Original Article

The Effect of Home Care on Metabolic Profile and Blood Pressure in Type 2 Diabetic Patients who Underwent General Surgeries

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Abstract

Background: The stress of surgery itself results in metabolic disturbance. Few studies have mentioned how to manage the metabolic profile of diabetic patients after discharge from the hospital. The present study aimed to determine the effect of home care on metabolic profile and blood pressure in type 2 diabetic patients who underwent general surgeries. **Methods:** Seventy type 2 diabetic patients who were undergoing surgery were assigned to the intervention and control groups via blocking order. The intervention group received a 3-month home care with an interprofessional team approach. The levels of fasting blood glucose, glycosylated hemoglobin (HbA1c), total cholesterol, triglycerides, high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterols, systolic blood pressure, and diastolic blood pressure were measured before and three months after the intervention in both groups. In the control group, only routine care was performed in the postsurgery period. Data were entered in SPSS software version 23 and were analyzed. **Results:** There were no significant differences between the intervention and control groups for background characteristics. Systolic blood pressure ($P < .001$), diastolic blood pressure ($P = 0.005$), lipid profile ($P = 0.001$) [except for triglycerides level], fasting blood glucose ($P = .001$), and HbA1c ($P = .003$) decreased significantly in the intervention group. After controlling baseline data by applying analysis of covariance, a significant increase in HDL-c ($P = .032$) was seen. Also, the difference between the mean percentage of variations in HbA1c levels between intervention and control groups was significant. **Conclusions:** Our study showed improvement in HbA1c and HDL-c levels with home care programs in patients with diabetes who underwent general surgeries. More studies with longer follow-ups are necessarily addressing the effects of home care on other metabolic parameters in these patients.

Keywords: *Blood glucose, blood pressure, diabetes mellitus, home care services, lipid, type 2*

Introduction

Type 2 diabetes mellitus (DM) is one of the most common chronic diseases globally and is expected to affect more than 642 million adults by 2040.[1] On the other hand, more than 50% of diabetic patients need at least one surgery in their lifetime.[2] The stress of surgery itself results in metabolic disturbance and persistent hyperglycemia, which are risk factors for endothelial dysfunction, postoperative sepsis, and impaired wound healing.[3] In this regard, postsurgical complications such as disturbance in glucose or blood pressure control as well as wound healing are not only associated with high costs to the patient and the healthcare system but also increase the readmission of these patients and impair quality of life.[2] Therefore, diabetic patients need detailed information and adequate support to manage their diseases after hospital discharge. This support should be provided not only at hospital discharge but also during the postdischarge period and even at the patient home.[4] One potential strategy for effective postdischarge management of diabetic patients is diabetes self-management education intervention. Diabetes self-management education is one of the best strategies for improving DM self-management and is critical for patient empowerment, glycemic control, and prevention of diabetes-related postsurgical complications.[2,5] Numerous studies were conducted in different countries to describe home care benefits in relation to various diseases, including diabetes. However, none precisely assess the impact of home care on the metabolic profile of diabetic patients who have undergone surgery.[4,6-8]

Therefore, considering the point that home care could be an effective method to control

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metabolic profiles in diabetic patients after surgery, in this randomized controlled trial, we aimed to compare the effect of home care on metabolic profile and blood pressure in type 2 diabetic patients who underwent general surgeries.

Methods

Study design and setting

The present study was a randomized controlled clinical trial (IRCT20211222053491N1). The data collection lasted from August to December 2019 in the selected educational hospitals in the third biggest city in the central part of Iran, named Isfahan.

Study participants and sampling

The study's sample size was 70 type 2 diabetic patients undergoing general surgery to be discharged from the hospital with a minimum age of 45 years. Patients were randomly assigned to the intervention and control groups by permuted block randomization. According to the sample size, 18 blocks of four were considered. The types of placement of patients (four individuals) inside each block were imagined and recorded from the total number of samples from the intervention and control groups. A number was assigned to each of these states and recorded. Numbers were written on spherical objects of the same color and size and put into the bag. Then a three-year-old child was asked to remove the objects from the bag as many blocks as needed, even if repeated, and after recording the number on the object, return the object to the bag again. In this way, at the time of sampling, sampling was done according to the order of the blocks and the number taken out of the bag (n = 35/group).

