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Research Article

Study on the Correction Between Postoperative Sore Throat and Intraoperative Hypothermia in Patients Undergoing General Anesthesia

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Abstract

Objective: To explore the relationship between postoperative sore throat and perioperative hypothermia in patients undergoing general anesthesia, and to provide clinical guidance for nursing interventions during resuscitation. **Methods:** General anesthesia patients who underwent elective surgery in a tertiary A hospital in Guangzhou City from 2024-1-1 to 2024-5-30 were selected as the study subjects, and 271 cases were collected. General data of patients were collected 1 d before surgery and patients were evaluated for preoperative sore throat, perioperative hypothermia data were collected by intraoperative and postoperative temperature monitoring, and after extubation, the occurrence of postoperative sore throat in general anesthesia patients was evaluated by using a visual analog scale of faces in the anesthesia recovery room, and according to the different symptoms, they were classified into sore throat group and non-sore throat group**. Results:** A total of 112 cases (41.33%) of postoperative sore throat occurred in general anesthesia patients. Among them, 37 cases (33.04%) of non-perioperative hypothermic patients experienced postoperative sore throat, while 75 cases (66.96%) of perioperative hypothermic patients experienced postoperative sore throat. The incidence of postoperative sore throat in patients with perioperative hypothermia was significantly higher than that in patients with non-perioperative hypothermia. **Conclusion:** Patients with perioperative hypothermia had a higher risk of postoperative sore throat, with a statistically significant difference ($P < 0.05$). Nursing staff in the recovery room need to target intraoperative hypothermia monitoring and prevention, maintain perioperative temperature stability, effectively reduce the risk of postoperative sore throats in patients under general anesthesia, and then improve the postoperative comfort of patients.

Keywords: Postoperative Sore Throat; Perioperative Hypothermia; Tracheal Intubation; Temperature Management During Resuscitation

Introduction

Postoperative sore throat (POST) is one of the common complications after tracheal intubation under general anesthesia, with an incidence of 46.5% [1]. POST is a symptom of dry mouth, sore throat, weak swallowing, hoarseness coughing, etc. In severe cases, it may even lead to tracheal intubation [2]. In severe cases, it can even lead to tracheoesophageal fistula, tracheal stenosis, lung infection, etc. [3]. The tracheal intubation is an invasive procedure. Tracheal intubation is an invasive operation, and the damage to the pharynx and tracheal mucosa during intubation, the compression of the airway mucosa by the inflatable sleeve of the catheter, and the stimulation of the airway by dry gas and inhaled anesthetic drugs during mechanical ventilation leads to POST after extubation. Inadvertent perioperative hypothermia

(IPH) is a clinical phenomenon in which the patient's core body temperature is lower than 36℃ due to non-medical purposes in the perioperative period, with a clinical incidence of 7% to 90% [4]. The postanesthesia care unit (PACU) is the main place for patients to recover after general anesthesia. POST and IPH are common complications in the PACU [5], and are also the difficulties and key points that plague the clinical work of postoperative anesthesia recovery.

At present, although many studies have explored the influencing factors of POST in general anesthesia patients, the relationship between IPH and POST has not yet been fully investigated, and therefore an in-depth discussion of this issue is of great significance for anesthesia resuscitation work. This study aims to investigate the effect of IPH on POST in general anesthesia patients and to provide a more scientific and effective basis for the management of POST in general anesthesia patients.

Objects and Methods

Subjects Of the Survey

This study was a prospective cross-sectional study, and 322 general anesthesia patients who underwent elective surgery in a tertiary-level hospital in Guangzhou City from 2024-1-1 to 2024-5-30 were selected as survey subjects. Inclusion criteria: ①patients were all >18 years old with good reading comprehension, verbal communication, and cognitive ability; ②patients received tracheal intubation general anesthesia rather than local or regional anesthesia either voluntarily or by the doctor's instructions; ③patients' health status may affect the results, so serious complications or other diseases affecting anesthesia effect are usually excluded; ④patients themselves were aware of their condition and voluntarily participated in this study.

