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Clinical Study on Nursing Intervention Measures for the Prevention of Hypothermia During Hysteroscopy Surgery

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Abstract This study randomly divided 800 patients undergoing hysteroscopy at XX Gynecological Hospital into two groups and administered different hypothermia prevention nursing interventions during surgery. A Logistic regression model was then used to analyze the factors contributing to hypothermia in hysteroscopy patients during surgery. Additionally, the study compared changes in body temperature, postoperative recovery indicators, nursing satisfaction, stress response, complications, and coagulation function between the two groups. Results indicated that for patients with a BMI value, preoperative body temperature, and operating room temperature of ≤23.17, 36.5°C, and 22.5°C, respectively, and a surgical duration >15.5 minutes, precise intervention measures could be implemented to reduce the incidence of intraoperative hypothermia. Thermal care interventions had a positive impact on body temperature and stress responses in gynecological hysteroscopy patients. The use of heating blankets can reduce the incidence of intraoperative hypothermia in hysteroscopy patients and improve postoperative comfort. Thermal care in gynecological hysteroscopy surgery effectively protects patients' coagulation function, reduces the incidence of shivering, and shortens postoperative recovery time.

Index Terms Logistic regression model, hysteroscopy surgery, thermal care, stress response

I. Introduction

Hysteroscopy is a type of endoscopy that uses a cold light source. The endoscope sheath is equipped with an operating port. During the procedure, a distension medium is used to expand the uterus, and the endoscope is connected to an imaging and display system to magnify the surgical field within the uterine cavity and cervical canal on a monitor. Micro-instruments are then inserted through the operating port to perform procedures within the uterine cavity and cervical canal, as well as to treat the fallopian tubes [1]-[4]. It offers advantages such as no incisions, minimal trauma, reduced patient discomfort, rapid recovery, and no impact on ovarian function, providing excellent protection for non-pregnant women. As a result, it has been widely promoted and adopted by medical professionals [5]-[7]. However, as hysteroscopic surgery becomes increasingly common in clinical practice, the incidence of “hypothermia” associated with the procedure has also risen [8], [9].

Hypothermia refers to a core body temperature below 36°C. Clinically, a core body temperature between 34°C and 36°C is generally classified as mild hypothermia, with an incidence rate of 50%-70% during surgery [10], [11]. Patients are required to fast for 6-8 hours prior to surgery. If their physical condition is poor, they may become more sensitive to cold stimuli, leading to reduced resistance [12], [13]. Hypothermia frequently occurs during hysteroscopy, and this condition can lead to complications such as cardiac events, coagulation disorders, and wound infections [14]-[16]. Some patients report that the initial hypothermia and shivering during surgery are more painful than the pain caused by the disease itself [17], [18]. Shivering can cause muscle spasms, increase metabolic rate and oxygen consumption, accelerate heart rate, and interfere with cardiac monitoring, thereby hindering the progression of the condition [19], [20]. Therefore, understanding the risk factors for hypothermia during surgery and actively implementing preventive nursing interventions can effectively prevent the occurrence of complications [21], [22]. Of course, in addition to monitoring the patient's temperature during surgery, operating room medical staff should also fully consider the various causes of hypothermia in surgical patients and take necessary, safe, and simple warming measures to increase peripheral skin temperature and reduce heat loss from the body [23]-[26]. Additionally, proper documentation and registration of hysteroscopy use should be maintained to facilitate post-operative tracking, thereby improving the overall nursing standards and medical safety of hysteroscopy procedures [27], [28].

