

Original Article

Application of responsibility-based nursing in patients with both DM and PTB

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Abstract: Objective: To evaluate the application value of responsibility-based nursing intervention in the nursing of patients with both diabetes mellitus (DM) and pulmonary tuberculosis (PTB). Methods: A total of 180 patients with both DM and PTB admitted to our hospital from April 2019 to April 2020 were enrolled as research objects, of which 86 patients were under routine nursing intervention as a regular group (Reg group) and other 94 patients were under responsibility-based nursing intervention as a responsibility group (Res group). The unhealthy emotion, treatment compliance, self-efficacy, self-care ability, and life quality of both groups were evaluated after nursing intervention, and they were compared in blood glucose level and PTB treatment outcome. Results: After intervention, the Res group got lower self-rating anxiety scale (SAS) and self-rating depression scale (SDS) scores than the Reg group (both $P < 0.05$). The Res group also got higher scores of self-efficacy, self-care ability, and life quality, and showed significantly higher treatment compliance rate and nursing satisfaction than the Reg group after intervention (all $P < 0.05$). Additionally, after intervention, the Res group got higher scores of life quality than the Reg group (all $P < 0.05$). The levels of fasting blood glucose (FBG), 2 hour postprandial blood glucose (2h PG), and glycosylated hemoglobin (HbA1c) in the Res group were lower than those in the Reg group, and the cavity closure rate, sputum negative conversion rate, and focus absorption rate of the Res group were all significantly higher than those of the Reg group (all $P < 0.05$). Conclusion: Responsibility-based nursing intervention can improve the treatment compliance, self-management ability, self-efficacy, and life quality of patients with both DM and PTB.

Keywords: Responsibility-based nursing, diabetes mellitus, pulmonary tuberculosis, blood glucose

Introduction

As a common metabolic disease with an increasing incidence, diabetes mellitus (DM) poses a serious threat to human life and health [1]. It is estimated that the global prevalence of DM was 9.3% (463 million people) in 2019, and will rise to 10.2% (578 million people) in 2030 and 10.9% (700 million people) in 2045 [2]. Pulmonary tuberculosis (PTB) is an infectious disease resulting from mycobacterium tuberculosis, which is the leading cause of death due to one single infectious disease [3]. In 2016, it disturbed approximate 10.4 million people worldwide [4]. Patients with DM are a high-risk group of PTB, because DM will damage host immunity and result in higher susceptibility to various infectious diseases including PTB [5]. There exists a two-way relationship between DM and PTB in patients with the former. Both of

them influence each other, which accelerates the progress of the diseases and increase the difficulty of clinical management [6]. Therefore, scientific, reasonable and professional nursing care should be carried out at the same time as the clinical treatment of DM complicated with PTB, so as to promote the recovery of patients.

Currently, most of clinical nursing is functional, which focuses on simple nursing on patients against diseases, but neglects or considers less about human integrity, lacks systematic understanding of patients' illness and psychological state, and easily gives rise to unclear responsibilities between doctors and nurses. In recent years, as clinical nursing advances continuously, patients expect higher requirements of nursing quality, so routine nursing intervention mode can no longer meet their nursing needs. Responsibility-based nursing is a new

patient-centered nursing mode, in which one nurse is responsible for the whole process from admission to discharge, and the responsibility-based nursing is carried out without losing basic nursing care in the meantime [7]. According to one study, individual responsibility system is an indispensable good nursing practice, which can effectively improve the nursing quality [8].

In this study, we compared the application value of routine nursing and responsibility-based nursing in the management of patients with DM complicated with PTB, with the goal of finding a scientific and effective management scheme for such patients.

