Study on the Preventive Effect of Evidence-Based Preventive Nursing on Urinary Tract Infections in Elderly Female Diabetic Patients

Yang Xu

Taizhou Second People's Hospital Affiliated to Yangzhou University, Taizhou 225500, Jiangsu, China

Abstract: *Objective*: To investigate the preventive effect of evidence-based preventive nursing on urinary tract infections (UTIs) in elderly female diabetic patients. *Methods*: Seventy-nine elderly female diabetic patients admitted to our hospital from March 2023 to March 2025 were selected and randomly divided into observation group (40 cases) and control group (39 cases) using the envelope method. The control group received routine nursing, while the observation group received evidence-based preventive nursing. The outcomes were compared between the two groups. *Results*: After treatment, blood glucose levels in both groups were significantly reduced, and the improvement in various indicators in the observation group was better than that in the control group ($P < 0.05$). Additionally, quality of life scores were significantly improved in both groups, with the observation group showing better improvement than the control group ($P < 0.05$). The duration of catheter indwelling and hospital stay in the observation group were lower than those in the control group ($P < 0.05$). *Conclusion*: Evidence-based preventive nursing can systematically reduce the risk of urinary tract infections, improve patient outcomes, and provide effective references for clinical nursing practice.

Keywords: Evidence-based nursing; Urinary tract infection; Diabetes; Elderly women

1. Introduction

With the accelerating process of population aging and the continuous increase in the prevalence of diabetes, the health problems of elderly female diabetic patients have become increasingly prominent. Due to physiological decline, immune dysfunction, and long-term hyperglycemia, these patients are more susceptible to concurrent urinary tract infections, which significantly reduce their quality of life and may lead to severe complications such as pyelonephritis and bacteremia, further increasing the medical burden [1, 2]. However, although the traditional routine nursing model can provide basic medical support, it focuses on symptom observation and basic operations and lacks systematic evaluation and targeted intervention of risk factors for urinary tract infections. Routine nursing is difficult to meet the complex and changing nursing needs of elderly female diabetic patients, especially in terms of blood

glucose management, catheter maintenance, and infection prevention and control [3]. Therefore, this study adopted evidence-based preventive nursing for elderly female diabetic patients admitted to our hospital from March 2023 to March 2025 to explore its intervention effects and provide a basis for clinical treatment selection.

2. Materials and methods

2.1. General information

Seventy-nine elderly female diabetic patients admitted to our hospital from March 2023 to March 2025 were selected and randomly divided into an observation group (40 cases) and a control group (39 cases) using the envelope method. There were no statistically significant differences in basic patient characteristics between the two groups ($P > 0.05$), as shown in **Table 1**. This study is approved by the hospital ethics committee and complied with the relevant ethical principles of the Declaration of Helsinki.

Table 1. Comparison of general data between two groups of patients ($\bar{x} \pm s$ /n)

General data	Observation group (n=40)	Control group (n=39)	t/x^2	P
Age (years)	60–82	60–85	0.301	0.764
	72.41 ± 1.44	72.31 ± 1.51		
Disease course (years)	2–11	2–15	0.444	0.658
	4.56 ± 0.69	4.63 ± 0.71		

2.2. Inclusion and exclusion criteria

2.2.1. Inclusion criteria

(1) Female patients aged 60 years or older.

(2) Clinically confirmed diagnosis of type 2 diabetes mellitus.

(3) Patients and their families have signed informed consent and are willing to participate in the study.

(4) No recent history of urinary system surgery or invasive procedures.

(5) No cognitive dysfunction, able to cooperate with nursing operations and health education.

2.2.2. Exclusion criteria

(1) Complicated with other acute infections or malignant tumors.

(2) Long-term use of immunosuppressants or systemic antibiotics within the past 3 months.

(3) Presence of congenital or acquired abnormalities of urinary tract anatomy.

(4) Participation in other clinical trials that may interfere with the results of this study.