Reference [29] identifies the causes of intraoperative hypothermia and preventive measures, describing its adverse effects, including cardiac abnormalities, impaired wound healing, increased surgical site infections, shivering, and coagulation disorders. Literature [30] examines the risk factors for hypothermia during surgery, constructs a predictive model for hypothermia, and applies it to clinical practice, verifying its effectiveness in assisting healthcare personnel in identifying high-risk patients and implementing targeted preventive measures. Literature [31] aims to deepen understanding of unexpected hypothermia in perioperative care among healthcare personnel, describes the effects of hypothermia during surgery on patients, and emphasizes its association with healthcare personnel's knowledge and experience. Literature [32] introduces unexpected hypothermia (UH) during surgery and discusses the risk factors for urinary tract infections in adult surgical patients. Various risk factors contribute to the development of UH, and perioperative nurses should be aware of these risk factors to implement preventive measures and improve patient outcomes. Literature [33] aims to map the nursing prescriptions for patients with intraoperative hypothermia with the activities proposed in the nursing intervention classification. Using descriptive, literature-based, and other research methods, it reveals that cross-mapping can help unify nursing practice. Literature [34] compared experimental warming interventions with conventional warming interventions in preventing perioperative hypothermia. Based on a literature review and meta-analysis of clinical trials, it validated that experimental warming interventions outperform conventional warming interventions. Literature [35] aimed to determine nurses' awareness and practices regarding the prevention of perioperative hypothermia. Based on a survey, it was found that nurses had a high level of awareness regarding the prevention of perioperative hypothermia, but their practice levels were low, and recommendations were proposed. Literature [36] analyzed the feasibility of health literacy training in preventing and controlling perioperative unexpected hypothermia (IPH). Based on a comparative experiment, it was demonstrated that health literacy training and effective health management measures can improve the quality of IPH prevention and management by healthcare personnel. Literature [37] conducted a literature review to identify risk factors for unplanned hypothermia during the perioperative period, emphasizing that maintaining vigilance during the perioperative period is essential to enhance patient safety, while further research is needed to validate the risk factors for perioperative hypothermia. Literature [38] aimed to determine whether the use of normal-temperature packs, including preoperative forced-air warming blankets, could reduce the incidence of IPH, and validated the effectiveness of preoperative forced-air warming blankets, particularly in cases with longer surgical durations, effectively lowering the incidence of IPH. Literature [39] compared three heating methods—heating pads, body-contact heated blankets, and heated infusion systems—in preventing intraoperative hypothermia during open gastrointestinal surgery. Experimental results showed that the two heating methods were similarly effective in preventing intraoperative hypothermia. Literature [40] discussed how preoperative warming helps prevent hypothermia in patients during surgery and provided clinical doctors with evidence-based, practical, and preheating method resources based on a literature review. It emphasized the necessity of further research and analyzed preoperative warming recommendations.

This study selected 800 patients undergoing hysteroscopy surgery and randomly divided them into an observation group and a control group using a random draw method, with 400 patients in each group. The control group received conventional nursing care, while the observation group received a hypothermia nursing care model in the operating room. Using sample size estimation and logistic regression analysis models, we analyzed the multifactorial causes of intraoperative hypothermia in hysteroscopy patients. We determined the optimal cutoff values for each variable using ROC curves and then performed logistic regression analysis on each variable to assess their roles during hysteroscopy surgery. Subsequently, we investigated the effects of thermal care interventions on patients' body temperature and stress responses, and clarified the recovery outcomes of patients after implementing thermal care preventive intervention protocols.

II. Data and methods

II. A. Clinical data

This study selected 800 patients who underwent routine hysteroscopy at XX Gynecological Hospital from January 2010 to December 2024 as the research subjects. A random draw method was used to divide the patients into two groups, with 55 patients in each group. The control group ranged in age from 26 to 73 years old, with an average age of 49.26 years old. The observation group had a minimum age of 25.22 years, a maximum age of 71.16 years, and an average age of 49.22 years. There was no statistically significant difference in age between the two groups ($P > 0.05$), making them comparable.

Inclusion criteria: ① No severe cardiovascular disease, respiratory system disease, or renal insufficiency; ② No obvious mental illness or cognitive impairment; ③ Patients provided informed consent for this study and voluntarily signed the informed consent form. Exclusion criteria: ① Patients taking medications that may affect temperature regulation, such as antibiotics or anti-inflammatory drugs, prior to surgery; ② Patients with fever or infection symptoms prior to surgery.

II. B.Methods

The control group received conventional care, including preoperative assessment, intraoperative vital signs monitoring, aseptic techniques, and postoperative wound care. The observation group received hypothermia care measures in the operating room, specifically:

① Preoperative warming: Comprehensive assessment of the patient's body temperature was conducted prior to surgery to identify potential risks. Based on the patient's body temperature status, a series of warming measures were provided.