In this study, the enrolled patients underwent orthopedic, gastrointestinal, neurosurgery, genitourinary, cardiac, head and neck, lung, and vascular surgery.

Inclusion criteria were a diagnosis of type 2 DM for more than 1 year (according to the American Diabetes Association criteria), basic literacy skills, an age of 45 years or more, and no history of serious illnesses such as liver cirrhosis, end-stage renal disease, cancer, or mental illnesses (according to patient's medical records).

Exclusion criteria were moving to another place for residence, voluntary withdrawal from the study, and affliction by serious illnesses during the study.

Data collection tool and technique

The data collection tools were the Patient Background checklist, laboratory tool, digital brachial barometer, and a glucometer. After sampling and obtaining consent, the patients completed the demographic characteristics checklist in the control and intervention groups. Then, according to the coordination with the patient's family, the first day after discharge and after 10 hours of fasting of the patient, in both control and intervention groups, blood samples were taken for lipid profile [total cholesterol, low-density lipoprotein cholesterol (LDL-c), high-density lipoprotein cholesterol (HDL-c), triglyceride (TG)], glycosylated hemoglobin (HbA1c), estimated average glucose (eAG), and fasting blood sugar (FBS) test. Also, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured in both groups.

Patients in both groups who use insulin were given a glucometer. The patient and his/her family member were trained to use the glucometer. The patients were asked to measure their blood sugar at least twice a day, one of which is FBS, to record the results in the notebook they were given and in the virtual group each week under the management of the research team members. An endocrinologist evaluated the results, and if necessary, it was recommended to change the treatment plan. The researcher's contact number was provided to the patients and their families to contact the nurse whenever they had a problem outside the designed home visit. In patients who did not undergo insulin therapy, the researcher measured and recorded fasting or postmeal blood glucose measurements each time they visited home. The results were sent to the endocrinologist, and therapeutic measures were taken if necessary. Also, the care provider was asked to measure the patient's BP in every home visit and record the results. Three months later, at the end of the study, blood samples were taken for lipid profile, HbA1c, and FBS in both groups. The control group received routine postoperative care.

Patients in the intervention group were like the control group regarding data collection. However, in the intervention group, the patient was scheduled for the first session of home attendance according to the need assessment. In the intervention group, in each visit to the patient's home, all the care and educational needs of the patient and the family were covered.

In this study, blinding of the data analyst was done. None of the hospitalized patients knew which group they were in at the sampling time. In other words, none of the patients in the control group knew that there were other patients in this study who received the services. They did not know that they receive care at home. In this study, the blinding of the main researcher was irrelevant.

Data were analyzed with parametric and nonparametric statistic tests via Statistical Package for the Social Sciences (SPSS) version 23.0 statistical software (SPSS, Inc., Chicago, IL, USA). One-way analysis of variance was used for quantitative variables confirming the assumption of normal data distribution, and for qualitative variables with nominal scale, the Chi-square test was used.

Ethical considerations

This study was approved by the Ethics Committee, affiliated with Isfahan University of Medical Sciences (IR.MUI.RESEARCH.REC.1398.210).

