

Regulation of Hemodynamic Stability in Urological Stone Patients During General Anesthesia Recovery Period Through Thermal Insulation Nursing Based on Temperature Intervention

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Abstract: *Objective:* This study primarily analyzes the effectiveness of thermal insulation nursing (empowered by temperature intervention) in urological stone patients during the general anesthesia recovery period. *Methods:* A total of 76 urological stone patients who underwent surgical treatment as the preferred option were selected as the research subjects. The earliest consultation time was May 2024, and the latest was May 2025. The patients were randomly divided into two groups using the random number table method, namely the observation group and the control group, with 38 patients in each group. The intervention indicators of the patients were compared. *Results:* The overall satisfaction rate in the observation group was higher than that in the control group, and the incidence of adverse reactions was lower, with $p < 0.05$. At 0.5 hours, 1 hour after surgery, and at the end of surgery, the body temperature in the observation group was significantly different from that in the control group, with $p < 0.05$. Postoperatively, various hemodynamic indicators in the observation group were significantly different from those in the control group, with $p < 0.05$. The time to clench the first upon verbal command, the time to open the eyes upon verbal command, the extubating time, and the recovery retention time in the observation group were all shorter than those in the control group, with $p < 0.05$. Postoperative stress indicators and agitation scores at different time points in the observation group were significantly different from those in the control group, with $p < 0.05$. *Conclusion:* For urological stone patients during the general anesthesia recovery period, actively implementing thermal insulation nursing combined with temperature intervention not only enhances hemodynamic stability but also effectively reduces the risk of adverse reactions such as hypothermia and shivering. It optimizes the recovery condition, significantly improves the stress state, and increases nursing satisfaction.

Keywords: Thermal insulation nursing; Temperature intervention; Urological stones; General anesthesia recovery period; Hemodynamics; Stability

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1. Introduction

In recent years, due to the accelerated development of modern medical technologies, the methods of anesthesia for surgical treatment have become more diverse, and the application of general anesthesia protocols has yielded relatively promising results. General anesthesia enables the body to absorb drugs intravenously, effectively suppressing the human nervous system. Additionally, after surgery, patients' respiratory and skeletal muscles are more relaxed, which facilitates the smooth conduct of operations. However, for patients undergoing surgical treatment, hypothermia refers to a body temperature below 36°C throughout the perioperative period. Particularly during the recovery phase from general anesthesia, the causes of hypothermia in patients are attributed to surgical and anesthetic factors and are also considered a common complication during the peri-anesthesia period ^[1]. The presence of hypothermia can induce numerous complications, making it difficult to ensure adequate oxygen supply to tissues, while also suppressing coagulation and immune functions, which is highly detrimental to optimizing prognostic outcomes. Therefore, after patients are transferred to the anesthesia recovery room post-surgery, it is essential to closely monitor their vital signs and actively implement thermal insulation nursing measures to accelerate the recovery of their vital signs, reduce the occurrence of postoperative adverse reactions, and thereby achieve the goal of optimizing prognosis ^[2].

The following study selects patients with urinary stones during the general anesthesia recovery period as the research subjects to systematically explore the effects of temperature intervention-enabled thermal insulation nursing.

2. Materials and methods

2.1. Baseline data

The study included 76 patients with urinary stones who underwent general anesthesia surgery at the hospital as the primary subjects. The diagnosis and treatment periods spanned from May 2024 to May 2025. The patients were randomly divided into two groups using a random number table method, namely the observation group (38 cases) and the control group (38 cases). Comparing the data between the two groups indicated a *p*-value > 0.05, suggesting significant comparability.

2.1.1. Control group

22 males and 16 females, with the oldest patient aged 76 and the youngest aged 57, averaging (64.86 ± 4.54) years.

2.1.2. Observation group

The male-to-female ratio was 23:15, with ages ranging from 55 to 79 years and a median age of (64.82 ± 4.60) years.

