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The Effect of Body Temperature Flush Solution on Patients Undergoing Holmium Laser Lithotripsy via Ureteroscopy

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Abstract: *Objective:* To investigate the effect of isothermal flushing solution on the body temperature of patients undergoing holmium laser lithotripsy under ureteroscopy. *Method:* Thirty patients who underwent ureteroscopic holmium laser lithotripsy in our hospital from August 2024 to August 2025 were selected as the study subjects. They were randomly divided into an observation group and a control group using a random number table method, with 15 patients in each group. Among them, the observation group patients received intraoperative infusion of isothermal flushing solution, while the control group patients received intraoperative infusion of flushing solution at room temperature. Compare and analyze the changes in vital signs before and after surgery, temperature levels at different time points during surgery, and incidence of adverse reactions during the perioperative period between two groups of patients. *Result:* The postoperative central body temperature, mean arterial pressure, and heart rate of the observation group were significantly better than those of the control group ($p < 0.05$); The body temperature of observation groups T1, T2, and T3 was better than that of the control group; The incidence of adverse reactions was significantly lower than that of the control group ($p < 0.05$). *Conclusion:* The application of isothermal flushing solution in ureteroscopic holmium laser lithotripsy can improve the safety of the surgery, maintain the patient's body temperature during the operation, effectively reduce the occurrence of adverse reactions, and promote patient recovery.

Keywords: Body temperature flushing solution; Holmium laser lithotripsy under ureteroscopy; Body temperature

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1. Introduction

Holmium laser lithotripsy under ureteroscopy has become one of the mainstream surgical methods for treating ureteral stones due to its advantages of minimal trauma and precise efficacy. Continuous infusion of flushing solution during surgery can not only ensure clear surgical field of view, but also reduce the difficulty of removing debris. However, under the influence of long-term and large infusion of flushing solution at room temperature, the fluctuation of the patient's core body temperature is significant, and hypothermia related

complications are prone to occur [1].

At present, clinical research on how to maintain intraoperative body temperature stability by optimizing flushing fluid parameters is increasingly focused on, and the advantages of temperature flushing fluid are gradually becoming prominent. This article mainly explores the effect of isothermal flushing solution on the body temperature of patients undergoing holmium laser lithotripsy under ureteroscopy.

2. Data and methods

2.1. General Information

This experiment included a total of 30 patients who underwent holmium laser lithotripsy under ureteroscopy. Random number table method was used for group allocation, with a total of 15 patients participating in the control group, including 9 males/6 females; The average age is (45.21 ± 6.88) years old; For the average diameter of stones, this group had a diameter of (1.35 ± 0.41) cm; an additional 15 cases were included in the observation group, with 10 males/5 females; The average age is (46.13 ± 7.25) years old; The average diameter of the stones in this group was (1.38 ± 0.43) cm. There was no statistically significant difference in the above information between the two groups of patients ($p > 0.05$).

2.1.1. Inclusion criteria

(1) Diagnosed with ureteral calculi through imaging examination, meeting the indications for holmium laser lithotripsy under ureteroscopy
(2) ASA classification I-II
(3) The body has no severe infection or other serious illness
(4) The patients and their families are aware of the experimental procedures, objectives, etc. and express their willingness to cooperate

2.1.2. Exclusion criteria

(1) Within the range of severe cardiovascular and cerebrovascular diseases
(2) Abnormal coagulation function
(3) Patients with preoperative fever or abnormal body temperature
(4) People who are allergic to the components of the flushing solution

2.2. Method

In the intervention process for both groups of patients, tracheal intubation anesthesia was taken as the primary step, and the surgical operation was performed by the same group of medical staff. Ureteroscopy, holmium laser equipment, and surgical procedures were all the same.

The control group used room temperature flushing solution (22–25 ℃) for intraoperative perfusion, controlling the perfusion pressure. The pressure perfusion pump was used as the main tool to ensure that the index value was between 80–120mmHg, and the perfusion speed was adjusted according to the clarity of the surgical field of view. The observation group used isothermal flushing solution for intraoperative perfusion, and the flushing solution was preheated to 37 ℃ by a constant temperature heater, which was consistent with the core body temperature of the human body. The parameters such as perfusion pressure and speed were not different from those of the control group.

2.3. Observation indicators

2.3.1. Vital signs indicators

Select 10 minutes before and 10 minutes after surgery as monitoring and judgment time points, and compare the two groups based on accurate understanding of central body temperature, mean arterial pressure, and heart rate.

2.3.2. Intraoperative body temperature

Record the central body temperature of two groups of patients 10 minutes before surgery (T0), 30 minutes after surgery (T1), 60 minutes after surgery (T2), and at the end of surgery (T3).

2.3.3. Perioperative adverse reactions

Observe and record how many patients in each group experienced chills, nausea, vomiting, and worsening incision pain within 1 day after surgery, and use the total incidence rate as an important comparative indicator.

2.4. Statistical processing

SPSS 24.0 software was used to process the data. Count data was expressed as the number of cases (%) and subjected to a chi square test. Metric data was expressed as mean ± standard deviation ($\bar{x} \pm s$) and subjected to a *t*-test. $p < 0.05$ was considered statistically significant.

