Original Article

Establishment and obstacle analysis of evidence-based nursing indexes for unplanned hypothermia management in patients undergoing laparoscopic operation

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Background: This study sought to implement evidence-based nursing practices for patients undergoing laparoscopy surgery to prevent unplanned hypothermia, to develop review indicators for evidence-based nursing practices, and to analyze obstacles and contributing factors.

Methods: Using the Joanna Briggs Institute health care model as the evidence-based theoretical framework, clinical problems were identified, evidence was systematically researched, evaluated and summarized, an index and method of examination was established, and quality items were examined. According to the results of the baseline review, the obstacles and promoting factors were analyzed, and methods and countermeasures were developed.

Results: This study summarized 15 pieces of best evidence in relation to the following 5 aspects: risk assessment, body temperature monitoring, ambient temperature, passive insulation, and active insulation. There were 11 quality review indicators, only 4 of which had compliance rates of 100%. The main obstacle factors were a lack of nursing norms and operating procedures, a lack of information, and a lack of motivation among nursing staff.

Conclusions: Based on the best evidence and the professional judgment of clinical staff, the quality review index is scientific and implementable. In the application of this clinical evidence, obstacles and other factors should be solved to promote the transformation of evidence.

Keywords: Laparoscope; unplanned hypothermia; review indicators; evidence-based nursing

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Introduction

Laparoscopic technology has a number advantages, including that it results in less trauma, a quick recovery, fewer complications, and has wide indications (1). It is widely used in clinical practice, as it could evidently reduce pain and reduce length of hospital stay. However, patients undergoing laparoscopic surgery are easily affected by general anesthesia, carbon dioxide (CO_2) pneumoperitoneum, and other factors that can result in unplanned hypothermia (2). Hypothermia is defined as a core body temperature <36 ℃. In laparoscopic operation, 50–90% patients could have hypothermia (3). The risk of hypothermia is greatly increased in patients over 60 with poor physical state, low body weight, impaired thermoregulation, An American Society of Anesthesiologists

(ASA) risk class higher than I, pre-existing hypothermia before surgery, anesthesia methods, surgery time, extent and nature, and the room temperature (4). Hypothermia is very common in patients with general anesthesia. There was no evidence compared the incidence between open surgery and laparoscopic surgery. However, because of the main risk factor of hypothermia is radiation and convection induced heat loss and laparoscopic surgery has a smaller incision than open surgery, we believe hypothermia is more likely to happen in laparoscopic surgery (5). Hypothermia increases the amount of intraoperative blood loss, infection, cardiovascular diseases, and recovery time, and in serious cases, causes ventricular fibrillation, cardiac arrest, and even death (6). The guidelines for the prevention of surgical site infection by the Asia Pacific Society of Infection Control [2019] emphasize that hypothermia is a risk factor of surgical site infection (7). To decrease the occurrence of unplanned hypothermia in patients with laparoscopic operation, the evidence-based project team strictly followed the theoretical framework of the Joanna Briggs Institute (JBI) evidence-based health care model (8) and evidence-based nursing methods in previous study, and summarized the best evidence for the prevention of unplanned hypothermia in patients undergoing laparoscopic surgery (9). In our previous evidence summary, 12 studies were included and 15 pieces of evidences were identified (9). Based on these best evidences, this study identified indicators for the clinical quality of care review for the prevention of unplanned hypothermia during laparoscopic surgery, and analyzed the related obstacle and contributing factors. Obstacle factor analysis is an effect method to improve the nursing work. We can find the main problems in nursing work and ways to deal with them (10). The conclusions drawn in this study include appropriate action strategies to introduced the best evidence into clinical practice, promote the implementation of evidence-based care, and promote the continuous improvement of high-quality clinical care.

