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Research on the Effect of Operating Room Nursing on Perioperative Body Temperature Protection of Patients and the Improvement Methods

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Abstract: *Objective*: To investigate the application effect of comprehensive thermoprotective nursing strategies in preventing unplanned hypothermia in surgical patients during the perioperative period, and to analyze the weak links and improvement directions in the temperature management process. *Methods*: A total of 286 patients undergoing elective surgery in a tertiary grade A hospital from January 2024 to June 2025 were selected and randomly divided into an observation group and a control group, with 143 cases in each group. The control group received routine temperature care, while the observation group carried out comprehensive measures such as preoperative risk assessment and pre-insulation, intraoperative active insulation and dynamic monitoring, and postoperative continuous insulation on this basis. Core body temperature changes, incidence of hypothermia, incidence of shivering, intraoperative blood loss, postoperative recovery time, and incidence of surgical site infection were compared between the two groups. *Results*: The results showed that the core body temperature of the observation group was higher than that of the control group at 30 minutes, 60 minutes after the start of the operation, at the end of the operation and when entering the recovery room. The incidence of perioperative hypothermia and postoperative chills was significantly lower than that of the control group. The incidence of intraoperative blood loss, postoperative recovery time and surgical site infection was better than that of the control group, and the differences were statistically significant. *Conclusion*: Comprehensive body temperature protection nursing measures can effectively maintain stable body temperature during the perioperative period, reduce the occurrence of hypothermia and hypotheria-related complications, promote postoperative recovery of patients, and provide a reference for the optimization of the operating room body temperature management process.

Keywords: Operating room nursing; Perioperative period; Hypothermia; Body temperature protection; Insulation strategies

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1. Introduction

Unplanned hypothermia during the perioperative period refers to an abnormal state where a patient's core

body temperature is below 36 ℃ during surgery. It is a common perioperative complication and has a higher incidence in the absence of effective preventive measures. It can lead to adverse outcomes such as coagulation dysfunction, increased risk of surgical site infection, increased cardiovascular adverse events, and delayed anesthesia recovery. It is associated with a variety of factors such as anesthesia inhibition of body temperature regulation, low-temperature exposure in the surgical environment, open body cavity for heat dissipation, and cold fluid infusion. As the concept of enhanced recovery after surgery progresses, body temperature management has shifted from passive heat preservation to a systematic protection model covering the entire process before, during and after surgery. Evidence-based studies have shown that the bundled heat preservation strategy can reduce the incidence of hypothermia and improve the effectiveness of nursing execution. However, there are still problems such as inaccurate risk assessment, inadequate implementation of insulation measures, and incomplete collaboration mechanisms in clinical practice. Therefore, a more standardized management plan needs to be established. This study uses a randomized controlled trial to evaluate the application effect of the comprehensive body temperature protection nursing strategy, providing a basis for optimizing the body temperature management process in the operating room [1].

2. Data and methods

2.1. General information

Patients who underwent elective surgery in the operating room of a tertiary grade A hospital from January 2024 to June 2025 were selected as the study subjects.

2.1.1. Inclusion criteria

(1) Age 18 to 75 years;
(2) American Society of Anesthesiologists Class I to III;
(3) Undergoing elective surgery under general anesthesia or intraspinal anesthesia with an estimated operation time of ≥ 60 minutes;
(4) Patients' informed consent and voluntary participation in this study.

2.1.2. Exclusion criteria

(1) Those with preoperative fever (body temperature ≥ 38.0 ℃) or preoperative core body temperature < 36.0 ℃;
(2) Preoperative hyperthyroidism or hypothyroidism, adrenal cortical insufficiency or other systemic diseases that affect body temperature regulation;
(3) Patients undergoing emergency surgery or day surgery;
(4) Those who need cardiopulmonary bypass during the operation;
(5) Pregnant patients.

2.1.3. Study design

A total of 286 patients who met the criteria were included and randomly divided into the observation group and the control group using the random number table method, with 143 cases in each group. There were no statistically significant differences ($p > 0.05$) between the two groups in terms of general information such as gender, age, body mass index, anesthesia method, type of surgery and duration of surgery, and they were

comparable. **Table 1** shows the comparison of general data between the two groups [2].