Exclusion criteria: ①patients with preoperative complications of other laryngeal diseases and discomforts such as vocal polyps, acid reflux, etc.; ②patients with combined serious mental or neurological illnesses who are unable to cooperate with the completion of the investigation; ③allergies to specific medications, adverse reactions in the history of anesthesia, etc.; ④patients who have to be admitted to the ICU after the operation; ⑤patients who are too weak to communicate; ⑥patients who are intubated for a second time; ⑦patients with tracheal intubation using a double-lumen tracheal catheter. This study was approved by the Medical Ethics Committee of the hospital.

Survey Instruments

General Information Questionnaire

The general data of the patients were investigated, including the type of surgery, age, gender, body mass index, smoking history, surgical history, financial concerns, cardiac function rating, airway rating, ASA classification, difficult airway, surgical position, intubation time, suction times, choking times, agitation times, delayed awakening, endotracheal tube model suitability, use of hormonal drugs, preoperative anxiety, endotracheal tube type, and other bias factors and the independent variable "whether perioperative hypothermia occurs".

Hamilton Anxiety Scale

Hamilton Anxiety Rating Scale [6] (HAM-A) is a clinical scale used to assess an individual's level of anxiety. It consists of 14 items assessing different anxiety symptoms such as nervousness, fear, muscle tension, etc. Each item is rated on a scale of 0 to 4 and the total score ranges from 0 to 56. Higher scores indicate more severe anxiety symptoms. In this study, a HAMA score of ≥7 was defined as anxiety, and this scale is widely used in clinical assessment and research on the severity of anxiety.

Faces Visual Analog Scoring Method

The Facial Visual Analogue Scale (F-VAS) was used to assess the patient's postoperative pharyngeal pain. The F-VAS is the most commonly used unidimensional measure of pain intensity, and consists of a 100-mm straight line, with one end of the line, indicating "no pain at all" and the other end indicating "the most severe pain imaginable" or "pain to the extreme", etc. Patients are asked to mark the corresponding position on this line, and those with a score above 0 are considered to have sore throat [7]. This method is sensitive, easy to understand, and widely used in clinical research. Shown in Figure 1.

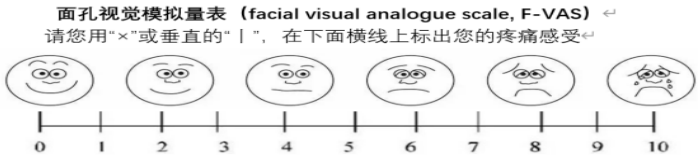

Figure 1: Facial Visual Analogue Scale (F-VAS).

Data Collection Methods

The researcher explained the purpose, method, and significance of the study to the subjects 1 d before the operation, obtained the consent and support of the subjects and their families, and signed the informed consent form. The researcher assessed the patient's medical history, the presence of preoperative sore throat, and the degree of preoperative anxiety face-to-face 1 d preoperatively by means of an oral questionnaire, and collected the general data of the respondents based on the cases and the patients' oral complaints. The data collection of IPH included the following two aspects: ①**intraoperative temperature monitoring:** a monitor was used to monitor the patient's temperature in real-time during

the operation, and the data were recorded by temperature probes or temperature sensors. ②**Postoperative temperature monitoring:** a frontal thermometer or other temperature monitoring equipment was used in the anesthesia recovery room to track postoperative body temperature. On the day of surgery, a face visual analog scale was used to assess the patient's sore throat before leaving the anesthesia recovery room after extubation.

Statistical Methods

SPSS 25.0 software was used for data entry and statistical analysis. Measurement data were expressed using mean ± standard deviation when they conformed to a normal distribution, median and quartile when they did not conform to a normal distribution, and count data were expressed as frequency, percentage, or percent. One-way analysis of POST scores and count data: t-test and ANOVA were used for normally distributed data, and rank sum test or Kruskal-Wallis H-test was used when it did not meet normal distribution. Multifactorial logistic regression analysis was used, with IPH as the main variable and other factors as covariates for corrected logistic regression analysis. Differences were considered statistically significant at $P < 0.05$.