3. Results

3.1. Comparison of vital signs indicators between two groups of patients

The vital signs of the observation group were more stable than those of the control group 10 minutes after surgery ($p < 0.05$), as shown in **Table 1**.

Table 1. Comparison of vital signs indicators between two groups of patients ($\bar{x} \pm s$)

Group	Count down	Central body temperature (℃)		Heart rate (Time/Min)		Mean arterial pressure (mmHg)	
		Pre-operative 10 min	Post-operative 10 min	Pre-operative 10 min	Post-operative 10 min	Pre-operative 10 min	Post-operative 10 min
Control group	15	36.71 ± 0.40	35.77 ± 0.32	73.11 ± 4.87	82.45 ± 5.59	84.90 ± 5.84	95.66 ± 6.21
Observation group	15	36.80 ± 0.36	36.69 ± 0.27	72.59 ± 5.34	75.17 ± 4.98	85.23 ± 6.12	87.04 ± 5.74
t-value		0.648	11.285	0.279	3.766	0.151	3.948
p-value		0.522	0.000	0.783	0.001	0.881	0.000

3.2. Comparison of body temperature between two groups of patients at different time points during surgery

The body temperature of observation groups T1, T2, and T3 was better than that of the control group ($p < 0.05$), as shown in **Table 2**.

Table 2. Comparison of body temperature between two groups of patients at different time points during surgery (℃, $\bar{x} \pm s$)

Group	Countdown	T0	T1	T2	T3
Control group	15	36.72 ± 0.37	36.21 ± 0.30	35.89 ± 0.33	35.80 ± 0.32
Observation group	15	36.88 ± 0.32	36.71 ± 0.27	36.70 ± 0.22	36.59 ± 0.24
t-value		1.267	4.798	7.910	7.649
p-value		0.216	0.000	0.000	0.000

3.3. Comparison of perioperative adverse reaction rates between two groups of patients

In the comparison of the total incidence of adverse reactions, the observation group had a lower value ($p < 0.05$), as shown in **Table 3**.

Table 3. Comparison of perioperative adverse reaction rates between two groups of patients [n (%)]

Group	Countdown	Shiver	Nausea and vomiting	Increased incision pain	Overall incidence rate
Control group	15	3	2	1	6 (40.00)
Observation group	15	0	1	0	1 (6.67)
χ^2-value					4.658
p-value					0.031

4. Discussions

Under ureteroscopy, holmium laser lithotripsy relies on continuous irrigation of flushing fluid to achieve clear surgical field and stone removal. However, the temperature difference between the flushing fluid and the body can easily cause heat exchange, leading to a decrease in core body temperature. The incidence of hypothermia is relatively high in this surgical procedure, mainly due to the flushing fluid taking away body heat, anesthesia inhibiting the thermoregulatory center, and closely related to surgical exposure. Low body temperature can activate the body's stress response, causing changes in heart rate and blood pressure in a stable state. It may also have an impact on immune function, which is not conducive to early postoperative recovery for patients [2]. Therefore, how to effectively maintain the intraoperative body temperature of patients undergoing ureteroscopic holmium laser lithotripsy is of great concern in clinical practice. The core of body temperature flushing solution refers to flushing products with a temperature that is consistent with the normal body temperature (about 37 ℃) to avoid stimulating sensitive parts of the body due to temperature differences. In ureteroscopic holmium laser lithotripsy, low-temperature flushing solution has a certain impact on the mucosal epithelial cells of patients, and the incidence of postoperative inflammatory reactions is relatively high. Waiting for the body temperature flushing solution to be consistent with the physiological environment of the mucosa can minimize irritation to the mucosa as much as possible.

The results of this study showed that the central body temperature of the observation group was (36.69 ± 0.27) ℃, the average arterial pressure was (87.04 ± 5.74) mmHg, and the heart rate was (75.17 ± 4.98) beats/min 10 minutes after surgery, all of which were better than the control group ($p < 0.05$). Moreover, the body

temperatures of T1, T2, and T3 were more stable than those of the control group ($p < 0.05$), indicating that equal temperature flushing solution can effectively reduce intraoperative heat loss, maintain stable core body temperature, and avoid significant impact on the circulatory system. Analysis of the reasons: The isothermal flushing solution is consistent with the core body temperature of the human body, which can avoid the "cold dilution" effect caused by continuous infusion of room temperature flushing solution, and is conducive to improving the imbalance between heat production and heat dissipation in the body thus achieving the goal of maintaining a steady body temperature [3].

Compared with the 40.00% incidence of adverse reactions in the control group, 6.67% in the observation group was in a more ideal state ($p < 0.05$), further confirming the clinical advantages of isothermal flushing solution. The reason is that when the patient's body temperature is in a stable state, the level of stress in the body gradually decreases, which increases the incidence of stress reactions such as chills, nausea, and vomiting. At the same time, avoiding the impact of low body temperature on local blood circulation at the incision site is of certain value for the patient's early postoperative recovery.

5. Conclusion

In summary, among patients undergoing ureteroscopic holmium laser lithotripsy, the use of isothermal flushing solution has significant advantages and is one of the measures to maintain stable vital signs, avoid significant temperature drops at different time points during surgery, and reduce the possibility of symptoms such as chills, nausea, and vomiting. It is worth promoting and applying.

Disclosure statement

The author declares no conflict of interest.

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