2.3. Methods

2.3.1. Control group

The patients of the control group received routine nursing care. Daily observation of catheter patency and urine characteristics, regular disinfection of the urethral orifice; instructing patients to maintain perineal cleanliness, avoiding catheter traction or twisting; monitoring blood glucose according to medical advice and providing suggestions for a low-sugar diet; routine education on the importance of indwelling catheters and possible complications, helping patients to relieve anxiety.

2.3.2. Observation group

The patients from the observation group received evidence-based preventive nursing care:

(1) Evidence-based risk assessment and multidisciplinary collaboration

    (a) Establish a multidisciplinary nursing team consisting of endocrine nurses, urology nurses, nutritionists, and rehabilitation therapists. Through reviewing patient medical records, laboratory reports (including urinalysis, blood glucose levels, renal function indicators, etc.), and postoperative recovery status, systematically assess the risk level of urinary tract infection, focusing on core factors such as diabetes duration, stability of blood glucose control, duration of catheter indwelling, and bladder residual urine volume.

    (b) For high-risk patients such as those with large blood glucose fluctuations or long-term bedridden status, develop individualized intervention plans, clarify nursing goals and priorities: For example, for patients whose blood glucose is not up to standard (fasting blood glucose > 7.0mmol/L or 2-hour postprandial blood glucose > 10.0mmol/L), prioritize adjusting the hypoglycemic regimen and increase monitoring frequency to 4 times per day, namely before each meal and at bedtime.

(2) Stepwise health intervention and behavior management.

    (a) Implement health education in stages, focusing on standardizing catheter maintenance procedures within the first week of catheter indwelling: Check the fixed position of the catheter during morning nursing, which should be 5–7cm from the urethral orifice. Use the "high lift platform method" to fix the catheter, avoiding traction or twisting; instruct patients to use a sterile cotton ball dipped in 0.5% iodophor solution to disinfect the urethral orifice and surrounding skin in a circular pattern, extending the range to a diameter of 10cm, once in the morning and once in the evening; empty the drainage bag twice a day, including in the morning and before bedtime. Close the drainage tube valve before emptying and wipe the interface with 75% alcohol after emptying.

    (b) Strengthen blood glucose management during the mid-term of 1–2 weeks of indwelling: Collaborate with a nutritionist to design a meal plan (5–6 meals per day, with carbohydrates accounting for 45%–50% of total calories). Recommend low glycemic index foods such as oats, buckwheat, and green leafy vegetables. Simultaneously guide patients to keep a food diary and monitor postprandial blood glucose fluctuations; for patients injecting insulin, use a "rotation injection method" that cycles through the abdomen, outer thigh, and upper arm deltoid muscle, pressing the injection site with a sterile cotton swab for 5 minutes after each injection to avoid subcutaneous bleeding.

    (c) Introduce bladder function training during the later period from 1 week before catheter removal to 2 weeks after catheter removal: Adopt a "progressive catheter clamping method", initially opening the catheter for 10 minutes every 2 hours, gradually extending the clamping time to 4 hours. After catheter removal, guide patients to urinate regularly every 3 hours, adopting a seated and forward-leaning position, pressing the lower abdomen with both hands to assist in urination. After urination, perform a clockwise circular massage on the bladder area with moderate force for 10 circles to promote the discharge of residual urine.

(3) Infection prevention and dynamic monitoring:

    (a) Use an anti-reflux urine collection device, suspending the drainage bag 20cm below the bladder level on the bedrail and replacing it once a week.

    (b) Implement urine acidification intervention: Take 200mg of vitamin C orally daily, divided into two doses after meals, while increasing the intake of acidic foods such as citrus fruits and tomato juice to maintain urine pH between 5.5–6.5.

(c) Establish a urination diary template requiring patients to record each urination volume (using a graduated urinal), color (clear/turbid/bloody), and pain score (0–10). Nurses summarize and analyze the records daily, and immediately send urine samples for culture when the urine volume is less than 100ml per time or the turbidity persists for more than 3 days.

(4) Psychological support and family involvement:

(a) Introduce mindfulness-based stress reduction training, playing a 10-minute guided audio (including abdominal breathing and muscle relaxation techniques) every morning to help patients relieve anxiety.