Results

Univariate analysis of the effect of general information of general anesthesia patients on the occurrence of POST

Of the 322 POST questionnaires collected from general anesthesia patients, a total of 271 questionnaires were completed, with a completion rate of 84.16%. The gender distribution was more average, 41.70% of those aged 18 to 44, 49.50% of those with BMI between 18.5 and 24, 12.50% of those with a history of smoking and alcohol, 67.50% of those with ASA rating class II, 18.81% of those with preoperative anxiety, and 35.05% of those with IPH. Other general information is shown in Table 1.

According to whether POST occurred or not, 271 general anesthesia patients were divided into two groups, the POST group, and the non-POST group, with 112 cases in the POST group, accounting for 41.33%, and 159 cases in the non-POST group, accounting for 58.67%. The unifactorial analysis of the influence of general information on the occurrence of POST in the two groups is shown in Table 1.

Sports Event		Number of cases (N=271)	POST group (N=112)	Non-POST group (N=159)	test statistic	P-value
Type of surgery	urology	82 (30.26)	36 (32.14)	46 (28.93)	1.626	0.471
	otolaryngology	47 (17.34)	19 (16.96)	28 (17.61)		
	gastrointestinal	42 (15.50)	12 (10.71)	30 (18.87)		
	thyroid gland	27 (9.96)	11 (9.82)	16 (10.06)		
	mammary gland	14 (5.17)	6 (5.36)	8 (5.03)		
	orthopedic surgery	37 (13.65)	15 (13.39)	22 (13.84)		
	ear nose and throat	18 (6.64)	13 (11.61)	5 (3.14)		
	thoracic	2 (0.74)	0 (0.00)	2 (1.26)		
	burn	2 (0.74)	0 (0.00)	2 (1.26)		
age	18-44	113(41.70)	56 (50.00)	57 (35.85)	12.66	0.005
	45-59	73 (26.94)	30 (26.79)	43 (27.04)		
	60-74	77 (28.42)	24 (21.43)	53 (33.33)		
	74-90	8 (2.95)	2 (1.79)	6 (3.77)		
distinguishing between the sexes	male	119 (43.91)	45 (40.18)	74 (46.54)	0.959	0.327
	women	152 (56.09)	67 (59.82)	85 (53.46)		
BMI	<18.5	19 (7.01)	6 (5.36)	13 (8.18)	0.786	0.853
	≥18.5	135 (49.82)	52 (46.43)	83 (52.20)		
	≥24	77 (28.41)	37 (33.04)	40 (25.16)		
	≥27	40 (14.76)	17 (15.18)	23 (14.47)		