② Intraoperative temperature monitoring: Using temperature monitoring devices, the patient's core temperature is measured in real time, which helps nursing staff promptly identify any drops in body temperature and adjust the operating room temperature accordingly to prevent hypothermia.

③ Surgical site warming: During surgery, nursing staff can use warming blankets or heating pads to help maintain the patient's body temperature. After surgery, appropriate warming measures should be immediately implemented to minimize heat loss.

④ Fluid warming: Before administering fluids, nursing staff should use fluid warmers or other specific heating devices to warm the fluids, ensuring they are as close to body temperature as possible, which can effectively prevent hypothermia.

⑤ Anesthesia management: Nursing staff should closely monitor the patient's temperature changes, communicate promptly with the anesthesiologist, and adjust the dosage of medication appropriately. Additionally, during anesthesia, nursing staff can use warming blankets or other insulation measures to reduce the risk of hypothermia.

⑥ Postoperative recovery: Nursing staff should provide the patient with warming blankets, electric heaters, or other warming measures based on the patient's temperature condition to help the patient quickly return to normal body temperature.

II. C.Observation indicators

① Compare two groups of stress indicators, including body temperature, adrenaline (AD), norepinephrine (NE), heart rate (HR), stress response, thermal comfort, and coagulation function.

② Compare the incidence of complications in the two groups, including delayed awakening, hypothermia, and shivering.

II. D.Statistical methods

Statistical analysis of the data was performed using SPSS statistical software. Quantitative data were expressed as means and analyzed using the t test; categorical data were expressed as $\left[n(\%)\right]$ and analyzed using the χ^2 test. A value of $P < 0.05$ indicated a statistically significant difference.

This study compared the percentage (rate) of complications occurring in cesarean sections between the comprehensive warming group (observation group) and the conventional warming group (control group). The outcome measure was whether complications occurred, which was a binary outcome. The study explored whether there was a statistically significant difference in the incidence of complications between the two groups, which required the following four conditions:

① The incidence of complications in cesarean sections in the control group was P_1;

② The incidence rate of cesarean section complications in the observation group is P_2;

③ The significance level is α;

④ The test power is β.

Sample size calculation formula:

$$n = \frac{2(u_\alpha + u_\beta)^2 p(1-p)}{\delta^2} \tag{1}$$

n represents the sample size, u_α, u_β, $p = (P_1 + P_2)/2$, and P_1 can be obtained from the literature. P_2 can be obtained from a preliminary experiment, $\alpha = 0.05$, and u is two-sided, with $u_{0.05} = 1.96$. When the power (test efficiency) is 0.8, $u_{0.8} = 0.84$, and $\delta = P_2 - P_1$.

Logistic regression analysis sample size estimation:

Through stepwise screening of categorical factors, statistically significant variables are included in the final logistic regression analysis, significantly reducing the number of variables used in the multivariate analysis and thereby reducing the sample size. Combining the above sample size estimation methods, the observation group of 400 cases + the control group of 400 cases = 800 cases meets the study project's requirements for sample size.

Logistic regression, also known as logistic regression analysis [41], is a generalized linear regression analysis model that adds a sigmoid mapping function to the linear regression analysis model. The principle of logistic regression is to use a logistic function to map the results of linear regression $(-\infty,+\infty)$ to $(0,1)$.

The mathematical expression of the linear regression function is:

$$y=\theta_0+\theta_1 x_1+\theta_2 x_2+\cdots+\theta_n x_n=\theta^T x \tag{2}$$

where x_i is the independent variable, y is the dependent variable, the range of y is $(-\infty,+\infty)$, θ_0 is the constant term, $\theta_i(i=1,2,\ldots,n)$ are the coefficients to be determined, and different weights θ_i reflect the different degrees of influence of the independent variables on the dependent variable.