2.2. Methodology

In the control group, patients received routine care, while in the observation group, patients underwent thermal insulation nursing based on temperature intervention, as follows:

2.2.1. Preoperative phase

Prior to surgery, nursing staff should closely observe the patient's condition and physical status. If the patient

exhibits signs of restlessness or anxiety, targeted psychological counseling should be provided, and the patient's concerns should be addressed through gentle communication. Additionally, patients should be thoroughly informed about the surgical procedure, the characteristics and safety of general anesthesia, and the treatment plan to alleviate their anxiety and fear regarding the surgery. Patients should be instructed to fast for 12 hours and abstain from water for 8 hours before surgery to prevent aspiration or vomiting during the procedure.

2.2.2. Intraoperative phase

During the surgical procedure, it is essential to establish intravenous access, with nursing staff assisting the surgeon in performing relevant anesthesia procedures and helping the patient maintain a proper position. This not only ensures patient comfort during the surgery but also provides the surgeon with a clear surgical field. Furthermore, surgical supplies should be prepared in advance to ensure coordination with the surgeon and minimize the patient's exposure to cold environments. Infusion bags required for the surgery should be processed using a liquid warming device to maintain a temperature of approximately 38°C, closely matching the normal body temperature.

2.2.3. Postoperative phase

After surgery, patients should be transferred to the post-anesthesia care unit, where nursing staff should cover the patient's body with a constant-temperature blanket set at approximately 37°C to provide continuous warmth and maintain body temperature stability. The infusion fluids required for postoperative patients should be warmed, and the temperature should be maintained at around 38°C to prevent the effects of low temperature on the body. Close monitoring of the patient's vital signs is essential, and targeted interventions should be promptly implemented if any abnormal temperature changes occur.

2.3. Evaluation indicators

- (1) Compare patient satisfaction with nursing care and the incidence of adverse reactions.
- (2) Assess intergroup differences in body temperature changes at various time points, hemodynamic indicators, postoperative recovery time, stress indicators before and after surgery, and agitation scores at different time points using a systematic evaluation approach.

2.4. Statistical analysis

2.4.1. Data processing

SPSS 21.0 statistical software was used in this study to perform statistical analysis

2.4.2. Data description

Count data were presented as (n%), and measurement data as ($\bar{x} \pm s$)

2.4.3. Difference testing

Count data were tested using χ^2 , and measurement data using t , and the criteria for determining statistical significance was set as $p < 0.05$.

3. Results

3.1. Research on nursing satisfaction in the observation group and the control group

The overall satisfaction rate in the observation group was higher than that in the control group, with $p < 0.05$, details in **Table 1**.

Table 1. Comparison of nursing satisfaction between the two groups (n/%)

Group	n	Highly satisfied	Satisfied	Dissatisfied	Total satisfaction
Observation	38	23	14	1	37 (97.37)
Control	38	20	10	8	30 (78.95)
χ^2					6.1758
p					0.0129

3.2. Comparison of body temperature changes at different time points between the two groups

There was no significant difference in body temperature between the groups before surgery. For instance, $p > 0.05$. At 0.5 hours, 1 hour after the start of surgery, and at the end of surgery, the body temperature in the observation group was higher than that in the control group, with $p < 0.05$, details show in **Table 2**.

Table 2. Analysis of body temperature changes at different time points in the observation group and the control group ($\bar{x} \pm s$)

Group	n	Preoperative (°C)	0.5 h after surgery start (°C)	1 h after surgery start (°C)	End of surgery (°C)
Observation	38	36.23 $\pm$ 0.46	36.75 $\pm$ 0.32	36.79 $\pm$ 0.42	36.57 $\pm$ 0.26
Control	38	36.21 $\pm$ 0.44	35.24 $\pm$ 0.23	35.66 $\pm$ 0.35	35.98 $\pm$ 0.62
t -value		0.1937	23.6202	12.7411	5.4097
p -value		0.8470	0.0000	0.0000	0.0000

3.3. Comparison of hemodynamic indicators at different time points between the observation group and the control group

After surgery, the SBP, DBP, and HR between the groups were compared, with $p < 0.05$, details show in **Table 3**.