Methods

Clinical nursing question identification

According to the baseline data of our medical institution, the incidence of intraoperative hypothermia during laparoscopic surgery between April and May 2021 was 33.3%. Presently, there is no unified management process for the treatment of hypothermia during laparoscopic surgery at our medical institution. Thus, this study aimed to standardize the management of hypothermia in laparoscopic surgery and reduce the incidence of unplanned hypothermia in patients undergoing laparoscopic surgery. All the staffs signed the informed consent. This study was approved by the Ethics Committee of Suzhou Municipal Hospital (No. KL901269). The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Establishment of a research team

Establishment of an evidence-based project team

The evidence-based team comprised 13 members, including 1 supervisor of evidence-based nursing from the Evidence-based Nursing Center of Fudan University and 12 clinical staff. The nursing center tutor served as the general consultant for the project and was responsible for guiding the project. The clinical staff included 1 director of nursing, who was responsible for supervising the progress of the project, 1 head nurse of surgery, who was responsible for overall planning and coordination, 1 head nurse, who served as the project leader, 2 chief physicians, who were responsible for project coordination and implementation, 7 nursing staff (3 of whom had engaged in evidence-based nursing at the Center of Fudan University, who were responsible for the quality control, coordination, and design of the project, the review of the indicators, and the data analysis, 2 nurses, who were responsible for the whole evidence summary process, evaluation and reform implementation, and 2 nurses who were responsible for data collection and analysis).

Establishment expert panel

The expert panel in this study comprised 10 members, including 3 clinicians (all of whom held a master's degree; 2 chief physicians, and 1 attending physician), 7 nurses (1 of whom held a master's degree, and 6 of whom held under graduate degrees; 1 of whom was a nurse, and 6 of whom were in-charge nurses), who had worked from 4 to 26 (13.20±2.11) years.

Literature retrieval

In accordance with the "6S" evidence model (11), computer

evidence retrieval was carried out from top to bottom. The databases searched included BMJ Best Practice, Up To Date, Cochrane Library, JBI International Collaborating Center for Evidence-based Health Care Library, Guidelines International Network, National Institute for Health and Care Excellence (NICE), Scottish Intercollegiate Guidelines Network (SIGN), Medline, PubMed, Embase, Web of Science, CNKI, Wanfang Database, CQVIP. The following Chinese search keywords were used: "Laparoscopic/minimally invasive/endoscope", "Perioperative/perioperative period/intraoperative", and "hypothermia/hypothermy". The following English search keywords were used: "laparoscope/laparoscopic/minimal invasive/endoscope/endoscopy", "perioperative/peri-operative/intraoperative", and "hypothermia". The search period was limited to the date of database establishment to April 2021. Twelve articles were retrieved, including 1 guideline (12), 2 evidence summaries (13,14), 1 expert consensus (15), 6 systematic evaluations (16-21), and 2 randomized controlled trials (RCTs) (22,23). Initially, we collected and retrieved 15 pieces of evidence.

Evaluate and summarize the best evidence

The corresponding evaluation criteria for quality evaluation was selected based on the literature type. The Appraisal of Guidelines for Research and Evaluation Instrument (AGREE II) was used as the quality evaluation standard (24). The CASE evaluation list was adopted for the evaluation and summary of the evidence (25). The quality evaluation tool of the JBI (2016 edition) (26) was used to evaluate the expert consensus. Assessment of Multiple Systematic Review (AMSTAR) was used for the systematic evaluation (27). The authenticity evaluation of the RCTs was conducted using the authenticity and quality evaluation RCT tool [2016] of the Australian JBI Evidence-based Health Care Center (28). The risk of bias in the RCTs was evaluated using the Cochrane Risk Assessment Checklist of Bias [2011] (29). The Australian JBI Evidence-based Health Care Center Evidence Recommendation Level System (2014 version) (30) was used to classify all the included evidence, and the following summary of 15 pieces of evidence was produced:

(I) Predictors scores can be used to assess the risk of intraoperative hypothermia in patients undergoing laparoscopic surgery (grade B recommendation);
(II) Patients at low risk of hypothermia may be provided with passive thermal insulation and warm flushing solutions (grade B recommendation);
(III) Patients at high risk of hypothermia may be provided with forced air heating devices, liquid heating, and other active insulation measures (grade B recommendation);
(IV) The following temperature sites should be monitored: tympanic membrane, bladder, pulmonary artery, nasopharynx and esophagus (grade B recommended);
(V) Before the induction of anesthesia, the patient's temperature must be measured and recorded, and then measured every 30 minutes until the end of the procedure (grade B recommendation);
(VI) The ambient temperature should be maintained at least 21 ℃, and the room temperature could be reduced after establishing active heating (grade A recommendation);
(VII) Passive insulation should be provided by quilts, blankets, or surgical sheets to keep warm (grade A recommendation);
(VIII) Forced air heating is recommended (grade B recommendation);
(IX) The temperature of the forced air heater can be set to the maximum and then adjusted to patient temperature (at least 36.5 ℃) (grade B recommendation);
(X) An inflatable lithotomy blanket can be used for lithotomy laparoscopic surgery (grade B recommendation);
(XI) Inflatable upper body blankets can be used for lateral recumbent endoscopic surgery (grade B recommendation);
(XII) A heated and humidified CO_2 pneumoperitoneum can be used (grade B recommended);
(XIII) During laparoscopic operation, peritoneal flushing fluid could be warmed to 38–40 ℃ before use (grade A recommendation);
(XIV) Intravenous fluids or blood products could be warmed to 37 ℃ with a heating device rather than being removed from a heating cabinet (grade B recommendation); and
(XV) Intraoperative intravenous infusion of amino acids can be used for insulation (grade B recommendation).

Table 1 Clinical review indicators and review methods

Evaluation item	Clinical evaluation indicator	Evaluation methods
System (n=4)	1. A perioperative hypothermia risk scale is available in the department (predictors scale)	On-site checking
	2. The department has a perioperative hypothermia management process	On-site checking
	3. The department has enough inflatable thermometers and maintenance records	On-site checking
	4. The department has adequate ear temperature gun equipment	On-site checking
Medical staff (n=40)	5. Nurses have knowledge of hypothermia prevention and management	Questionnaire
	6. Predictors scores are used to correctly assess the risk of hypothermia in laparoscopic patients before surgery	On-site checking
	7. Proper insulation measures based on surgical risk are provided. Specifically:	On-site questions and views
	(I) Low-risk patients are provided with passive thermal insulation and lukewarm rinse solution (risk probability ≤70%)	
	(II) Medium-risk patients are provided with passive insulation and warm rinse solution and a warm blanket (70%< risk probability <80%)	
	(III) High-risk patients are provided with passive insulation and warm rinse solution and a warm blanket and warmed CO_2 pneumoperitoneum (risk probability ≥80%)	
	8. Intraoperative temperature monitoring is undertaken	On-site checking
	9. The patient's body temperature is measured and recorded with an ear thermometer before the induction of anesthesia	On-site checking
	10. An ambient temperature not less than 21 ℃ is maintained, and the operating room temperature is adjusted after establishing active heating	On-site checking
	11. The correct heating blanket model is selected. Specifically:	On-site checking
	(I) An inflatable lithotomy blanket in lithotomy laparoscopic surgery is used	
	(II) Inflatable upper body heating blankets in lateral decubitus endoscopic surgery are used	

Develop clinical obstacle factors and conduct baseline reviews

The principal of the project team organized the expert group members to conduct a feasibility, appropriateness, meaningfulness, effectiveness (FAME) evidence evaluation. They analyzed the 15 recommendations and formulated 11 corresponding obstacle factors (*Table 1*).

Statistical analysis

The data was recorded with Excel. The compliance rates were calculated by Excel.

Results

Baseline evaluation results

In June 2021, a total of 40 operating room staff from Suzhou Municipal Hospital (35 operating room nurses and 5 anesthesiologists) were selected as baseline subjects, and their implementation of the evidence-based indicators for the prevention of unplanned hypothermia in patients undergoing laparoscopic operation was evaluated. A total of 10 indicators were examined, among which only 4 indicators (1, 3, 4, and 10) had 100% compliance rates; indicators 2, 5, 6, 7, 8, 9, and 11 had compliance rates of 0%, 42.2%, 19.3%, 40.7%, 70.1%, 10.3%, and 87.2%, respectively. Thus, there was a large gap between the evidence and practice as represented by the clinical indicators.

Analysis method of obstacle factors

According to the Ottawa Model of Research Use (31), the team members discussed the implementation rate of baseline review indicators item by item, comprehensively analyzed obstacles to the process of evidence application and

formulated corresponding countermeasures (*Table 2*).