(b) Organize weekly nursing rounds with family members, demonstrating catheter cleaning, blood glucose meter usage, and other operations, and distribute graphic manuals containing step-by-step illustrations and answers to frequently asked questions.

(c) Establish a patient support group, inviting patients who have recovered well from urinary tract infections to share their experiences, such as dietary adjustments and exercise plans, to enhance treatment confidence. The nursing team holds weekly evidence-based discussion meetings to optimize intervention plans based on the latest guidelines and patient data, ensuring the scientific validity and timeliness of intervention measures.

2.4. Observation indicators

2.4.1. Blood glucose levels

Observe and compare the blood glucose levels, including fasting blood glucose (FBG) and 2-hour postprandial blood glucose (2h PG), of patients in both groups before and after treatment. For fasting blood glucose measurement, patients are required to fast for at least 8 hours. Venous blood samples are collected in the morning and tested using the glucose oxidase method with an automatic biochemical analyzer. For 2-hour postprandial blood glucose measurement, the timer starts when the patient takes the first bite of food. After 2 hours, fingertip blood is collected and tested using a portable blood glucose meter. The instrument needs to be calibrated before operation, and the blood collection site must be properly sterilized.

2.4.2. Quality of life

Observe and compare the Diabetes Specific Quality of Life (DSQL) scale scores of patients in both groups before and after treatment. The scale includes four dimensions: physiological function, psychological and mental state, social relationships, and treatment status. It uses a 5-point scoring system ranging from 1 to 5, with a minimum score of 27 and a maximum score of 135. A higher score indicates a lower quality of life for the patient.

2.4.3. Clinical indicators

Observe and compare clinical indicators, including catheter indwelling time and hospital stay, between the two groups.

2.5. Statistical methods

Statistical analysis is performed using SPSS 21.0 software package. Measurement data are expressed as ($\bar{x} \pm s$), conforming to a normal distribution. Comparisons between groups are made using the t-test. Count data are expressed as relative numbers, and comparisons between groups are performed using the chi-square test. Clinical efficacy is compared using the rank sum test. A P-value < 0.05 is considered statistically significant.

3. Results

3.1. Comparison of blood glucose levels between the two groups

Before treatment, there was no significant difference in blood glucose levels between the two groups ($P > 0.05$). After treatment, blood glucose levels in both groups decreased significantly, and the improvement in various indicators in the observation group was better than that in the control group ($P < 0.05$), as shown in **Table 2**.

Table 2. Comparison of blood glucose levels before and after treatment between two groups (Mean±SD, mmol/L)

Group	Cases (n)	FBG		2h PG	
		Before treatment	After treatment	Before treatment	After treatment
Observation group	40	11.15 ± 1.87	6.29 ± 1.29*	13.08 ± 1.88	8.41 ± 1.63*
Control group	39	11.08 ± 1.94	7.08 ± 1.32*	12.94 ± 2.08	6.44 ± 1.54*
t	-	0.163	2.690	0.314	5.519
P	-	0.871	0.009	0.754	< 0.001

Note: Compared with the same group before treatment, * $P < 0.05$

3.2. Comparison of quality of life levels between the two groups

Before treatment, there was no significant difference in the quality of life levels between the two groups ($P > 0.05$). After treatment, the quality of life scores of both groups decreased significantly, and the improvement in various indicators of the observation group was better than that of the control group ($P < 0.05$), as shown in **Table 3**.

Table 3. Comparison of quality of life scores before and after treatment between two groups (Mean±SD)

Group	Cases (n)	Before treatment	After treatment
Observation group	40	84.15 ± 6.15	41.26 ± 5.84*
Control group	39	83.84 ± 6.20	56.44 ± 6.08*
t	-	0.223	11.319
P	-	0.824	< 0.001

Note: Compared with the same group before treatment, * $P < 0.05$

3.3. Comparison of clinical indicator levels between the two groups

The duration of catheter indwelling and hospital stay in the observation group were lower than those in the control group ($P < 0.05$), as shown in **Table 4**.