Table 1. Comparison of general data of the two groups of patients

Items	Gender (male/ female)	Age (years, $\overline{x} \pm s$)	Body mass index (kg/m^2, $\overline{x} \pm s$)	Anesthesia method (general anesthesia/ intraspinal anesthesia)	Surgical type (Abdominal surgery/ orthopedic surgery/ others)	Operation duration (min, $\overline{x} \pm s$)
Observation group (n = 143)	78/65	52.36 ± 12.48	23.82 ± 3.15	96/47	64/51/28	118.46 ± 35.27
Control group (n = 143)	82/61	53.17 ± 11.92	23.56 ± 3.28	101/42	68/48/27	121.38 ± 33.96
t value	0.253	0.568	0.692	0.488	0.286	0.719
p value	0.615	0.571	0.489	0.485	0.867	0.473

2.2. Methods

2.2.1. Nursing measures for the control group

The control group received routine operating room temperature care measures. After entering the operating room, patients were covered with conventional quilts, and whether to add quilts was determined based on the subjective judgment of the nursing staff. The ambient temperature in the operating room is generally controlled at 21 to 24 degrees Celsius, and the humidity is controlled at 40 to 60 percent. The fluid transfused during the operation is at room temperature (about 22 ℃), and no liquid heating device is used. The patient was covered with a regular cotton quilt in the recovery room for warmth after the operation [3].

2.2.2. Nursing measures for the observation group

The observation group adopted comprehensive body temperature protection measures on the basis of routine care as follows.

(1) Preoperative stage

① Risk assessment: Before entering the room, patients were evaluated by operating room nurses using the Hypothermia risk assessment scale. High-risk patients (aged ≥ 65 years, body mass index < 18.5 kg/ m^2 or expected operation time ≥ 120 min) were identified and managed. ② Pre-warming: Immediately after entering the preoperative preparation room, the patient is pre-warmed with an inflatable heating blanket at a temperature of 38 ° C for a duration of ≥20 minutes. ③ Environmental preparation: Set the operating room temperature to 24-25 ° C before the patient enters the room, and adjust it to 22-23 ° C after the patient enters the room according to the progress of the operation.

(2) During the operation

① All patients in the observation group used inflatable heating blankets throughout the operation. The appropriate covering method was selected based on the surgical site, and the temperature of the heating device was set at 38–43 ℃ and adjusted dynamically. ② Fluid heating: During the operation, all intravenously infused crystalloid fluid, colloid fluid, and blood products were heated to 37 ℃ by a thermostatic infusion heater before infusion. The body cavity irrigation fluid was preheated to 38 ° C to 40 ℃ in a constant temperature box. ③ Body temperature monitoring: Continuously monitor core body temperature using a nasopharyngeal temperature probe from the start of anesthesia induction until the end of the patient leaving the recovery room. Record every 5 minutes after anesthesia induction, every

15 minutes during the stable period of surgery, and increase monitoring frequency when the body cavity is exposed or when there is a large volume of fluid infusion. ④ Reduce heat loss by covering non-surgical areas with cotton blankets or thermal blankets and applying thermal surgical membranes around surgical incisions to reduce the area of body surface exposure and heat loss [4].

(3) Postoperative stage

① Continue to insulate. When the patient is transferred to the anesthesia recovery room and in the recovery room, continue to use inflatable heating blankets for insulation to maintain core body temperature above 36.0 ℃. ② Handover management: Operating room nurses and recovery room nurses have a special handover of body temperature management, recording the trajectory of body temperature changes during the operation and the insulation measures taken. ③ Shivering management: When shivering is detected in the patient, immediately assess the core body temperature and take measures such as increasing coverage, raising the temperature of the heating blanket, and administer medication as directed by the doctor if necessary.

2.3. Observation of indicators

(1) Core body temperature

Core body temperatures were recorded in both groups of patients after anesthesia induction (at the time of entering the room), 30 minutes after the start of surgery, 60 minutes after the start of surgery, immediately after the end of surgery, and when entering the recovery room after surgery.

(2) Incidence of perioperative hypothermia

A core body temperature of less than 36.0 ° C at any monitoring point during the perioperative period is considered hypothermia.

(3) Incidence of postoperative chills: Chills are defined as visible muscle tremors or generalized tremors in patients according to the Wrench classification criteria.

(4) Intraoperative blood loss

A combined calculation using a negative pressure suction bottle and gauze weighing.

(5) Postoperative recovery time

The time from the end of the surgery to the recovery from anesthesia, the eyes open upon call, and the ability to perform commanded actions.