Materials and methods

Research objects

A total of 180 patients with both DM and PTB admitted to Hunan Province Chest Hospital from April 2019 to April 2020 were enrolled as research objects, of which 86 patients were nursed under routine nursing intervention as a regular group (Reg group) and other 94 were nursed under responsibility-based nursing intervention as a responsibility group (Res group). The inclusion criteria of the study: Patients meeting the diagnostic criteria of DM and PTB [9, 10], and those with detail clinical data. The exclusion criteria of the study: Patients with comorbid dysfunction in the heart, liver, kidney, or other important organs, patients who lost the ability of taking care of themselves, patients unable to complete evaluation involved in the study, patients with severe diabetic complications such as diabetic foot, pregnant women, and lactating women. This study was carried out with permission from the Medical Ethics Committee of Hunan Province Chest Hospital and in compliance with the requirements of medical ethics. All participants and their families agreed to participate in the study.

Nursing intervention

Patients in the Reg group were given routine nursing intervention, including basic nursing such as introducing disease-related knowledge to them after their admission and informing them of some adverse reactions and precautions that will occur after medication.

Patients in the Res group were given responsibility-based nursing intervention. Specifically, (1) Health education: On the first day of admission of each patient, nursing staff were arranged to popularize knowledge about DM and PTB to the patient and his families, including etiology, pathogenesis, clinical symptoms, treatment methods, and related precautions, and the staff were also required to answer patients' questions regarding diagnosis and treatment. (2) Psychological nursing: Nursing staff were required to actively and sincerely communicate with patients, understand their psychological state, put themselves in the patients' shoes, and help patients build up confidence in overcoming diseases and adhering to regular treatment. Additionally, the staff were also required to actively communicate with patients' families and ask the families to work with them to help patients improve mood and attitude towards disease treatment. (3) Diet nursing: Nursing staff were arranged to formulate a scientific diet plan for each patient according to his illness and physical condition, so as to strictly control his daily intake of calories and fat and urge the patient to mainly eat foods rich in high-quality protein and high-fiber foods. In addition, the staff were also arranged to emphasize the importance of diet rules to help patients develop good eating habits. (4) Guidance on drug use: There are many kinds of drugs for patients, so it is necessary to inform patients of the drug name, expected curative effect, and side effects after they take the drug. The nursing staff were required to communicate more with patients, grasp the injection time of drugs, strengthen the monitoring of adverse reactions after patients took drugs, and monitor blood glucose of each patient every day. Moreover, the nursing staff were arranged to instruct patients to control their diet and rest, and strengthen the protection against hypoglycemia reaction. Long-term use of drugs against PTB may damage patients' hearing, liver, and kidney functions, so patients who take such drugs should be examined regularly. In case of adverse reactions, the situation should be timely fed back to clinicians. (5) Intervention in exercise: The nursing staff were arranged to develop a scientific and reasonable exercise plan for each patient according to his condition and physical quality, and inform the patient of the relevant preparation before exercise, the essentials of action, and the intensity

of exercise, and strengthen supervision over reactions of the patient after hisr exercise or ask the patient suspend exercise. In case of symptoms such as dyspnea, the amount of exercise should be reduced.

Outcome measures

The levels of fasting blood glucose (FPG), 2 hour postprandial blood glucose (2h PG), and glycosylated hemoglobin (HbA1c) of the two groups before intervention and after 3 months of intervention were determined. After 3 months of treatment and nursing, the treatment outcome of PTB was evaluated. Cavity closure refers to the situation where the diameter of the cavity is shortened by $\geq 50\%$; sputum negative conversion refers the situation where sputum bacterium turns negative for 2 months; focal absorption refers to the situation where the focal absorption area is larger than 30% according to the results of chest X-ray examination.

Before intervention and after 3 months of intervention, the general self-efficacy scale (GSES) and exercise of self-care agency scale (ESCA) were adopted to evaluate the self-efficacy and self-care ability of each patient, respectively [11, 12]. The former has a full score of 40 points and the later has a full score of 172 points. Lower GSES and ESCA scores indicate worse self-efficacy and self-care ability, respectively.