tobacco and alcohol history	there are	34 (12.55)	15 (13.39)	19 (11.95)	0.66	0.797
	not have	237 (87.45)	97 (86.61)	140 (88.05)		
surgical history	there are	167 (61.62)	67 (59.82)	100 (62.89)	2.199	0.138
	not have	104 (38.38)	45 (40.18)	59 (37.11)		
economic crisis	there are	10 (3.69)	3 (2.68)	7 (4.40)	1.518	0.218
	not have	261 (96.31)	109 (97.32)	152 (95.60)		
Cardiac function ratings	Class I	208 (76.75)	88 (78.57)	120 (75.47)	0.059	0.808
	Class II	63 (23.25)	24 (21.43)	39 (24.53)		
Airway Ratings	Class I	153 (56.46)	62 (55.36)	91 (57.23)	2.739	0.434
	Class II	109 (40.22)	46 (41.07)	63 (39.62)		
	Class III	7 (2.58)	31 (2.68)	4 (2.52)		
	Class IV	2 (0.74)	1 (0.89)	1 (0.63)		
ASA rating	Class I	16 (5.90)	8 (7.14)	8 (5.03)	1.508	0.68
	Class II	183 (67.53)	80 (71.43)	103 (64.78)		
	Class III	71 (26.20)	23 (20.54)	48 (30.19)		
	Class IV	1 (0.37)	1 (0.89)	0 (0.00)		
difficult airway	be	6 (2.21)	2 (1.79)	4 (2.52)	0.127	0.721
	clogged	265 (97.79)	110 (98.21)	155 (97.48)		
surgical position	supine position	236 (87.08)	98 (87.50)	138 (86.79)	3.226	0.199
	lateral position	14 (5.17)	8 (7.14)	6 (3.77)		
	truncation (medicine)	21 (7.75)	6 (5.36)	15 (9.43)		
Duration of intubation	≤1h	2 (0.74)	0 (0.00)	2 (1.26)	5.467	0.362
	1h-1h30	59 (21.77)	25 (22.32)	34 (21.38)		
	1h30-2h	86 (31.73)	39 (34.82)	47 (29.56)		
	2h-2h30	55 (20.30)	20 (17.86)	35 (22.01)		
	2h30-3h	24 (8.86)	12 (10.71)	12 (7.55)		
	≥3h	45 (16.61)	16 (14.29)	29 (18.24)		
Number of sputum aspirations	0	238 (87.82)	96 (85.71)	142 (89.31)	0.324	0.851
	≥1	27 (9.96)	12 (10.71)	15 (9.43)		
	≥2	6 (2.21)	4 (3.57)	2 (1.26)		
Number of choking coughs	0	171 (63.10)	64 (57.14)	107 (67.30)	3.64	0.457
	≥1	54 (19.93)	25 (22.32)	29 (18.24)		
	≥2	21 (7.75)	10 (8.93)	11 (6.92)		
	≥3	17 (6.27)	9 (8.04)	8 (5.03)		
	≥4	8 (2.95)	4 (3.57)	4 (2.52)		
Number of agitations	0	241 (88.93)	98 (87.50)	143 (89.94)	0.141	0.998
	≥1	14 (5.17)	6 (5.36)	8 (5.03)		
	≥2	10 (3.69)	3 (2.68)	7 (4.40)		

	≥3	4 (1.48)	3 (2.68)	1 (0.63)		
	≥4	2 (0.74)	2 (1.79)	0 (0.00)		
Delayed awakening	be	4 (1.48)	3 (2.68)	1 (0.63)	2.547	0.111
	clogged	267 (98.52)	109 (97.32)	158 (99.37)		
Whether the tracheal tube meets the	be	12 (4.43)	8 (7.14)	4 (2.52)	2.828	0.093
	clogged	259 (95.57)	104 (92.86)	155 (97.48)		
Whether or not hormones are used	be	105 (38.75)	37 (33.04)	68 (42.77)	5.009	0.025
	clogged	166 (61.25)	75 (66.96)	91 (57.23)		
Preoperative anxiety	be	51 (18.82)	28 (25.00)	23 (14.47)	7.073	0.008
	clogged	220 (81.18)	84 (75.00)	136 (85.53)		
Catheter type	Ordinary capsule	257 (94.83)	106 (94.64)	151 (94.97)	0.134	0.715
	The wire is encapsulated	14 (5.17)	6 (5.36)	8 (5.03)		
IPH	be	95 (35.06)	75 (66.96)	20 (12.58)	49.361	0
	clogged	176 (64.94)	37 (33.04)	139 (87.42)		

Table 1: Univariate analysis of the effect of general information of general anesthesia patients on the occurrence of POST [cases (percentage, %)].