Table 3. Study on hemodynamic indicators at different time points between the two groups ($\bar{x} \pm s$)

Group	n	SBP (mmHg)		DBP (mmHg)		HR (mmHg)	
		Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative
Observation	38	133.95 $\pm$ 10.52	132.09 $\pm$ 8.13	80.52 $\pm$ 9.04	85.57 $\pm$ 8.13	70.55 $\pm$ 8.17	75.09 $\pm$ 5.13
Control	38	133.99 $\pm$ 10.47	152.36 $\pm$ 8.44	80.57 $\pm$ 9.08	96.64 $\pm$ 8.25	70.51 $\pm$ 8.13	80.42 $\pm$ 6.58
t -value		0.0166	10.6626	0.0241	5.8915	0.0214	3.9380
p -value		0.9868	0.0000	0.9809	0.0000	0.9830	0.0002

3.4. Analysis of postoperative recovery time in the two groups

Compared with the control group, all indicators in the observation group showed $p < 0.05$, details show in **Table 4**.

Table 4. Comparison of postoperative recovery time between the observation group and the control group ($\bar{x} \pm s$)

Group	n	Fist response to call (min)	Eye opening response to call (min)	Extubation time (min)	Recovery room stay time (min)
Observation	38	10.95 $\pm$ 3.21	15.84 $\pm$ 1.45	23.21 $\pm$ 2.14	55.28 $\pm$ 4.35
Control	38	15.02 $\pm$ 4.41	20.51 $\pm$ 2.26	34.12 $\pm$ 2.68	69.62 $\pm$ 5.22
<i>t</i> -value		4.5997	10.7211	19.6099	13.0094
<i>p</i> -value		0.0000	0.0000	0.0000	0.0000

3.5. Research on stress indicators before and after nursing in the observation group and the control group

Before surgery, there were no differences in indicators between the groups, with $p > 0.05$; After surgery, the stress indicators in the observation group were compared with those in the control group, with $p < 0.05$, details show in **Table 5**.

Table 5. Comparison of changes in stress indicators between the two groups ($\bar{x} \pm s$)

Group	n	AD (pmol/mL)		NE (pmol/mL)		CRP (ng/L)	
		Pre-operative	Post-operative	Pre-operative	Post-operative	Pre-operative	Post-operative
Observation	38	51.88 $\pm$ 4.55	110.77 $\pm$ 7.99	142.75 $\pm$ 7.04	151.22 $\pm$ 9.84	7.06 $\pm$ 1.12	46.58 $\pm$ 4.22
Control	38	51.84 $\pm$ 4.51	156.65 $\pm$ 8.08	142.79 $\pm$ 6.84	175.35 $\pm$ 7.77	7.09 $\pm$ 1.14	59.14 $\pm$ 5.17
<i>t</i> -value		0.0385	24.8890	0.0251	11.8638	0.1157	11.6016
<i>p</i> -value		0.9694	0.0000	0.9800	0.0000	0.9082	0.0000

3.6. Comparison of agitation scores between the two groups at different time points

The agitation scores of the observation group at 3 minutes, 5 minutes, 10 minutes, and 15 minutes postoperatively were all lower than those of the control group, with $p < 0.05$, refer **Table 6**.

Table 6. Analysis of agitation scores in the observation and control groups at different time points ($\bar{x} \pm s$)

Group	n	3-min Score (points)	5-min Score (points)	10-min Score (points)	15-min Score (points)
Observation	38	2.33 $\pm$ 0.31	6.68 $\pm$ 1.14	5.06 $\pm$ 0.43	3.14 $\pm$ 0.24
Control	38	4.26 $\pm$ 0.21	13.05 $\pm$ 1.15	9.95 $\pm$ 0.21	6.92 $\pm$ 0.33
<i>t</i> -value		31.7742	24.2497	62.9916	57.1053
<i>p</i> -value		0.0000	0.0000	0.0000	0.0000

3.7. Comparison of adverse reactions between the two groups

When comparing the adverse reactions between the two groups, $p < 0.05$, refer **Table 7**.