The self-rating anxiety scale (SAS) and self-rating depression scale (SDS) were adopted to evaluate the anxiety and depression of each patient before intervention and after 3 months of intervention, respectively [13, 14]. Both scales have a full score of 100 points, and higher scores indicate more serious anxiety and depression.

After 3 months of intervention, a *Questionnaire on Treatment Compliance* designed by our own hospital was adopted for evaluating the compliance of each patient, which covered reasonable diet, regular exercise, standardized medication, regular outpatient review, regular monitoring of blood pressure and blood glucose, smoking and drinking. With a full score of 0-100 points, the questionnaire indicates non-compliance by a score < 70 points, basic compliance by a score between 70 and 85 points, and com-

pliance by a score > 85 points. The total compliance rate = (the number of patients with general compliance + that with compliance)/total number of patients $\times 100\%$. The Cronbach's α coefficient of this questionnaire was 0.813.

The EORTC Quality of Life Questionnaire (QLQ-C30) was utilized to evaluate the life quality of patients after 3 months of intervention, covering disease control, life behavior, exercise and psychological and emotional changes [15]. Each item has 100 points, and a higher score implies better life quality.

Statistical analyses

The obtained data were statistically processed via SPSS 19.0 and visualized to figures via GraphPad Prism 7. Enumeration data, expressed as [n (%)], were compared by the Chi-square test, and measurement data, expressed as the mean $\pm$ standard deviation ($\bar{x} \pm sd$), were compared between groups via the independent-sample T test, within groups before and after treatment via the paired t test, and among multiple groups using the one-way anova. Additionally, tukey's HSD was used to verify the correctness of the statistical values. $P < 0.05$ suggests a notable difference.

Results

Comparison of general data

There was no significant difference between the two groups with regards to general data such as sex, age, body mass index, course of DM, course of PTB, diet preference, place of residence, drinking history, exercise habits, and marital status (all $P > 0.05$) (**Table 1**).

Comparison of blood glucose control effect

Before intervention, there was no significant difference between the two groups in FBG, 2h PG, and HbA1c (all $P > 0.05$), while after intervention, the levels of them in both groups decreased, and the levels of them in the responsibly group were lower (all $P < 0.05$) (**Figure 1**).

Comparison of treatment outcome of PTB

According to evaluation of the treatment outcome of PTB in the two groups after intervention, the Res group showed higher cavity clo-

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Table 1. Comparison of general data between the two groups ([n (%)], $\bar{x} \pm s$)

Group	Regular group (n=86)	Responsibility group (n=94)	χ^2/t	P-value
Sex			1.477	0.224
Male	53 (61.63)	66 (70.21)		
Female	33 (38.37)	28 (29.79)		
Average age (Y)	55.98 $\pm$ 7.35	56.38 $\pm$ 8.11	0.346	0.730
BMI (kg/m ²)	23.28 $\pm$ 2.56	23.66 $\pm$ 2.38	1.032	0.304
Course of diabetes mellitus (years)	6.59 $\pm$ 3.02	6.15 $\pm$ 3.59	0.886	0.377
Course of pulmonary tuberculosis (years)	2.45 $\pm$ 1.11	2.65 $\pm$ 1.32	1.095	0.275
Dietary favor			0.504	0.478
Light	46 (53.49)	40 (42.55)		
Heavy	40 (46.51)	54 (57.45)		
Place of residence			0.837	0.360
Urban area	52 (60.47)	63 (67.02)		
Rural area	34 (39.53)	31 (32.98)		
Drinking history			0.416	0.519
Yes	37 (43.02)	36 (38.30)		
No	49 (56.98)	58 (61.70)		
Exercise habit			0.196	0.658
Yes	32 (37.21)	38 (40.43)		
No	54 (62.79)	56 (59.57)		
Marital status			0.221	0.639
Married	70 (81.40)	79 (84.04)		
Unmarried	16 (18.60)	15 (15.96)		

