of individuals), which included home self-care, diet, blood sugar control index, and outpatient review.

Results: The HbA1c level was significantly lower in the study group than in the control group (7.18±1.65% vs 8.46±2.02%, mean ± Standard deviation; $p< 0.05$), as was the cholesterol level (4.57±0.85mmol/L vs 5.24±1.95mmol/L, $p< 0.05$). The hypoglycemia incidence rates were 10.9% and 23.5% in the study and control groups, respectively, while the rates of HbA1c compliance were47.8% and 40.9%. There were no significant differences between the two groups in the total scores for triglycerides, low-density lipoprotein, uric acid, and pain.

Conclusion: Intensive case management can improve the blood glucose levels of diabetes patients, but is not ideal in reducing their pain and or the rate of reaching standard blood glucose levels. After the intensive phase, it is recommended that a case manager continues to manage patients in the life-long maintenance phase, with appropriate alterations to the intensity and frequency of interventions. The Internet should be used for flexible communications with patients, combining empowerment and education to help patients in a timely manner, increasing attention to reducing their distress, and improving blood glucose check-up compliance rates.

Keywords: *Diabetes; Intensive-Stage; Case Management; Continuous Nursing Practice*

Introduction

Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia [1]. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and in-

creased glucose production. Long-term disturbance of carbohydrate metabolism and metabolism of fat and protein can lead to multi-system damage, chronic progressive diseases, functional decline and failure of eyes, kidneys, nerves, heart, blood vessels and other organs. The ongoing acceleration of the aging process and changes in eating habits and lifestyle in the population are resulting in increases in the incidence, disability, and mortality rates of diabetes, which has seriously affected public health. Diabetes incidence has nearly tripled worldwide over the last 3 decades [1,2]. According to the latest statistics from the International Diabetes Federation, therewere 463 million people suffering from diabetes in 2019, with China making up the largest proportion with 116.4 million cases [3]. The United States has the highest spending on diabetes-related health care, at about $294.6 billion, followed by China at about $109 billion. In other words, the socioeconomic burden of diabetes is enormous [3,4]. As a disease management model [5,6], case management has achieved significant results in improving the quality of medical treatment and nursing care, and reducing related medical expenses [7]. Case management in China starts late and the degree to which it occurs varies greatly between regions [8-10]. Continuation of care cannot be guaranteed for the majority of discharged patients in China due to the large number of cases and relative shortage of nurses. Therefore, resources for continuing care services must be restricted so they are available to those in urgent need. It is also unrealistic to strengthen case management over long periods of time. Most literature regarding the effects of evaluations have involved examinations of glycation, lipids, readmission rates, and self-management behavior [11], but not patient distress. In September 2017, the study hospital sent 15 people to Hualien Tzu Chi Hospital (a legal entity of the Taiwan Buddhist Tzu Chi Medical Group) for 3 weeks to study the role and orientation of case managers and to set up management files. On their return, they were granted the qualification of case managers. A continuous care model of case management from admission to discharge was developed by the diabetes case manager, which defined the population and strengthened management time, paid attention to the pain experienced by patients, and achieved good results.

Information and Methods

Inclusion and exclusion criteria

The study inclusion criteria were meeting the WHO diagnostic criteria for diabetes plus any of the following conditions: (1) newly diagnosed diabetes, (2) glycated hemoglobin (HbA1c) level of ≥9.0% (3) complications such as hyperosmolar hyperglycemic state, diabetic ketoacidosis, hypoglycemia, and diabetic foot. The exclusion criteria were (1) visual, hearing, or cognitive impairment, (2) severe cerebrovascular disease and chronic diseases that require intensive care or (3) not agreeing to study participation.