Table 7. Study on adverse reactions in the observation and control groups (n/%)

Group	n	AD (pmol/mL)			
		Hypothermia	Mild	Moderate	Severe
Observation	38	1 (2.63)	1 (2.63)	1 (2.63)	0 (0.00)
Control	38	7 (18.42)	4 (10.53)	4 (10.53)	3 (7.89)
χ^2		5.0294		7.5165	
p		0.0249		0.0061	

4. Discussion

It is widely acknowledged that urinary stones, as a common type of urinary system disease, carry a high risk of incidence and can significantly impact the quality of life of affected individuals ^[3]. In the clinical treatment of patients with urinary stones, surgical intervention is the preferred method. With the rapid advancement of medical technology, the importance of drug anesthesia in diagnostic and therapeutic procedures has gradually become prominent, particularly general anesthesia, which temporarily suppresses the central nervous system, leading to loss of consciousness and pain sensation, and is widely recognized in clinical practice. However, the recovery period from general anesthesia is relatively complex and critical, during which patients experience certain physiological changes. Therefore, it is crucial to ensure that their hemodynamic indicators remain stable during this stage. The reason is that excessive fluctuations in human hemodynamics can slow down the postoperative recovery of patients, prolong their hospital stay, and even expose them to a higher risk of complications such as hypertension, hypotension, arrhythmia and more, directly threatening their life and health.

During the recovery period from general anesthesia, hypothermia is a common issue that can significantly affect patients' physiological functions and cause substantial fluctuations in their hemodynamic indicators ^[4]. Under such circumstances, patients' blood vessels constrict, and peripheral vascular resistance significantly increases, leading to elevated blood pressure levels. Meanwhile, patients' cardiac electrophysiological activities are also affected, exposing them to a higher risk of arrhythmia ^[5]. Therefore, it is essential to implement necessary thermal insulation nursing measures for patients with urinary stones during the recovery period from general anesthesia.

In clinical practice, integrating temperature intervention measures into thermal insulation nursing can effectively inhibit heat loss and facilitate the body's own heat production in patients, enabling them to maintain a normal body temperature throughout the perioperative period. During surgical treatment, the human body gradually loses heat due to factors such as radiation, conduction, evaporation, and convection. Based on thermal insulation nursing, the use of heated blankets and insulating blankets can reduce heat loss caused by radiation and convection ^[6]. During the implementation of thermal insulation nursing, the risk of pathological physiological reactions caused by low body temperature in patients is significantly reduced, preventing excessive vasoconstriction ^[7].

According to the comparison results of data indicators, after temperature intervention was applied to enhance thermal insulation nursing, various clinical indicators of patients were superior to those of the control group, with $p < 0.05$. This indicates that the rational use of thermal insulation nursing can improve the hemodynamic stability of patients with urinary stones during the general anesthesia recovery period, enabling them to awaken within a short period and facilitating the improvement of their stress state, thereby reducing the risk of hypothermia events. The reason for this is that this nursing model is innovative and can compensate for the deficiencies of traditional

nursing. It employs highly targeted nursing measures based on various factors contributing to hypothermia. Through the heating treatment of infused liquids and the use of thermal insulation blankets, it maintains the stability of vital signs in patients during the general anesthesia recovery period, which is more conducive to accelerating their recovery.

5. Conclusion

Overall, applying temperature intervention to enhance thermal insulation nursing for patients with urinary stones during the general anesthesia recovery period can further improve their stress state during the recovery period, ensure the stability of their hemodynamic indicators, effectively prevent adverse reactions such as hypothermia, and facilitate their early postoperative awakening.

Disclosure statement

The author declares no conflict of interest.

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