Table 1: Demographic characteristics in both groups

	Intervention group (*n*=35)	Control group (*n*=35)	*P*
Marriage (%)			0.391
Married	69.4%	73.5%	
Widow	22.2%	26.5%	
Divorced	5.6%	0.0%	
Single	2.8%	0.0%	
Age (years)	59.26±13.9	64.47±13.78	0.123
Sex (%)			0.243
Women	59.5%	47.5%	
Men	40.5%	54.3%	
Education (%)			0.326
High-school	67.6%	82.9%	
Diploma	21.6%	11.4%	
Associate degree and above	10.8%	5.7%	
Insurance (%)			0.589
Yes	94.6%	97.1%	
No	5.4%	2.9%	
Insurance-kind (%)			0.214
Health service	0.0%	14.3%	
Social security	26.5%	25.7%	
Others	23.5%	14.3%	
Supplementary insurance	5.9%	11.4%	
14	8.8%	8.6%	
23	5.9%	0.0%	
24	29.4%	22.9%	
34	0.0%	2.9%	
Job (%)			0.856
Employee	2.8%	5.9%	
Housewife	52.8%	50.0%	
Freelance job	19.4%	14.7%	
Retired	25.0%	29.4%	
Duration of diabetes mellitus (%)			0.949
1-5 years	36.1%	31.4%	
6-10 years	25.0%	22.9%	
11-15 years	13.9%	17.1%	
>15 years	25.0%	28.6%	
Surgery-kind (%)			0.172
Orthopedic surgery	37.8%	62.9%	
Gastrointestinal surgery	21.6%	14.3%	
Neurosurgery	10.8%	11.4%	
Genitourinary surgery	10.8%	2.9%	
Cardiac surgery	2.7%	5.7%	
Head and neck surgery	8.1%	0.0%	
Lung surgery	5.4%	0.0%	
Vascular surgery	2.7%	0.0%	
Others	0.0%	2.9%	
Duration of hospitalization (day)	10.05±14.82	10.52±9.66	0.880

The researcher then obtained informed consent from all participants in the hospital, introducing herself and explaining the study goals. Participants were free to leave the study at any stage without loss or damage.

Results

Baseline comparisons

Patients in intervention and control groups were comparable regarding age, sex, marriage status, education level, distribution of insurance, insurance kind, job, duration of DM, type of surgery, and duration of hospitalization [Table 1].

Before randomization, intervention and control groups did not differ regarding SBP, DBP, total cholesterol, FBS, TG, HDL-c, LDL-c, eAG, and HbA1c levels [Table 2].

Postintervention data

In the intervention group, SBP, DBP, lipid profiles (except for HDL-c and TG level), eAG, FBS, and HbA1c decreased significantly and HDL-c level increased significantly after intervention. The control group showed a slight but not statistically significant decrease in variables during the follow-up period.

After controlling baseline data by applying analysis of covariance, a significant increase in HDL-c was seen. Also, the difference between the mean percentage of variations in HbA1c levels between intervention and control groups was significant [Table 2].

Discussion

This study aimed to determine the effect of home care on BP, lipid profile, FBS, and HbA1c levels in patients

Table 2: Comparison of variables between intervention and control groups

Variables		Groups		*P*
		Intervention (*n*=35)	Control (*n*=35)	
SBP (mmHg)	before	132.02±17.13	127.96±16.35	
	after	121.16±15.94	124.46±27.85	
	P_1	<0.001	0.506	
	P_2	0.189		
DBP (mmHg)	before	80±11.78	79.46±14.03	
	after	74.32±13.49	75.71±11.36	
	P_1	0.005	0.271	
	P_2	0.599		
Cholesterol (mg/dL)	before	147.92±55.04	126.94±38.49	0.064
	after	167.51±53.83	165.16±43.93	0.846
	P_1	<0.001		
	P_2	0.599		
FBS (mg/dL)	before	160.46±73.78	186.66±111.51	0.247
	after	129.6±51.46	141.94±71.07	0.428
	P_1	0.001		
	P_2	0.551		
TG (mg/dL)	before	138.22±51.05	146.43±98.12	0.655
	after	158.2±86.84	154.42±62.86	0.839
	P_1	0.409		
	P_2	0.715		
HDL (mg/dL)	before	35.35±13.96	33.20±11.39	0.475
	after	45.54±14.23	39.29±7.72	0.033
	P_1	<0.001		
	P_2	0.032		
LDL (mg/dL)	before	72.81±31.11	65.22±20.77	0.226
	after	90.1±32.13	87.99±25.66	0.767
	P_1	<0.001		
	P_2	0.973		
EAG (mg/dL)	before	187.35±72.2	177.53±75.32	0.577
	after	145.53±54.42	165.13±54.81	0.154
	P_1	0.001		
	P_2	0.095		
HbA1C (%)	before	8.12±2.49	7.78±2.61	0.575
	after	6.71±1.86	7.52±2.07	0.102
	P_1	0.003		
	P_2	0.560		
	The difference between the mean percentage of variations	*P*=0.020		

Data presented as mean±SD. *P* value: Independent sample *t*-test; P_1: Paired sample *t*-test; P_2: ANCOVA

with type 2 diabetes who are discharged from the hospital after general surgery. We found that SBP, DBP, lipid profiles (except for HDL-c and TG levels), eAG, FBS, and HbA1c levels decreased significantly and HDL-c level increased significantly after intervention. However, after controlling baseline data by applying analysis of covariance, there was a significant increase in HDL-c and HbA1c levels between intervention and control groups.