The mathematical expression for the logical function is:

$$g(y)=\frac{1}{1+e^{-y}} \tag{3}$$

Map the results of linear regression from $(-\infty,+\infty)$ to $(0,1)$:

$$g(y)=\frac{1}{1+e^{-y}}=\frac{1}{1+e^{-(\theta_0+\theta_1 x_1+\theta_2 x_2+\cdots+\theta_n x_n)}}=\frac{1}{1+e^{-\theta^T x}} \tag{4}$$

By taking the result y of the linear regression function, we construct the logistic regression function. Logistic regression has widespread applications in fields such as sociology, biostatistics, clinical research, quantitative psychology, econometrics, data analysis and mining, disease diagnosis, drug efficacy assessment, economic data analysis, and macroeconomic forecasting. It is primarily used for regression analysis where the dependent variable is a categorical variable. These are all categorical variables, not continuous numerical values. In logistic regression, the independent variables can be either categorical or continuous variables. Among these, when the dependent variable has two categories, it is called binary logistic regression, and when the dependent variable has multiple categories, it is called multinomial logistic regression.

III. Results

III. A. Multifactorial analysis of intraoperative hypothermia in patients undergoing hysteroscopic surgery

III. A. 1) Univariate analysis of intraoperative hypothermia

A univariate analysis of factors influencing intraoperative hypothermia in patients undergoing hysteroscopy is shown in Table 1. There were no statistically significant differences between the two groups in terms of age, marital status, educational level, underlying diseases, and presence of comorbidities (P > 0.05). There were no statistically significant differences between the two groups in terms of arterial pressure, body temperature upon entering the operating room, and intraoperative blood loss (P > 0.05). However, there were statistically significant differences between the two groups in terms of BMI, anesthesia duration, surgical duration, operating room temperature, post-anesthesia body temperature, preoperative body temperature, intraoperative fluid administration, and intraoperative uterine distension fluid usage (P < 0.05).

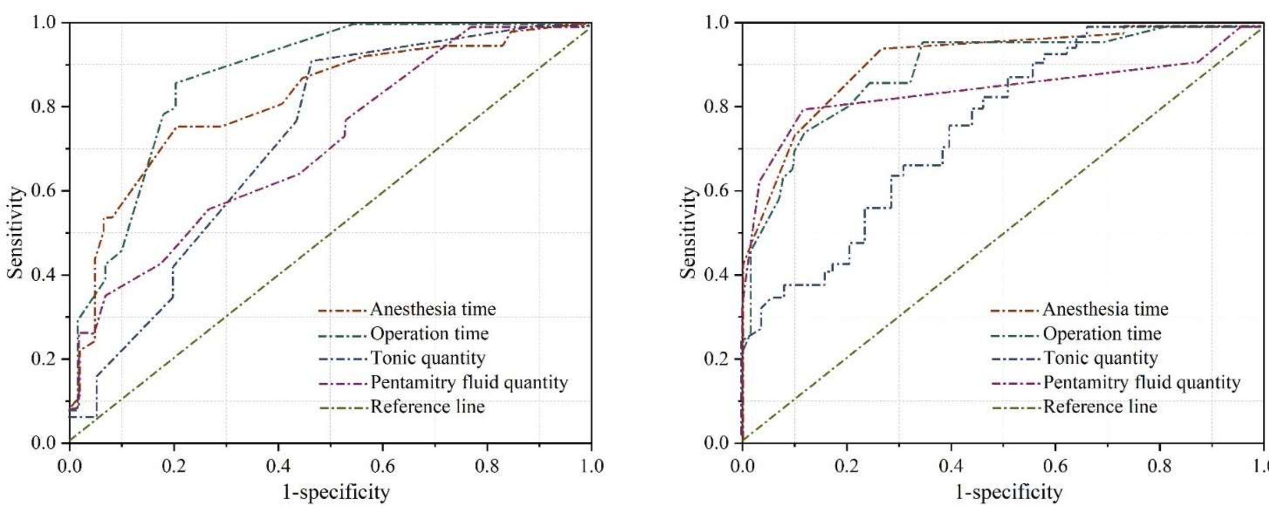
Table 1: Hypothermia factors in patients with hysteroscopy