Methods

This study adopted a cohort design. Convenience sampling was used to select diabetes patients hospitalized in the First Affiliated Hospital of Jinan University in Guangzhou, China between October 2017 and March 2019 for the control group, and between April 2019 to September 2019 for the study group. The control group received routine nursing management involving no systematic follow-up management after discharge, and a registered nurse followed up from one to three times by telephone over 3 months. The study group received intensive case management, performed by a case manager from admission to 3 months after discharge. The case manager visited the patient within 48 hours of admission to evaluate diabetes-related problems and establish the diabetes case management record table. They also set up a WeChat group to enable communication with patients at any time.

A comprehensive evaluation was performed on the day of discharge according to the main problems experienced by each patient during hospitalization. The items that did not meet the standards were discharge management, overall care, nursing and follow-up, with follow-up being conducted at fixed time points of 1,4, and 12 weeks after discharge. After 3 months of intensive management, the management maintenance phase was initiated. Patients with unacceptable blood sugar and fat levels needed to be tracked, and those with acceptable levels needed to be reminded to participate in follow-up sessions. General data and related biochemical indexes for all patients were recorded before group admission and at the end of the intensive management stage (3 months after discharge).

Research tools

The Diabetes Distress Scale was developed by Polonsky., *et al.* in 2005 to evaluate psychological distress relating to diabetes. The scale has good reliability and validity, and can be used in scientific research and clinical practice, and in 2008 the scale was reduced from 28 to 17 questions [12,13].

The following indicators were assessed at the end of the intensive phase (3 months after discharge)

- Biochemical indicators of fasting blood glucose, glycosylated hemoglobin （HbA1c）, blood lipids, cholesterol, and uric acid.
- Hypoglycemia incidence, which was defined as the rate of reaching the standards for blood glucose (standard being <7 mmol/L fasting blood glucose) and HbA1c (standard being <7%). Low-density lipoprotein (LDL) level (<2.6 mmol/L), not associated with arteriosclerosis cardiovascular disease [14].
- Score on a diabetes pain scale.

Statistical methods

Data analysis was completed using SPSS (version 20.0) software with measurement data expressed as mean ± Standard deviation values, and t-tests with two independent samples were applied to the intergroup data. The paired t-test was used for within-group analyses, with $p < 0.05$ considered to be significant.

Results

Baseline data of patients in both groups

Some patients who were not monitored for HbA1c were excluded (92 in the study group and 68 in the control group). There were no significant differences between the two groups in sex, age, educational level, blood glucose level, or blood lipid levels (Table 1).

Variable	Study group N=92	Control group N=68	T/X2	P
Age(mean ± SD)	41.75 ± 11.78	42.44 ± 7.59	0.45	0.653
Sex				
Male (n)	60	43		
Female (n)	32	25	0.067	0.868
medication				
oral medication (n)	25	18		
insulin (n)	17	12		
oral medication +insulin (n)	50	38	0.039	0.981
Education level (mean ± SD)	4.10 ± 1.54	4.04 ± 1.54	0.22	0.83
Duration of DM (mean ± SD)	9.49 ± 5.00	8.93 ± 3.64	0.79	0.43
BMI (mean ± SD)	24.37 ± 4.89	24.27 ± 4.55	0.13	0.895
FBG (mean ± SD)	10.43 ± 5.14	11.31 ± 5.05	1.08	0.282
HbA1c (mean ± SD)	10.89 ± 3.01	10.31 ± 2.15	1.43	0.154
TC (mean ± SD)	5.14 ± 1.30	5.09 ± 1.19	0.22	0.825
TG (mean ± SD)	2.66 ± 0.83	2.01 ± 1.52	0.04	0.967
HDL (mean ± SD)	1.04 ± 0.65	1.14 ± 0.77	0.91	0.366
LDL (mean ± SD)	3.06 ± 0.93	2.96 ± 0.80	0.73	0.469
Uric acid (mean ± SD)	368.46 ± 132.11	343.46 ± 114.30	1.25	0.212

Table1: *Baseline data comparison between the control and study groups.*
Abbreviations: SD, Standard deviation; DM, diabetes mellitus; BMI, Body Mass Index; FBG, Fasting blood glucose; HbA1c, Glycated hemoglobin; TC, Cholesterol; TG, Triglyceride; HDL, High-density lipoprotein; LDL, Low-density lipoprotein.