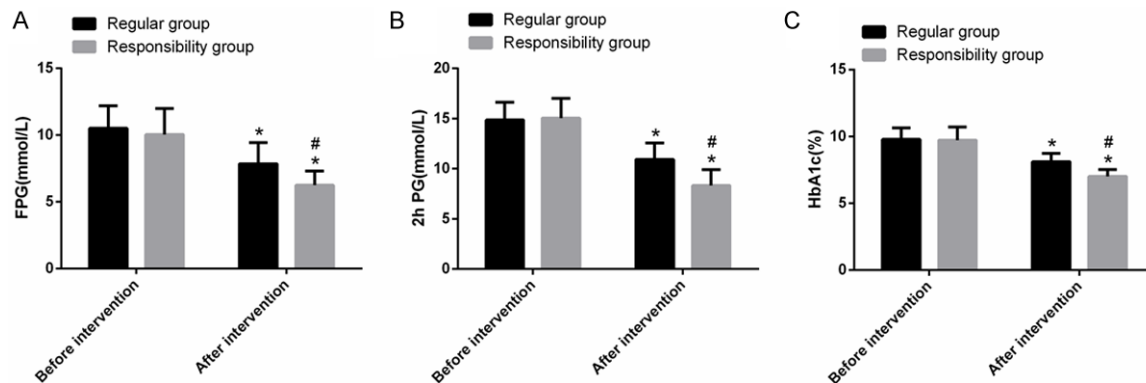


Figure 1. Comparison of blood glucose level. A. Comparison of FBG level between the two groups before and after intervention. B. Comparison of 2 h PG level between the two groups before and after intervention. C. Comparison of HbA1c level between two groups before and after intervention. Notes: * indicates $P < 0.05$ vs. the same group before intervention; # indicates $P < 0.05$ vs. the regular group.

sure rate, sputum negative conversion rate, and focus absorption rate than the Reg group (all $P < 0.05$) (Table 2).

Comparison of adverse emotion scores

Before intervention, the two groups were not greatly different in SAS and SDS scores (both $P > 0.05$), while after it, SAS and SDS scores of

both groups decreased greatly, and the two scores of the Res group were lower (both $P < 0.05$) (Figure 2).

Comparison of GSES and ESCA scores

According to comparison of GSES and ESCA scores between the two groups, before intervention, the scores of the two groups were not

Table 2. Comparison of treatment outcome of PT [n (%)]

Group	Regular group (n=86)	Responsibility group (n=94)	χ^2	P-value
Cavity closure	43 (44.19)	60 (63.83)	6.987	0.008
Sputum negative conversion	48 (55.81)	68 (72.34)	5.353	0.021
Focal absorption	64 (74.42)	84 (89.36)	6.861	0.009

ance rate of the Reg group was only 69.77%, significantly lower than that of the Res group (86.17%) (Table 3).

Comparison of life quality scores

Evaluation of the life quality of patients by QLQ-C30 showed that the scores of disease control, life behavior, exercise and psychological emotion of the Res group were significantly higher than those of the Reg group (all $P < 0.05$) (Table 4).

Comparison of nursing satisfaction

According to evaluation of patients' nursing satisfaction, the Res group showed significantly higher overall nursing satisfaction than the Reg group (92.31% vs. 79.79%, $P < 0.05$). During the evaluation of patients' satisfaction with nursing, many patients in the Reg group indicated that nursing was not in place and they needed hospitals to provide them with more comprehensive, higher-quality, and more professional nursing, while only a few people in the res group gave negative comments on nursing quality (Table 5).