Project		Low body temperature group (n= 60)	Normal group (n= 60)	Statistical value	P value
Age		37.98	40.24	0.7392	0.4623
Marital status (%)	married	83.33	85.00	0.3983	0.7006
	unmarried	8.33	10.00		
	divorce	8.33	5.00		
Cultural degree (%)	Primary school and below	21.67	23.33	0.1508	0.9915
	Junior high school	40.00	33.33		
	High school	10.00	15.00		
	College and above	28.33	28.33		
Disease (%)	Uterine polyp	58.33	53.33	0.721	0.4811
	Uterine fibroids	8.33	8.33		
	Incomplete abortion	18.33	13.33		
	Other	15.00	25.00		
Basic disease (%)	Nothing	95.00	83.33	1.6213	0.1097
	Have	5.00	16.67		
Arterial blood pressure (mmHg)		123.98	120.88	1.3719	0.1713

BMI (kg/m^2)	21.54	23.8	5.6479	0
Take the temperature of the operating room (℃)	36.9	37.3	0.6188	0.54
After hypothermia (℃)	37.07	37.01	8.4409	0
The operation begins to be warm (℃)	36.69	36.44	10.9994	0
Room temperature (℃)	21.64	23.76	9.9993	0
Anesthesia time (min)	35.61	22.71	5.6	0
Operation time (min)	23.86	13.43	6.3002	0
The amount of liquid in the operation (ml)	353.72	265.42	3.5589	0
Blood output (ml)	14.2	6.23	1.6004	0.1113
The amount of the liquid in the operation (ml)	3009.48	2411.29	4.3713	0

III. A. 2) Analysis of related variables predicting hypothermia during hysteroscopic surgery

The ROC curves for each variable in predicting hypothermia during hysteroscopy are shown in Figure 1, where (a) and (b) represent different variables, respectively; the analysis of relevant variables in predicting hypothermia during hysteroscopy is shown in Table 2. Analysis of the ROC curves for the above-mentioned relevant variables indicates that the areas under the curve for preoperative body temperature, operating room temperature, surgical duration, postoperative body temperature, and anesthetic duration are 0.9214, 0.8908, 0.8703, 0.8596, and 0.8202, respectively. Among these, BMI, intraoperative fluid administration volume, and uterine distension fluid volume have no predictive value. The cutoff values for preoperative body temperature, operating room temperature, surgical duration, postoperative body temperature, and anesthesia duration were 36.53°C, 22.52°C, 15.51 min, 36.71°C, and 26.54 min, respectively. The sensitivity for predicting hypothermia occurrence was 95.02%, 75.08%, 87.02%, 79.97%, and 75.28%, respectively, and the specificity was 73.56%, 88.01%, 77.92%, 87.96%, and 79.93%, respectively.



(a)Different variables (b)Different variables

Figure 1: ROC curve of hypothermia occurring during the prediction of hysteroscopy

Table 2: Analysis of hypothermia in hysteroscopy

Project	AUC	Critical value	Sensitivity	Specificity	AUC 95%CI	
					Lower limit	Upper limit
BMI (kg/m^2)	0.7524	23.22	0.8204	0.5487	0.6697	0.8402
Room temperature (℃)	0.8908	22.52	0.7508	0.8801	0.8305	0.9504
After anesthesia (℃)	0.8596	36.71	0.7997	0.8796	0.7802	0.9314
The surgery began to be warm (℃)	0.9214	36.53	0.9502	0.7356	0.8701	0.9686
Anesthetic time (min)	0.8202	26.54	0.7528	0.7993	0.7402	0.8899
Operating time (min)	0.8703	15.51	0.8702	0.7792	0.8101	0.9397

The amount of liquid in the operation (ml)	0.7189	21.57	0.9103	0.5309	0.6203	0.8115
The amount of the fluid in the operation (ml).	0.7109	2849.99	0.5194	0.7703	0.6193	0.801

III. A. 3) Multivariate analysis of factors affecting intraoperative hypothermia

The results of the logistic regression analysis of factors influencing intraoperative hypothermia during hysteroscopy are shown in Table 3. The eight continuous variables mentioned above were used as independent variables, and the occurrence of intraoperative hypothermia was used as the dependent variable for the logistic regression analysis. The results of the logistic multivariate analysis indicate that BMI, preoperative body temperature, and operating room temperature are protective factors against the occurrence of hypothermia during hysteroscopic surgery, while surgical duration is an independent risk factor for the occurrence of hypothermia during hysteroscopic surgery.