Comparison of the Occurrence of POST in Patients with General Anesthesia Due to different Factors

The results of the analysis of the impact of different factors on the occurrence of POST showed that age, use of hormones, the presence of preoperative anxiety, and whether perioperative hypothermic led to POST had a significant impact, in which the association between perioperative hypothermic and POST was the most significant (P =0.000), and the results showed that See Table 2. There was a total of 112 cases of POST in patients under general anesthesia, of which a total of 37 cases of non-perioperative hypothermic POST accounted for 33.04%, and a total of 75 cases of POST accounted for 66.96%. 37 cases, accounting for 33.04%, and perioperative hypothermic POST totaled 75 cases, accounting for 66.96%. The incidence of perioperative hypothermic POST was significantly higher than the incidence of non-perioperative hypothermic POST, the difference was considered statistically significant at $P < 0.05$.

sports event		**Number of cases (N=271)**	**POST group** (N=112)	**Non-POST group (N=159)**	**Wald X^2 Value**	**P-value**
age	18-44	113(41.70)	56 (50.00)	57 (35.85)	12.075	0.005
	45-59	73 (26.94)	30 (26.79)	43 (27.04)		
	60-74	77 (28.41)	24 (21.43)	53 (33.33)		
	74-90	8 (2.95)	2 (1.79)	6 (3.77)		
Whether or not hormones are used	clogged	105(38.75)	37 (33.04)	68 (42.77)	3.745	0.025
	be	166(61.25)	75 (66.96)	91 (57.23)		
Preoperative anxiety	be	51 (18.82)	28 (25.00)	23 (14.47)	4.082	0.008
	clogged	220(81.18)	84 (75.00)	136 (85.53)		

IPH	be	95 (35.06)	75 (66.96)	20 (12.58)	69.748	0
	clogged	176(64.94)	37 (33.04)	139 (87.42)		

Table 2: Effect of different factors on the occurrence of POST in patients under general anesthesia [cases (percentage, %).

Results of Binary Logistic Regression Analysis of Factors Influencing the Occurrence of POST in General Anesthesia Patients

Outcome variable (dependent variable): whether POST occurred. Influencing factors (independent variables): factors that may influence POST, such as age, presence of hormone use, presence of preoperative anxiety, and presence of IPH. Binary logistic regression analysis was performed.

Uncorrected, age, preoperative anxiety, and IPH had a significant effect on event occurrence, with increasing age negatively correlating with the probability of POST, while preoperative anxiety and IPH significantly increased the probability of POST, and the use of hormones had a near-significant effect but did not meet the criteria for significance. The results are shown in Table 3. The regression coefficient for IPH was 2.890, indicating a strong positive correlation between IPH and the occurrence of POST. The difference was considered statistically significant at $P < 0.05$.

After correcting for age, the presence of hormones, the presence of preoperative anxiety as covariates, and IPH as the main variable, the results of the logistic regression analysis are shown in Table 4. The effect of IPH on POST was significantly strengthened, with a regression coefficient of 2.905 and an OR of 18.269 for IPH, implying that patients with IPH had approximately 18.269 times the risk of POST than those with non-IPH. The difference was considered statistically significant at $P < 0.05$.

Taken together, the effect of IPH on POST demonstrated significance both before and after correction, but the magnitude of the effect was significantly stronger after correction, suggesting that the actual effect of IPH on the risk of POST was demonstrated after correcting for possible confounders (e.g., age, the use of hormones or not, and the presence of preoperative anxiety).

norm	form	regression coefficient	standard error	Wald X^2 Value	OR value	95% CI	P-value
age		-0.643	0.185	12.075	0.153	0.366-0.755	0.001
hormone use	No hormone uses as a control	0.602	0.32	3.745	1.825	0.287-1.008	0.053
Preoperative anxiety	No preoperative anxiety as a control	0.787	0.389	4.082	0.376	1.024-4.712	0.043
IPH	Non-IPH as a control	2.89	0.346	69.748	0.055	9.129-35.433	0

Table 3: Multifactorial Logistic Regression Analysis of the Occurrence of POST after General Anesthesia (Uncorrected).