Evaluation results after reformation

In July 2021, 1 month after the change of evidence-based practice, a total of 40 operating room medical staff (35 operating room nurses and 5 anesthesiologists) were selected as the objects to evaluate their implementation of the indicators for the prevention of unplanned hypothermia in patients undergoing laparoscopic surgery. A total of 11 items were examined, among which the compliance rate for indicators 1, 2, 3, 4, 5, 8, 10 was 100%, and the compliance rate for indicators 6, 7, 9, 11 was 98.7%, 90.3%, 92.1%, 97.6%, respectively. The incidence of unplanned hypothermia in patients undergoing laparoscopic surgery decreased from 33.3% to 10.2%. In conclusion, the incidence of unplanned hypothermia in patients undergoing laparoscopic surgery was greatly reduced following the implementation of the evidence-based practice changes.

Discussion

To accurately establish the evaluation indicators for the prevention of unplanned hypothermia in patients undergoing laparoscopic surgery and serve as the basis of evidence application

The development of clinical evaluation indicators is a process of improving patient outcomes by reducing the gap between baseline surveys and evidence, promoting practice change, and continuously driving quality improvement. In building evaluation indicators: (I) a score needs to be able to be calculated for each evaluation indicator (e.g., an accuracy and execution rate); (II) the evaluation method needs to be effective, sensitive and intuitive; (III) the subject of review should include people involved in each functional level. The censor shall record and collect data from time to time.

Evidence of the unplanned prevention of hypothermia in patients undergoing laparoscopic surgery was used to analyze obstacle factors

The analysis of obstacle factors should be scientific, rigorous, and feasible. In this study, indicator 1 was that the department has predictor scores for the probability of perioperative hypothermia, but the scores were not perfect, and corresponding treatment measures were lacking. The department has revised the predictor scoring table, developed corresponding thermal insulation measures according to the scoring range, and will conduct centralized training for operating room nurses. Indicator 2 of this study was that the department lacked a perioperative hypothermia management process. Thus, a laparoscopic hypothermia management process has been developed based on evidence and the actual situation of the department (*Figure 1*). In relation to Indicators 3, 4 and 11, the department was short of side decubitus heating blankets and ear heating gun equipment. After communicating with the procurement center, we have introduced side decubitus heating blankets and added 2 ear heating guns. Indicator 5 of this study was that due to the lack of relevant training on hypothermia knowledge in the department, nurses with junior experience and those recently transferred to the operating room lacked awareness of the harm of hypothermia to patients. In this department, operating room nurses will now be regularly trained in hypothermia prevention, and theoretical assessments will be conducted regularly. Questions about hypothermia prevention have now been added to and will be included in the assessment every Tuesday and Thursday morning. Indicator 6 required the scanning a two-dimensional code for scoring. The operation turnover is fast, and the workload of operating room nurses is heavy, so it is impossible to score all laparoscopic patients. To address this issue, visiting nurses must calculate the predictor scores instead of the preoperative preparation room nurses, calculate and record scan scores for laparoscopic surgery patients, and directly implement corresponding measures according to the scoring results. For indicator 7, the review team will supervise and examine the measures taken by visiting nurses for patients with hypothermia during surgery from time to time and included them in the assessment. Indicator 8 showed that the correct location and depth of the nasopharyngeal temperature probe used to monitor body temperature must be the distance from the nose tip to the earlobe of the patient. Due to the lack of standardized operation training for anesthesiologists, the correct position and depth of the nasopharyngeal temperature probe will be demonstrated to anesthesiologists during the morning meeting. For indicator 9, the nurses in the preoperative preparation room will use ear guns to measure and record the temperature of patients undergoing laparoscopic