Numerous studies with different designs were performed regarding the most beneficial expected home care results in diabetic patients.[2,4-9] *Han et al.,* in a systematic review and meta-analysis of 686 diabetic patients, showed that home care significantly reduced BP, HbA1c, LDL-c, and TG levels.[9] *Trento et al.,* in the study on 56 diabetic patients, showed improvement only in the HDL-c and HbA1c levels after home care visits.[10] *Ko et al.* reported that a seven-month home care period did not reduce HbA1c levels.[11] On the other hand, *Sadur et al.* reported that home care visits resulted in a decrease in HbA1c levels. This study was a randomized controlled trial among patients with either poor glycemic control (HbA1c >8.5%) or no HbA1c test performed during the previous year. The results of this study revealed a 1.3% decline in HbA1c in the intervention patients versus 0.2% in the controls.[12] Also, *Khodaveisi et al.* showed that home care significantly decreased the FBS, HbA1c, and TG levels.[4] They could not show any significant effect of home care on the cholesterol level, SBP, and DBP. Indeed, the HbA1c level was significantly higher in the intervention group versus the control group (9.25 ± 2.19 vs. 8.30 ± 1.24, respectively).

Recently, some studies have revealed that the stress response to surgery affects lipid profile.[13-15] The activation of the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis are characteristics of the stress response to surgical trauma.[13] Furthermore, a rise in glucocorticoid levels has been proposed to be involved in insulin resistance and lipid abnormalities.[16] In this regard, *He et al.,* in a study on 1,934 patients, showed that TG and LDL-c levels significantly increased after surgery.[13] Therefore, the lack of reduction in TG and LDL-c levels in our study may also be somewhat affected by postoperative stress, and studies with longer follow-up periods should be performed.

However, we could not show a significant beneficial effect of home care on the BP, lipid profile (except for HDL-c), and FBS. On the other hand, the insignificant effects of home care on SBP and DBP may be because, at baseline, BP in both groups was within normal ranges. The small sample size and short follow-up period may be effective in achieving such results. Also, we do not have measures that may have been influenced by the intervention, like the quality of life, cognitive status, and functional level. We, therefore, may have missed other possible positive effects of home care. In general, triple-blind studies with larger sample sizes and extended follow-up periods are needed to achieve more robust results.

Strengths and limitations

This study is a randomized controlled study. Randomization was influential in securing that the intervention and control groups were similar. The strength of the findings is limited by the fact that it is a single-center study, so the results should be generalized with caution. The small sample size is another limitation of our study.

Conclusion

Our study showed improvement in HbA1c and HDL-c levels with home care programs in patients with diabetes who underwent general surgeries. More studies with longer follow-ups are necessarily addressing the effects of home care on other metabolic parameters in these patients.

Acknowledgment

Thanks for the cooperation of the surgical departments of selected Hospitals, which cooperated a lot in building trust between the treatment team and the patient, also thanked the Endocrine and Metabolism Research Center for providing a suitable bed for this research by conducting tests.

Ethical Considerations

The researcher introduce herself and explained the study goals and completed the informed consent form for all participants. Participants were free to leave the study at any stage, and there was no loss and damage for them.

Code of Ethics

This study was approved by the Ethics Committee, affiliated with Isfahan University of Medical Sciences MUi. MED. REC. 1399.092.

Authors' Contributions

Maryam Heidapour(A), Mojtaba Akbari(B), Lila Faridani(C), Arefeh kabirzadeh(D), Parvaneh Abazari(E) A and E .conceived and planned the experiments. A, C and E. carried out the experiments. B. verified the analytical methods. B .C and E. contributed to the interpretation of the results. A,D and E . wrote the manuscript with input from all authors. A and E. conceived the study and were in charge of overall direction and planning.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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