Discussion

DM and PTB are two kinds of diseases that influence each other. On the one hand, patients with DM are prone to PTB because of the disorder of blood glucose and fat metabolism, low immunity and malnutrition caused by insulin secretion deficiency [16, 17]. On the other hand, the use of anti-tuberculosis drugs compromises the metabolic function of insulin and aggravates the glycolipid metabolism disorder [18]. Therefore, during treatment and nursing, their mutual influence should be taken into account, and a relatively scientific plan is

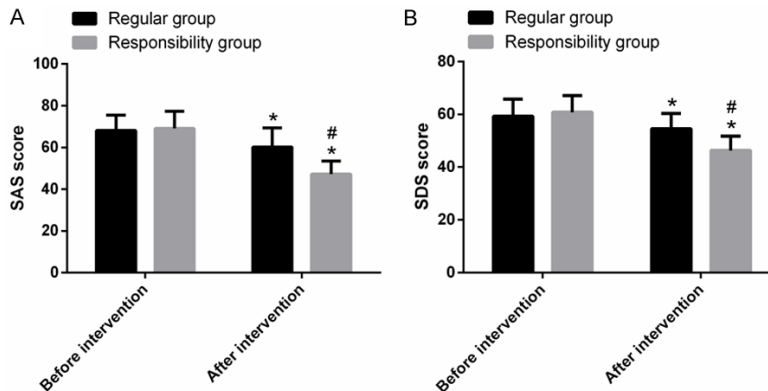


Figure 2. Comparison of SAS and SDS scores. A. Comparison of SAS score between the two groups before and after intervention. B. Comparison of SDS score between the two groups before and after intervention. Notes: * indicates $P < 0.05$ vs. same group before intervention; # indicates $P < 0.05$ vs. the regular group.

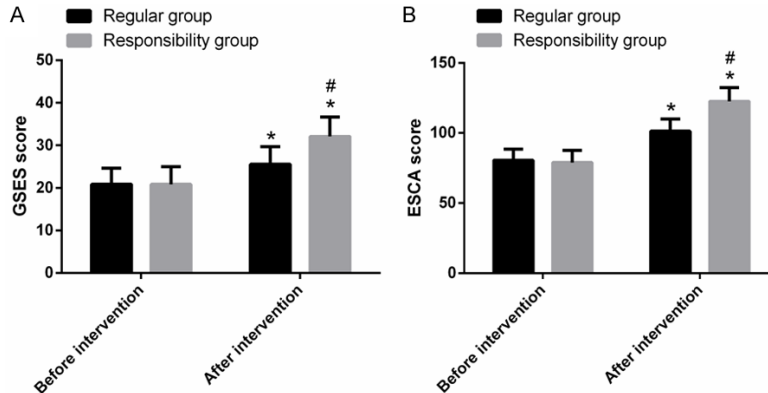


Figure 3. Comparison of GSES and ESCA scores. A. GSES scores of the two groups before and after intervention. B. ESCA scores of the two groups before and after intervention. Notes: * indicates $P < 0.05$ vs. the same group before intervention; # indicates $P < 0.05$ vs. the regular group.

greatly different (both $P > 0.05$), while after intervention, the two scores of both groups increased significantly, and the scores of the responsibly group were higher (both $P < 0.05$) (Figure 3).

Comparison of treatment compliance

According to evaluation of treatment compliance of the two groups, the treatment compli-

patients with DM are prone to PTB because of the disorder of blood glucose and fat metabolism, low immunity and malnutrition caused by insulin secretion deficiency [16, 17]. On the other hand, the use of anti-tuberculosis drugs compromises the metabolic function of insulin and aggravates the glycolipid metabolism disorder [18]. Therefore, during treatment and nursing, their mutual influence should be taken into account, and a relatively scientific plan is

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Table 3. Comparison of patients' treatment compliance [n (%)]

Group	Compliance	General compliance	Non-compliance	Total number of patients with compliance
Regular group (n=86)	22 (25.58)	38 (44.19)	26 (30.23)	60 (69.77)
Responsibility group (n=94)	46 (48.94)	35 (37.23)	13 (13.83)	81 (86.17)
χ^2	-	-	-	7.120
P-value	-	-	-	0.008

Table 4. Comparison of life quality scores between the two groups ($\bar{x} \pm SD$)