Table 2 Analysis of obstacles and promotion factors

Evaluation indicators	Evidence-based reform		Potential adopters		Practical environment	
	Obstacle factors	Promotion factors	Obstacle factors	Promotion factors	Obstacle factors	Promotion factors
Indicators 1–4	(I) A lack of high-quality process studies	(I) Affiliated hospital and teaching hospital of Southern Medical University. The library has sufficient database resources to facilitate information retrieval	(I) Operating room nurses lack evidence-based knowledge and acceptance is low	(I) The nursing department supports the project	No relevant process information is available in the department	(I) The department has a place for training
	(II) The application of this process increases the workload of potential adopters	(II) After the process is formulated, the audit process of the members of the evidence-based group will be rigorous	(II) The project team lacks experience in evidence transformation	(II) The department has sent 3 people to continue to study the evidence-based program		(II) Training will be provided on procedures and equipment related to hypothermia at weekly morning or monthly meetings
	(III) The predictor rating scale lacks corresponding treatment measures					
Indicators 5–11	(I) The acceptance of the intervention process needs to be improved	(I) The department has a public account platform that can publish the evidence content and implement the methods for learning in a timely manner	(I) Nurses with low seniority lack awareness of the harm of hypothermia to patients	(I) 97.2% of nurses hold a bachelor's degree or above, with solid basic knowledge, find it easy to accept new things and work in a positive learning atmosphere	(I) Lack of training and assessment of knowledge related to hypothermia in nurses with specialized training	(I) The evidence-based thinking and evidence transformation process will be reported and discussed in the department meeting, and questions will be answered on the spot
	(II) The number of temperature measurements needs to be increased	(II) After the reform, the evidence system will be complete and the flow chart clear	(II) Nurses with low seniority account for 48.4% of the department who lack knowledge of and experience with hypothermia The anesthesiologist has poor execution	(II) Senior nurses in the department have a higher degree of identification with evidence	(II) The application atmosphere for evidence transformation in the department is generally not good	(II) Doctors and nurses will work closely together to promote the change of evidence

Table 2 (*continued*)

Table 2 (*continued*)

Evaluation indicators	Evidence-based reform		Potential adopters		Practical environment	
	Obstacle factors	Promotion factors	Obstacle factors	Promotion factors	Obstacle factors	Promotion factors
				(III) The director of anesthesiology will be consulted and communicated with to increase understanding and cooperation	(III) The implementation of evidence requires the cooperation of anesthesiologists, which increases the difficulty of management	(III) The manager will support the application of equipment and materials
					(IV) The heating blanket model is not complete	
Countermeasures	(I) Develop standardized procedures for the prevention of unplanned hypothermia in patients undergoing laparoscopic surgery based on the best evidence and prioritize related training		(I) Predictors will be scored for the patients undergoing laparoscopic surgery by nurses in the preoperative preparation room, and the temperature of patients undergoing laparoscopic surgery will be measured and recorded with an ear temperature gun to reduce the workload of itinerant nurses		(I) The department has applied for 2 ear temperature guns	
	(II) Strengthen the training and assessment of knowledge related to hypothermia		(II) Anesthesiologists will be trained in the proper placement and depth of the nasopharyngeal temperature probe		(II) The department has introduced the lateral decubitus heating blanket	
	(III) Strengthen the training of evidence-based knowledge and improve the evidence-based ability of operating room nurses		(III) Nurses with low experience will be trained in hypothermia-related knowledge, including the assessment of theoretical knowledge and operational skills		(III) The documents related to hypothermia management have been perfected and will be kept in the office for study	
	(IV) Revise the predictor rating table and develop corresponding thermal insulation measures according to the scoring range				(IV) The official account platform regularly will send relevant content	