2.2 After 3 months of intensive intervention, the HbA1clevels in the study and control groupswere7.18±1.65 and 8.46±2.02, respectively ($p < 0.05$). The cholesterol index (7.18±1.65) and hypoglycemia incidence (10.9%) were significantly lower in the study group than in the control group (8.46±2.02, 23.5%), and the HbA1c rate of compliance was higher in the study group (47.8% vs30.9%). There were no significant differences in the total scores for triglycerides, LDL, uric acid, and pain scale (Table 2).

Variable	Control group N=68	Study group N=92	T/X^2	P
FBG (mean ± SD)	7.84 ± 1.93	7.24 ± 1.87	1.96	0.052
HBA1C (mean ± SD)	8.46 ± 2.02	7.18 ± 1.65	4.27	0.000
TC (mean ± SD)	5.24 ± 1.95	4.57 ± 0.85	2.67	0.009
TG (mean ± SD)	1.81 ± 1.62	1.44 ± 0.84	1.70	0.093
HDL (mean ± SD)	1.04 ± 0.65	1.13 ± 0.30	0.04	0.967
LDL(mean ± SD)	2.67 ± 0.90	2.66 ± 0.80	0.04	0.967
Uric acid(mean ± SD)	349.09 ± 91.19	350.30 ± 98.68	0.08	0.937
Incidence of hypoglycemia(n1/N)	16/68(23.5%)	10/92(10.9%)	4.61	0.032
compliance rate of FBG(n2/N)	23/68(33.8%)	48/92(52.2%)	5.33	0.021
Compliance rate of HbA1C(n3/N)	21/68(30.9%)	44/92(47.8%)	4.65	0.031
Compliance rate of TG(n4/N)	66/68(67.7%)	66/92(71.7%)	0.31	0.577
Compliance rate of LDL(n5/N)	20/68(29.4%)	30/92(32.6%)	0.19	0.67
Compliance rate of TC(n6/N)	27/68(39.7%)	45/92(48.9%)	1.34	0.247
Average score of emotion (mean ± SD)	3.97 ± 0.45	3.95 ± 0.52	0.32	0.750
Average pain score related Doctor (mean ± SD)	2.15 ± 0.52	2.14 ± 0.52	0.07	0.942
Average score of self-discipline (mean ± SD)	3.99 ± 0.25	3.88 ± 0.32	2.24	0.027
Average score of relationship (mean ± SD)	2.32 ± 0.44	2.28 ± 0.44	0.44	0.659
Mean Total Score (pain scale)(mean ± SD)	3.97 ± 0.46	3.94 ± 0.52	0.319	0.750

Table 2: *Comparison of indexes between study and control groups after 3 months of intensive intervention. Abbreviations: SD, Standard deviation; FBG, Fasting blood glucose; HbA1c, Glycated hemoglobin; TC, Cholesterol; TG, Triglyceride; HDL, High-density lipoprotein; LDL, Low-density lipoprotein. n1, Number of people with hypoglycemia;n2,n3,n4,n5,n6: number of people who reached the target with FBG, HbA1C,TG,LDL and TC respectively.*

Discussion

Case management during the intensive phase is beneficial to controlling blood sugar

Intensive-stage case management, which embodies structured management [15], has a remarkable beneficial effect in controlling the blood sugar levels of patients. Several studies have supported the effectiveness of case management interventions in significantly decreasing HbA1c [16-18].

However, a study [19] found significant changes in blood sugar, where the present study found that the HbA1c levels of patients decreased from 10.31% to 7.18%, which was consistent with an improvement of HbA1cof 2.7% [18]. The rate of reaching a standard blood glucose level during case management was higher in the study group than the control group, and the incidence of hypoglycemia was lower ($p < 0.05$). Similar to another study, only 47.8% and 32.4% of patients had acceptable blood glucose and LDL levels, respectively [20]. Each 1% reduction in glycation was associated with a significant reduction in microvascular and other diabetic complications [20]. The improvement in HbA1c in the study group was about 3%, indicating the cardiovascular benefits and prevention of complications.