Table 4. Comparison of clinical indicators between two groups (Mean±SD, days)

Group	Cases (n)	Catheter indwelling time	Hospital stay
Observation Group	40	4.08 ± 0.44	9.84 ± 1.08
Control Group	39	7.83 ± 0.64	11.93 ± 1.52
t	-	30.414	7.059
P	-	< 0.001	< 0.001

4. Discussion

Urinary tract infection is a common complication among elderly female patients with diabetes, and its high incidence is closely related to multiple pathological mechanisms. Due to shortened urethra, relaxed sphincter muscles, and decreased estrogen levels, elderly women have weakened defense functions of the urethral mucosa, making them susceptible to bacterial invasion. The long-term hyperglycemic state in diabetic patients not only provides a favorable environment for pathogenic bacteria reproduction but also inhibits white blood cell activity and weakens the body's immune response [4]. Additionally, diabetic autonomic neuropathy can lead to bladder emptying disorders and increased residual urine volume, further increasing the risk of infection [5]. Epidemiological studies have shown that the incidence of urinary tract infections among elderly female diabetic patients is approximately 2–3 times higher than that of non-diabetic individuals of the same age group. Moreover, infections are prone to progress to complex urinary tract infections, significantly prolonging hospital stays and increasing medical costs [6].

In this study, the control group received routine nursing care, which focused on basic symptom management and catheter maintenance. Routine nursing care is widely used due to its simplicity, universal applicability, and ability to meet basic clinical needs. However, its limitations cannot be ignored: routine nursing care lacks dynamic assessment of individual risk factors, such as personalized intervention measures targeting blood glucose fluctuations and duration of catheter indwelling. Furthermore, it does not adequately prioritize patient behavior management and multidisciplinary collaboration, resulting in a more passive approach to infection prevention and control [7].

The observation group received evidence-based preventive nursing care, which effectively addresses the shortcomings of traditional models by combining scientific evidence with multidisciplinary collaboration and tiered intervention. The core principle of this method lies in identifying high-risk patients through evidence-based risk assessment and implementing stratified management based on risk levels. For patients with poor glycemic control, glycemic levels are quickly stabilized by adjusting hypoglycemic regimens and increasing monitoring frequency. For patients with indwelling catheters, maintenance procedures and bladder function training are strengthened in stages to reduce mechanical injuries and residual urine retention [8]. Additionally, the introduction of urine acidification interventions, anti-reflux devices, and dynamic monitoring mechanisms reduces the risk of bacterial colonization and retrograde infection from the source [9].

In this study, the observation group showed significant improvement in blood glucose levels compared to the control group, with fasting blood glucose and 2-hour postprandial blood glucose levels decreasing to 6.29 ± 1.29 mmol/L and 8.41 ± 1.63 mmol/L, respectively. This provided a critical physiological foundation for the prevention of urinary tract infections. Simultaneously, the duration of catheter indwelling (4.08 ± 0.44 days) and hospital stay (9.84 ± 1.08 days) were significantly reduced in the observation group, indicating that systematic nursing interventions can accelerate the patient's recovery process.

It is worth noting that the success of the observation group's nursing program is attributed to the synergistic effect of multi-dimensional interventions. Tiered health management implements catheter maintenance, glycemic control, and bladder training in stages, avoiding information overload while ensuring the continuity of intervention measures. Dynamic monitoring and multidisciplinary collaboration ensure timely optimization of nursing strategies, such as rapid identification of abnormal urine volume or turbidity through urination diaries and early intervention for potential infections. The scientific and forward-looking nature of these various measures provides practical support for reducing the incidence of urinary tract infections.

5. Conclusion

In summary, evidence-based preventive nursing care effectively reduces the incidence of urinary tract infections among elderly female diabetic patients through comprehensive interventions in multiple aspects. It improves patients' treatment outcomes and quality of life, demonstrating significant clinical value for promotion.

Disclosure statement

The author declares no conflict of interest.

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