Table 3: Logistic regression analysis of hypothermia factors in hysteroscopy

Project	Regression coefficient	Standard error	Wald x^2	P value	OR value	AUC 95%CI	
						Lower limit	Upper limit
BMI (kg/m^2)	-0.9591	0.4196	5.1802	0.021	0.3804	0.1799	0.8795
After hypothermia (℃)	0.6212	4.1404	0.0204	0.8791	1.8603	0	6201.9997
The operation begins to be warm (℃)	-13.4405	5.7506	5.4592	0.0197	0	0	1.1207
Room room temperature (℃)	-1.9896	0.7609	6.9597	0.0107	0.1391	0.0315	0.5995
Anesthesia time (min)	-0.2207	0.1589	1.8498	0.1699	0.8098	0.5881	1.1002
Operation time (min)	0.5602	0.2595	4.5007	0.0293	1.751	1.0499	2.9301
The amount of liquid in the operation (ml)	0.0099	0.0101	1.2087	0.269	1.0106	1.0101	1.0095
The amount of swelling in the operation (ml)	0	0.0102	0.0287	0.8799	0.9996	1.0003	1.0093

III. B. Effects of thermal care interventions on patient temperature and stress responses

III. B. 1) Comparison of body temperature and postoperative recovery indicators between the two groups

The results of the comparison of body temperature between the two groups are shown in Table 4. There was no significant difference in preoperative body temperature between the observation group and the control group (P > 0.05). Compared with the control group, the observation group had higher body temperatures 10 minutes after anesthesia, 20 minutes into surgery, and at the end of surgery (P < 0.05). Compared with the control group, the observation group had a shorter time to ambulation (P < 0.05).

Table 4: Two groups of temperature contrast results

Group	Body temperature				The time of the bed (h)
	Preoperative	10 min after anesthesia	Operation 20min	Graduated	
Observation group	36.9977	36.99	36.53	36.71	16.49
Control group	36.0008	35.49	35.79	35.31	26.38
t	0.0871	6.89	8.14	14.55	16.89
P	0.9109	0	0	0	0

III. B. 2) Comparison of nursing satisfaction between the two groups

The comparison results of the two groups' satisfaction levels are shown in Table 5. Compared with the control group, the observation group had a higher overall satisfaction level of 99.78%, which was significantly different from the control group (P=0.0064, P<0.05).

Table 5: The two groups of satisfaction compared the results

Group	Very satisfied (%)	Satisfaction (%)	Discontent (%)	Total satisfaction (%)
Observation group	58.18	41.60	0.22	99.78
Control group	38.38	38.05	23.57	76.43

χ^2	8.9524
P	0.0064

III. B. 3) Comparison of stress responses between the two groups

The comparison results of the two groups' stress responses are shown in Table 6, where * indicates that the difference is not statistically significant compared to the control group before surgery (P > 0.05). The results indicate that, compared to the control group, the adrenaline and norepinephrine levels in the observation group were lower after surgery (P < 0.05).

Table 6: Two groups of stress reactions were compared

Group	Stage	Adrenal hormone (pmol/L)	Norepinephrine (pmol/L)
Observation group	Preoperative	51.9934*	141.9713*
	Postoperative	88.8582	157.9941
Control group	Preoperative	52.8399	141.9897
	Postoperative	105.0659	173.0071
t	Two groups were compared after surgery	14.7804	12.3145
P	Two groups were compared after surgery	0.0001	0.0005

III. B. 4) Comparison of complications between the two groups

The results of the comparison of complications between the two groups are shown in Table 7. Patients in the observation group had significantly lower rates of agitation, chills, and hypothermia than those in the control group. The incidence of complications in the observation group was 17.17% lower than that in the control group (P<0.05).

Table 7: Two groups of complications were compared

Group	Percentage of complications of the two groups (%)			
	Agitation	Cold war	Hypothermia	Complications
Observation group	0.12	4.00	1.39	5.50
Control group	4.00	8.00	10.67	22.67
χ^2	7.2208			
P	0.0153			

III. C. Effect of heating blankets on thermal comfort in two groups of patients

The results of the effect of electric blankets on thermal comfort in the two groups of patients are shown in Table 8. Comparison of thermal comfort between the two groups showed that after using electric blankets, the thermal comfort of the observation group (7.5872) was significantly higher than that of the control group (6.2374), with a statistically significant difference (P<0.001). This indicates that the use of electric blankets improved the thermal comfort of patients in the observation group during surgery.