(6) Incidence of surgical site infection

Redness, swelling, heat, pain or purulent discharge at the surgical incision within 30 days after surgery, or positive pathogen culture, in accordance with the diagnostic criteria for nosocomial infections.

(7) Length of stay in the recovery room.

2.4. Statistical processing

Data analysis was performed using SPSS 26.0 statistical software. Measurement data were expressed as mean ± standard deviation ($\overline{x} \pm s$), independent sample t-test was used for comparison between groups, and repeated measures analysis of variance was used for comparison of body temperature at different time points. Count data were expressed as percentages, and the χ^2 test was used for comparison between groups. A difference was considered statistically significant when $p < 0.05$.

3. Results

3.1. Comparison of perioperative core body temperature between the two groups of patients

The core body temperatures of the observation group were significantly higher than those of the control group at 30 minutes, 60 minutes after the start of surgery, immediately after the end of surgery, and when entering the recovery room after surgery, and the differences were statistically significant ($p < 0.05$). There was no significant difference in core body temperature between the two groups after anesthesia induction (at the time of entering the room) ($9 > 0.05$). **Table 2** shows the comparison of core body temperatures at each time point during the perioperative period between the two groups.

Table 2. Comparison of core body temperatures during the perioperative period between the two groups (℃, $\overline{x} \pm s$)

Monitoring time points	After anesthesia induction (when entering the room)	30 minutes after the operation begins	60 minutes after the operation begins	Immediately after the operation ends	When entering the recovery room after surgery
Observation group (n=143)	36.58 ± 0.23	36.42 ± 0.28	36.35 ± 0.31	36.38 ± 0.29	36.45 ± 0.26
Control group (n=143)	36.54 ± 0.25	35.96 ± 0.34	35.82 ± 0.39	35.78 ± 0.41	35.92 ± 0.36
t value	1.420	12.554	12.815	14.201	14.381
p value	0.157	<0.001	<0.001	< 0.001	< 0.001

3.2. Comparison of the incidence of perioperative hypothermia between the two groups of patients

There were 16 cases of perioperative hypothermia in the observation group, with an incidence rate of 11.19%; There were 49 cases of perioperative hypothermia in the control group, with an incidence rate of 34.27%. The incidence of hypothermia in the observation group was significantly lower than that in the control group, and the difference was statistically significant ($\chi^2 = 21.732$, $p < 0.01$).

3.3. Comparison of postoperative chills and other clinical indicators between the two groups

The incidence of postoperative chills in the observation group was 9.79%, significantly lower than 28.67% in the control group ($p < 0.01$). The intraoperative blood loss, postoperative recovery time and recovery room stay time in the observation group were all better than those in the control group, and the differences were statistically significant ($p < 0.05$). The incidence of surgical site infection was 2.10% in the observation group and 6.99% in the control group, and the difference was statistically significant ($p < 0.05$). The comparison of clinical indicators between the two groups is shown in **Table 3**.

Table 3. Comparison of postoperative chills and other clinical indicators between the two groups of patients

Observation indicators	Postoperative chills occur [cases (%)]	Intraoperative blood loss (mL, $\overline{x} \pm s$)	Postoperative recovery time (min, $\overline{x} \pm s$)	Recovery room stay time (min, $\overline{x} \pm s$)	Surgical site infection [cases (%)]
Observation group (n = 143)	14 (9.79)	185.46 ± 68.33	28.46 ± 10.27	52.37 ± 15.46	3 (2.10)

Control group (n = 143)	41 (28.67)	226.71 ± 75.48	36.58 ± 12.34	64.28± 18.37	10 (6.99
t value	16.261	4.865	6.111	6.015	4.114
p value	< 0.001	< 0.001	< 0.001	< 0.001	0.043

4. Discussion

4.1. Mechanisms and hazards of perioperative hypothermia

Perioperative hypothermia is caused by a combination of factors. Anesthetic drugs inhibit hypothalamic thermoregulatory function, causing blood vessels to dilate and core heat to redistribute to the periphery. The low-temperature environment in the operating room, the opening of body cavity, the expansion of skin exposure range, the infusion of cold fluid and cold rinse fluid, etc. all accelerate heat dissipation, causing patients to experience a decrease in core body temperature within a short period of time during the operation. The harm of hypothermia is not just cold discomfort. It also inhibits platelet function and thrombin activity, increases intraoperative blood loss, weakens the body's immune defense ability, raises the risk of surgical site infection and adverse cardiovascular events, and delays the metabolism of anesthetic drugs and the recovery process after surgery. In this study, the incidence of hypothermia in the control group was 34.27%, indicating that perioperative hypothermia is still relatively common in patients with an average operation duration of 120 minutes, and there is still a need to further strengthen clinical temperature management.