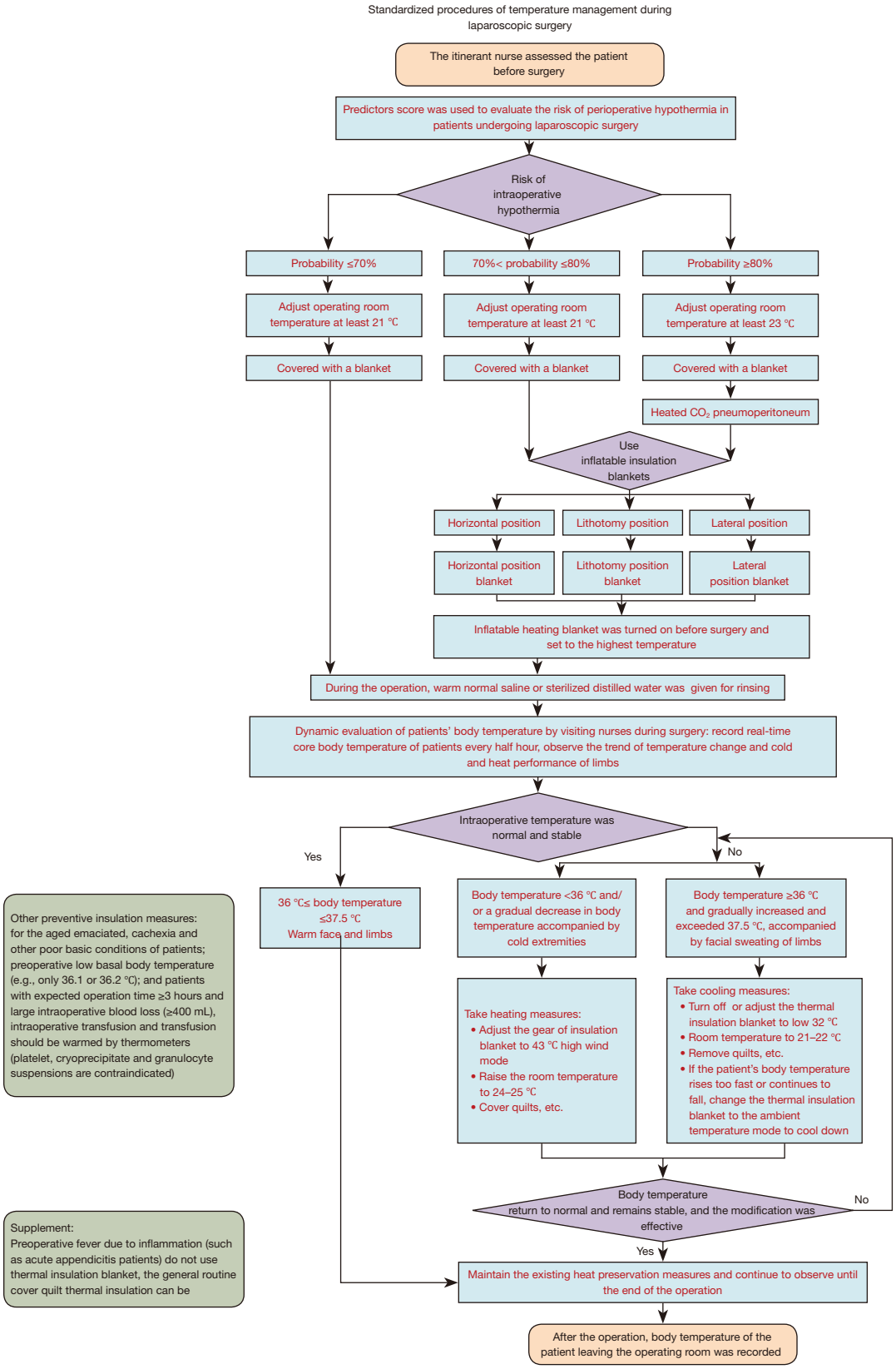

Figure 1 Laparoscopic hypothermia management process.

surgery. This will not only solve the problem of insufficient equipment but will also reduce the workload of itinerant nurses. Indicator 11 revealed that the preoperative itinerant nurses were unsure about the positions of some laparoscopic surgeries, as they did not have enough confidence in the selection of heating blanket models. The specialist team has prepared a mind map of various positions in the operating room and will conduct centralized training in the department meeting.

Conclusions

In this study, an evidence-based approach was developed to review indicators for the prevention of unplanned hypothermia during laparoscopic surgery. The 11 evidences played an important role in reducing the incidence of hypothermia in laparoscopic surgery. However, a large gap was found between the status quo and the evidence. Narrowing the gap between evidence and status quo is important to prevent hypothermia in laparoscopic surgery. At present, the biggest obstacles are the formulation of a temperature management process and the heavy workload of traveling nurses. Targeted intervention measures have been proposed to effectively shorten the gap between the evidence and clinical practice. At present, this practice of evidence transformation has only been applied in one hospital with a small number of participants and has a small scope. The formulation of countermeasures needs to be further verified by clinical work. The analysis of obstacle factors is a dynamic and continuous process. Further monitoring of practical applications must be undertaken to provide corresponding countermeasures to promote the transformation of evidence into clinical practice.

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Footnote

Data Sharing Statement: Available at https://gs.amegroups.com/article/view/10.21037/gs-22-23/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://gs.amegroups.com/article/view/10.21037/gs-22-23/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). All the staffs signed the informed consent. This study was approved by the Ethical committee of Suzhou Municipal Hospital (No. KL901269).

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