Evidence-based medicine has indicated that lowering total cholesterol and LDL levels significantly reduces the risks of macrovascular disease and death in diabetes patients [21]. The improvements associated with HbA1c case management are well documented, but improvements in lipid levels remain controversial. Significant improvements in total cholesterol and LDL levels after 1 year of case management were found in a study by Julie., *et al* [16]. However, the study by Gabbay., *et al.* showed no significant improvement in blood lipid levels after 6 months or 1 year of case management [19]. The present study found that the total cholesterol level improved, but there was no difference in the extent of improvement and the rate of compliance with LDL. Studies have indicated that moderate-intensity statin therapy can reduce LDL levels by 30% to 50% [22-24], and can be applied to patients aged over 40 years with LDL greater than 1.8mmol/L [25]. Therefore, it can be inferred that drug regulation plays a major role in the control of blood lipids. Lifestyle interventions have low efficacy, suggesting that case managers should not only promote a healthy diet and lifestyle, but instead focus on the compliance of patients towards lipid-regulating drugs, and strengthen management to improve awareness of patients and encourage the use of medication.

Case management during the intensive phase was not significant in reducing pain

A previous study found that 45.4% of type 2 diabetes patients have at least moderate diabetes distress, which increases the risk of poor treatment outcomes [26].Case management has been shown to improve negative emotions of pain by several researchers[18,19,27], but the present study found that the overall level of pain did not differ significantly between the two groups at 3 months. This result may be related to the short intervention time, but the pain related to self-discipline was lower in the study group than in the control group ($p < 0.05$). It has also be reported that chronic emotional, physical, and other disease complications such as diabetes can have a significant impacts on quality of life, ultimately affecting the ability to self-manage illnesses[28]. The case manager should therefore focus on the emotions of patients, and balance the degrees of support, education, and empowerment.

Duration of the reinforcement phase

Few studies have investigated the timing of the reinforcement phase, and most of the domestic and foreign literature on case management addresses the management time and style, and not differences in the degree of intervention between the reinforcement and maintenance phases. After 3 months of intensive case management in the present study, blood glucose control was improved, hypoglycemia incidence was reduced, and the self-management ability of patients improved gradually, but the overall rate of blood glucose compliance was still lower than 50%. It has also been reported that a higher exposure frequency ?The frequency of contact with the patient?is not associated with decreases in health care utilization, and that frequent follow-up contact with those receiving an intervention is sometimes associated with the severity of the patient's disease[29]. As a result, the intensification phase maybe followed by a life-long maintenance phase, with appropriate relaxation in the intensity and frequency of interventions. The Internet is useful for flexible contact and communication, assisting in providing a combination of empowerment and education to help patients when necessary.

In summary, the intensive phase of case management occurs when the case manager has established a good relationship with the patient by contacting them from the time of hospitalization and assessing and collecting data, providing a foundation for continuous nursing follow-up after discharge. During the present 3-month management period, case managers made three follow-up visits to patients using a telephone or a WeChat voice conversation. Patients could consult and communicate with their case manager at any time through the

WeChat platform to help them control blood sugar effectively. One limitation of this study was that data on the maintenance phase were not collected due to a lack of resources.

Conclusion

Intensive case management can improve the blood glucose levels of diabetes patients, however, the effects of blood lipids and pain relief were not satisfactory. After the intensive phase, it is recommended that a case manager continues to manage patients in the life-long maintenance phase, with appropriate alterations to the intensity and frequency of interventions. The effects of the maintenance phase still need to be tracked in the future. The Internet should be used for flexible communications with patients, combining empowerment and education to help patients in a timely manner, increasing attention to reducing their distress, and improving blood glucose check-up compliance rates.

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