Table 8: The effect of the heating carpet on the thermal comfort of the two groups

Group	Average thermal comfort	Standard error
Observation group	7.5872	0.1887
Control group	6.2374	0.2011
t	-24.8087	
P	0.0000	

III. D. Application and efficacy of thermal insulation care in hysteroscopic surgery

III. D. 1) Comparison of coagulation function between the two groups

The results of the comparison of coagulation function between the two groups are shown in Table 9. The results indicate that: prior to surgery, there were no statistically significant differences between the two groups in terms of thrombin time (TT), prothrombin time (PT), activated partial thromboplastin time (APTT), and fibrinogen (FIB) levels (all P > 0.05); After surgery, the levels of TT, PT, APTT, and FIB in the observation group were all lower than those in the control group (all P < 0.05).

Table 9: Comparison of two groups of coagulation

Observation index		Observation group	Control group	*t*	*P*
TT	Preoperative	10.8385	10.8805	0.4333	>0.05
	Postoperative	11.7601	19.6715	12.5341	<0.05
PT	Preoperative	12.1635	11.9775	0.2962	>0.05
	Postoperative	12.3088	19.8541	11.7776	<0.05
APTT	Preoperative	35.637	35.4273	0.1258	>0.05
	Postoperative	37.596	50.7047	10.0612	<0.05
FIB	Preoperative	2.0283	1.9108	0.2408	>0.05
	Postoperative	2.1337	2.7714	3.2694	<0.05

III. D. 2) Comparison of two groups' recovery times

The results of the comparison of awakening times between the two groups are shown in Table 10. The results indicate that the awakening time in the observation group was 39.9171 min, while that in the control group was 71.1087 min. The awakening time in the observation group was shorter than that in the control group, and the difference was statistically significant (t = 25.7825, P = 0.0000).

Table 10: Two groups of waking time comparison results

Group	Two groups of waking time and error comparison	
	Mean waking time (min)	Standard error
Observation group	39.9171	71.1087
Control group	3.5102	7.2651
t	25.7825	
P	0.0000	

IV. Discussion

IV. A. The impact of multiple factors contributing to hypothermia on patients undergoing hysteroscopic surgery

Currently, hypothermia still occurs frequently during hysteroscopic surgery. Therefore, analyzing the various factors contributing to hypothermia in surgical patients and implementing corresponding preventive measures in advance is of great significance in reducing the incidence of hypothermia.

In this study, a body mass index (BMI) > 23.22 kg/m² was identified as a protective factor against hypothermia during surgery, which may be related to the insulating effect of fat. Patients with preoperative body temperatures below 36.53°C and operating room temperatures ≤22.52°C were more prone to hypothermia, indicating that body temperature is closely related to environmental temperature. When the difference between the patient's body temperature and environmental temperature is small, the heat lost through convection from the body surface is relatively less, making hypothermia less likely to occur. When the surgical duration exceeds 15.51 minutes, the risk of hypothermia increases. Therefore, operating room nursing staff should closely monitor the surgical process. If the surgical duration is prolonged due to changes in the patient's condition, timely implementation of bundled hypothermia care measures is necessary.

IV. B. Effects of thermal care interventions on patient temperature and stress responses

The experimental results of this study indicate:

1) Under thermal care intervention, the body temperatures of gynecological hysteroscopy surgery patients 10 minutes after anesthesia, 20 minutes into surgery, and at the end of surgery were 36.99°C, 36.53°C, and 36.71°C, respectively, representing increases of approximately 1.5°C, 0.74°C, and 1.4°C compared to the control group. Additionally, these temperatures differed little from preoperative temperatures and exhibited minimal fluctuations. This suggests that thermal care intervention has a positive effect on body temperature control in patients undergoing gynecological hysteroscopy surgery.

2) The time to ambulation for patients undergoing gynecological hysteroscopy surgery under thermal care intervention was 16.49 hours, which was approximately 9.89 hours shorter than that of the control group. This indicates that thermal care intervention has a positive effect on accelerating the postoperative recovery rate in patients undergoing gynecological hysteroscopy surgery.