norm	form	regression coefficient	standard error	Wald X^2 Value	OR value	95% CI	P-value
age		-0.632	0.185	11.675	1.882	1.309-2.705	0.001
hormone use	No hormone uses as a control	0.601	0.332	3.274	0.548	0.286-1.051	0.07
Preoperative anxiety	No preoperative anxiety as a control	0.979	0.379	6.664	2.661	1.266-5.593	0.01
IPH	Non-IPH as a control	2.905	0.349	69.457	18.269	9.226-36.178	0

Table 4: Multifactorial Logistic Regression Analysis of the Occurrence of POST after General Anesthesia (Corrected).

Discussion

IPH Is a Risk Factor for The Development of POST In Patients Undergoing General Anesthesia

The results of this study showed that patients with IPH were significantly more likely to develop POST than patients with non-IPH, which was a risk factor for the development of POST in patients under general anesthesia. This phenomenon may be associated with IPH-induced coagulation dysfunction, decreased local immune response, slowed metabolism of anesthetic drugs, prolonged postoperative awakening time, and chills in the patients [8].

1. Coagulation dysfunction: hypothermia leads to a decrease in thrombin activity and a reduction in platelet release and aggregation, thus affecting the hemostatic process [9]. It increases the risk of postoperative bleeding, which in turn causes POST. 2. **Decreased local immune response:** hypothermia leads to decreased local immune function [10], while at the same time combining the symptoms of tracheal mucous membrane damage, pharyngeal edema and congestion during intubation, which makes the pharyngeal area prone to infection. 3. **Prolonged postoperative awakening time**: hypothermia slows down the metabolism and discharge of anesthetic drugs, leading to prolonged awakening time of the patient [11], which increases the irritation and compression time of tracheal intubation and thus exacerbates the chance of sore throat. 4. **Chills:** The rapid rhythmic contraction of the skeletal muscles in the throat pulls on the wound [12], which can aggravate the pain in the throat. The use of tramadol intramuscularly or intravenously, which can quickly stop the shivering and warm up with a heater [13], can alleviate the symptoms. These factors interact to influence the occurrence and severity of POST.

Effect of reducing IPH on decreasing the incidence of POST

Perioperative temperature management may have an important preventive role in the care of POST. According to the relevant literature [14], the active warming rate of perioperative body temperature is only 26.3%, which still needs to be further strengthened. It mainly includes the following measures:

Preoperative care: Ensure that the patient is normothermic, assess the patient's temperature and associated health status, and implement appropriate interventions. For example, pre-warming the patient appropriately prior to surgery to increase the hypothermia threshold and reduce core body temperature reduction can help prevent IPH [15-16].

Intraoperative nursing: 1. Temperature monitoring: continuously monitors the patient's body temperature to ensure that it stays within the normal range. 2. **Optimize nursing cooperation:** Optimize the process of surgical cooperation, which can help shorten the operation time and reduce the risk of hypothermia caused by prolonged exposure to the operation field. 3. **Room insulation**: the room temperature should be no less than 21℃ for adults and 23℃ for pediatrics [4]. 4. Limb insulation: minimize exposure of non-surgical areas, use sterile isolation materials to cover exposed areas to slow down evaporation and heat dissipation.5. Blood product/drug fluid warming: fluids over 1000 ML and refrigerated blood products should be warmed to 37°C or above by an intravenous infusion warmer to warm the input fluid before infusion, but blood products should not be warmed to more than 43°C [4].

Conclusions

Clinically known risk factors for triggering POST include the anesthetic tracheal intubation maneuver itself, gender, age, catheter diameter, number of suctions, and prolonged tracheal intubation. In this study, IPH was found to be one of the risk factors for POST in general anesthesia patients. Factors such as coagulation dysfunction, decreased local immune response and prolonged postoperative awakening time caused by hypothermia may exacerbate the occurrence of POST, and the incidence of POST in patients under general anesthesia can be reduced by effective perioperative temperature management.

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