Group	Disease control	Life behavior	Exercise	Psychological emotion
Regular group (n=86)	72.56±6.12	75.16±5.82	75.76±7.56	69.63±5.69
Responsibility group (n=94)	80.15±6.77	82.22±5.35	83.87±4.85	79.12±5.02
t	7.864	8.480	8.639	11.887
P-value	<0.001	<0.001	<0.001	<0.001

Table 5. Comparison of nursing satisfaction between the two groups [n (%)]

Group	High satisfaction	Moderate satisfaction	Dissatisfaction	Overall satisfaction
Regular group (n=86)	23 (34.85)	39 (59.09)	14 (21.21)	52 (79.79)
Responsibility group (n=94)	42 (53.85)	30 (38.46)	6 (7.69)	72 (92.31)
χ^2	-	-	-	5.464
P-value	-	-	-	0.019

needed to balance their development and obtain the expected treatment outcome. Previous studies have pointed out that in the management of patients with chronic diseases such as DM and PTB, it is necessary to provide a multi-scientific management plan to meet the diversified needs of patients, so as to help control the disease progression [19-21]. Under responsibility-based nursing, a patient-centered nursing activity, nursing staff put themselves in patients' shoes and meet various needs of patients from various aspects.

DM and PTB are both metabolic diseases, which are complicated and intractable. They need not only long-term medication for control, but also changes of their lifestyles. Patients with the two diseases will suffer psychological pain, anxiety, depression and other unhealthy emotions, which will give rise to a notable decline in their self-efficacy and treatment compliance, challenging disease management and control [22-24]. Therefore, it is necessary to reduce patients' unhealthy emotions and help them build up confidence, so as to enhance their self-efficacy, self-care ability and treatment compliance. In this study, we provided tar-

geted psychological counseling and health education for patients in the Res group to relieve their psychological pressure and help them build up confidence in overcoming diseases. As a result, after intervention, the Res group got significantly lower SAS and SDS scores and significantly higher GSES and ESCA scores and showed significantly higher total compliance rate than the Reg group. The results indicated that responsibility-based nursing can improve patients' treatment compliance, self-management ability and self-efficacy by relieving their negative psychological emotions.

Previous studies have come to the conclusion that development of PTB has a positive relationship with the state of blood glucose control, and good blood glucose control is beneficial to the management of PTB [25, 26]. Therefore, helping patients control their blood glucose balance is the top priority in the management of patients with both DM and PTB. In our study, with the aim of helping patients control blood glucose and slowing down the development of the diseases, targeted nursing was adopted, covering medication guidance and management over diet and exercise, so as to avoid

improper medication dosage and irrational drug use, ensure the rationality of patients' diet and provide nutrition for patients scientifically. In addition, exercise can promote the oxidation and utilization of sugar and increase the sensitivity of insulin [27], thus effectively helping control the blood glucose of patients and further enhancing the treatment outcome of PTB. In this study, after intervention, the Res group showed lower FBG, 2h PG and HbA1c and higher cavity closure rate, sputum negative conversion rate, and focus absorption rate than the Reg group. The results indicated that responsibility-based nursing intervention can effectively help patients with both DM and PTB control blood sugar and improve the treatment outcome of PTB. Furthermore, we evaluated the life quality and nursing satisfaction of the two groups. As expected, the Res group got significantly higher scores of disease control, life behavior, exercise and psychological emotion than the Reg group and also showed higher nursing satisfaction than the Reg group.

This study has some limitations. First, due the short research time, it is impossible to evaluate whether the responsibility-based nursing intervention has longer-term benefits. Second, the number of research objects enrolled in this study is small and they all come from the same hospital, so there may be some deviations in the research results. Finally, this study has not analyzed whether the responsibility-based nursing can reduce the medical burden of patients from the perspective of economics.

To sum up, responsibility-based nursing intervention can improve the treatment compliance, self-management ability, self-efficacy, and life quality of patients with both DM and PTB, and can also help control their blood pressure and progression of PTB more effectively.

Disclosure of conflict of interest

None.

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