4.2. Core elements and effects analysis of comprehensive body temperature protection strategies

The integrated body temperature protection strategy focuses on the entire perioperative management, with the core being the organic combination of preoperative prevention, intraoperative intervention, and postoperative continuous heat preservation. Preoperative risk assessment of high-risk patients and pre-warming measures can increase peripheral heat reserves and reduce the drop in body temperature caused by the redistribution of core heat after anesthesia induction; The continuous use of inflatable heating blankets, fluid heating, dynamic temperature monitoring, etc. during the operation can reduce the impact of surface heat dissipation and cold fluid input, and maintain core temperature stability in multiple aspects; Continuing to insulate after the operation can prevent hypothermia again during the transfer and recovery phases. The results of this study show that the body temperature of the observation group was higher than that of the control group at 30 minutes, 60 minutes after the start of the operation, at the end of the operation and when entering the recovery room. The indicators such as perioperative hypothermia, postoperative chills, intraoperative blood loss, postoperative recovery time and infection incidence were also better than those of the control group, indicating that the comprehensive body temperature protection strategy has good clinical application value.

4.3. Weak links in current body temperature management and methods for improvement

Although the effectiveness of the integrated body temperature protection strategy has been established, there are still weak links in body temperature management in practical application. Some nursing staff are not fully aware of the dangers of hypothermia, preoperative risk assessment lacks the support of quantitative tools, and high-risk patients are not identified in a timely manner; Active heat preservation equipment is underconfigured in some operating rooms, or has a low usage rate due to unskilled operation and inadequate

maintenance; There are also discontinuous records and untimely interventions in intraoperative temperature monitoring, which cannot achieve the purpose of dynamic management throughout the entire process. The coordination among anesthesiologists, surgeons, operating room nurses and recovery room nurses also needs to be strengthened. In response to these issues, hypothermia risk assessment should be incorporated into the standard process of preoperative visits, the configuration and maintenance system of active heat preservation equipment should be improved, continuous core temperature monitoring technology should be promoted, and standardized handover forms and multidisciplinary collaboration mechanisms should be established to continuously improve perioperative temperature management to be more standardized and efficient.

The comprehensive body temperature protection care strategy, which includes preoperative pre-warming, intraoperative active warming and fluid heating, and postoperative continuous warming, can effectively reduce the incidence of perioperative hypothermia and complications, accelerate postoperative recovery, and improve patient safety. Operating room nursing staff should, based on the actual clinical situation, continuously improve risk assessment, temperature monitoring, active heat preservation technology application and multidisciplinary collaboration system, thereby enhancing perioperative temperature management and facilitating postoperative recovery of patients.

5. Conclusion

In conclusion, unplanned hypothermia during the perioperative period is an important risk factor affecting surgical safety and postoperative recovery of patients, which can significantly increase the risk of adverse events such as chills, increased intraoperative bleeding, delayed awakening, and surgical site infections. This study confirmed that compared with conventional body temperature care, the integrated comprehensive body temperature protection care strategy of preoperative precise risk assessment and pre-insulation, intraoperative active insulation combined with dynamic body temperature monitoring, and postoperative continuous insulation can effectively maintain the stability of core body temperature in patients during the perioperative period and significantly reduce the incidence of hypothermia and related complications. Shortening postoperative recovery time, reducing intraoperative blood loss and lowering the risk of surgical site infection are of significant clinical value in improving surgical safety and accelerating postoperative recovery.

At the same time, this study also identified the weak links in the traditional temperature management process in the operating room and pointed out the direction for improvement in subsequent temperature protection work. In clinical nursing practice, the concept of full-process, proactive and individualized body temperature protection should be integrated into the entire operating room nursing process, continuously optimize the perioperative body temperature management process, improve the preoperative assessment system, standardize the intraoperative heat preservation operation, strengthen the postoperative heat preservation connection, and construct a standardized and systematic body temperature protection nursing model. In the future, it is necessary to further promote comprehensive body temperature protection nursing measures, continuously refine nursing plans, improve nursing quality, effectively ensure the body temperature safety of surgical patients during the perioperative period, and provide solid nursing support for the rapid recovery of patients after surgery.

Disclosure statement

The author declares no conflict of interest.

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