3) The overall satisfaction rate of gynecological laparoscopic surgery patients under thermal care intervention was 99.78%, an increase of 23.35% compared to the control group, indicating that gynecological laparoscopic surgery patients are more satisfied with thermal care intervention.

4) Under thermal care intervention, the levels of adrenaline and noradrenaline in gynecological laparoscopic surgery patients were 51.9934 pmol/L and 141.9713 pmol/L, respectively, representing a decrease of approximately 36.8648 pmol/L and 16.0228 pmol/L compared to the control group. Compared to preoperative levels, the fluctuations were smaller. This indicates that thermal care interventions have a positive effect on reducing stress responses in patients undergoing gynecological hysteroscopy surgery.

5) The incidence of complications such as agitation, chills, and hypothermia in gynecological laparoscopic surgery patients under thermal care intervention was 5.50%, a decrease of 17.17% compared to the control group. This indicates that measures such as temperature control, indoor warmth, heated intravenous fluid administration, uterine distension fluid management, and respiratory care effectively prevented agitation, chills, and hypothermia in patients.

IV. C. Effectiveness of heating blankets in preventing hypothermia during surgery

Heated blankets have self-heating properties. During use, patients should be regularly asked if they feel the blanket is too hot to prevent burns. If blisters form, they should be punctured with a sterilized needle and treated with an antibacterial ointment. In this study, none of the patients experienced the aforementioned adverse reactions. The results of this study indicate that heating blankets can improve patient comfort to some extent during hysteroscopy procedures and are worthy of clinical application. However, the cases included in this study were limited in source, potentially introducing selection bias. Future multi-center clinical trials could be conducted to further validate its efficacy and enhance the reliability of the results.

IV. D. Application and efficacy of thermal insulation care in hysteroscopic surgery

Hysteroscopic surgery requires exposing the patient's abdominal cavity for disinfection, abdominal lavage, normal-temperature intravenous infusion, and anesthesia suppression, all of which may cause the patient's body temperature to drop. Hypothermia can stimulate the nervous system, leading to complications such as abnormal heart rate, respiratory depression, tachycardia, metabolic acidosis, and coagulation disorders, and may even threaten the patient's life.

The results of this study showed that the levels of TT, PT, APTT, and FIB in the observation group were lower than those in the control group, and the incidence of hypothermia and shivering was significantly lower than that in the control group. Additionally, the recovery time for patients in the observation group was shorter than that in the control group, indicating that warming protection care is of great significance for hysteroscopic surgery. Warming protection care can effectively stabilize the patient's condition during surgery and improve their coagulation function. The main reasons may be:

(1) When patients continuously lose heat, regulating the operating room temperature plays a crucial role.

(2) Reducing the duration and area of patient exposure during surgery, accelerating the procedure, implementing coverage measures for patients, and preheating the operating table can all effectively minimize heat loss during surgery.

(3) Warming the fluids, medications, and irrigation solutions used during surgery reduces heat loss, thereby effectively lowering the incidence of hypothermia.

V. Conclusion

This study first employed a logistic regression model to analyze the factors contributing to intraoperative hypothermia in patients undergoing hysteroscopy. Subsequently, a comparative study was conducted to investigate the recovery outcomes of patients before and after the implementation of hypothermia prevention nursing interventions. The main conclusions are as follows:

(1) For patients with a BMI ≤ 23.22, preoperative body temperature ≤ 36.53°C, operating room temperature ≤ 22.51°C, and surgical duration > 15.5 minutes, early identification and warning can enable precise intervention measures to be implemented, providing targeted warming measures for patients to reduce the incidence of intraoperative hypothermia.

(2) For gynecological hysteroscopy patients, thermal care interventions such as temperature control, indoor warming, heated intravenous fluid administration, uterine distension fluid management, and respiratory care resulted in more stable body temperatures, reduced stress responses, and improved clinical care outcomes.

(3) Heating blankets can moderately improve patient comfort during hysteroscopy procedures and are worthy of clinical promotion and application.

(4) Warming protection care during gynecological hysteroscopy surgery effectively protects patients' coagulation function, reduces the incidence of hypothermia, shortens postoperative recovery time, and improves treatment outcomes.

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