



Perioperative Temperature Monitoring and Patient Warming: A Survey Study

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Objective: Hypothermia is defined as the decrease of core body temperature under 36°C. Hypothermia is observed at a rate of 50-90% in the perioperative period. In our study, we aimed to measure the perception of hypothermia in our country, to evaluate the measures taken by physicians to intercept hypothermia, to determine the frequency and the methods used to monitor body temperature and the techniques used in warming the patients. Another aim was to develop a guideline for preventing perioperative hypothermia.

Methods: The questionnaire consisted of 26 multiple-choice questions. The time needed to answer the questions was 8-10 minutes.

Results: Of the 1380 individuals, 312 (22.6%) answered the questions in the questionnaire. Of these, 148 (47.4%) declared they were working in university hospitals, 80 (25.6%) in training and research hospitals, 51 (16.4%) in government hospitals and 33 (10.6%) in various private hospitals. Of the 312 individuals, 134 (42.9%) were specialists, 107 (34.3%) were resident physicians, 71 (22.8%) were academics. In addition, 212 (67.9%) reported working in operating rooms, 49 (15.7%) in intensive care units and 42 (13.5%) both in operating rooms and intensive care units. In the answers, there was variation among the hospital types in applications of body temperature monitoring and warming the patient. Another finding was that the individuals had different approaches to the concepts on perioperative hypothermia and its consequences.

Conclusion: The perceptions of physicians and the allied health personnel in government and private hospitals should be enhanced by informing them about the passive and active heating systems to prevent hypothermia. Although the situation in university and training and research hospitals seems to be better, defects are still observed in practice. Preparation of a national guideline for prevention of perioperative hypothermia is needed.

Key Words: Perioperative care, hypothermia, survey

Introduction

Hypothermia is defined as the lowering of the core body temperature below 36°C. The frequency of perioperative hypothermia is 50-90% (1). Perioperative hypothermia, especially in operations exceeding half an hour and those occurring in patients in the high risk group lead to important complications. It causes prolongation of the effects of anaesthetic drugs and the duration of patient recovery, and increases the risk for complications like coagulopathy, respiratory and cardiovascular system depression, and surgical site infections. (1, 2). Risk of perioperative hypothermia is increased in patients with an ASA score higher than II, in those over 70 years of age, the newborns, and the patients with a concomitant disease (3, 4). The nature and duration of the surgical procedure, ambient temperature, the amount of intravenous fluids, blood and blood products used, the duration of mechanical ventilation and body temperature of the patient before anaesthesia induction, are the determinants of risk for perioperative hypothermia (2-5). Perioperative hypothermia, which underlie numerous complications that increase the morbidity and mortality, and that increase the duration of hospital stay and costs, is a condition that needs to be prevented, but has not been completely solved yet.

When the articles published until now has been reviewed, it was observed that approximately only 10 to 13 of 800 articles published were randomized, clinical, prospective trials. There are no common guidelines for the prevention of management of perioperative hypothermia that is used worldwide. Countries such as England and Germany use their national guidelines.

There exist no guidelines for the prevention of perioperative hypothermia commonly used in the hospitals in Turkey yet. In this present study, we aimed to measure the perception of perioperative hypothermia in our country, to determine the measures taken by the physicians on this issue, to determine the frequency and the route of body temperature measurement, and patient warming methods. Another aim of this study was to determine whether a guideline is required for preventing perioperative hypothermia according to the results obtained in the present study.

Methods

The present study was performed with İstanbul University Cerrahpaşa Medical School, Hospital Ethics Committee approval (Document No. 36050, Date: 18.10.2012). The questionnaire, prepared by two researchers (GMK and YD), is presented in Table 1. The questionnaire consists of a total of 26 multiple-choice questions. The physicians were to answer the questions in 8-10 minutes. A total of 1500 questionnaire forms were prepared for this survey study and permission was obtained from the Administrative Board of the Turkish Anaesthesiology and Reanimation Society to distribute the questionnaire forms to 1380 anaesthetists, who participated in the national congress performed in 2012 in Northern Cyprus. The physicians who participated in the congress were physicians working in the university, training and research, government and private hospitals.

Statistical analysis

The answers of the physicians to the survey questions are presented as numbers and percentages. Cross tabulation and the Chi-square test were used to compare the differences between the answers of the physicians with different educational levels about the concepts related to perioperative hypothermia and patient warming, and the differences between different types of hospitals regarding body temperature monitoring and perioperative warming applications. Bonferroni correction was used for post-hoc pair-wise comparisons between the groups. In the statistical analysis, a *p* value <0.05 was considered to be significant.

Results

Overall 312 (22.6%) of 1380 participants answered the questions and returned the questionnaire forms back. Among 312 physicians, 148 (47.4%) of them stated that they were working in university hospitals, 80 (2.6%) in training and research hospitals, 51 (16.4%) in government hospitals and 33 (10.6%) in various private hospitals. Out of 312 participants 134 (42.9%) were specialists, 107 (34.3%) resident physicians and 71 (22.8%) of them were academics. Of the participants, 212 (67.9%) of them stated that they were working in operating rooms, 49 (15.7%) in intensive care units and 42 (13.5%) both in intensive care units and operating rooms. The remaining 9 (2.9%) physicians indicated their place of work as "other". Overall 189 (60.6%) of the participants stated that the optimum operating room tempera-

ture should be 21-24°C, 109 (34.9%) 19-20°C and 14 (4.5%) 17-18°C.

Overall, 280 (89.7%) of 312 participants answered the question "What is perioperative hypothermia?" as body temperature below 36°C, 24 (7.7%) of them as body temperature below 37.5°C and 8 (2.6%) of them stated that perioperative hypothermia is the body being cold. The answers to the question "According to you, what part of the body is suitable to obtain the most accurate body temperature (the best site showing the core temperature)?" were oesophagus (n= 121, 38.8%), tympanic membrane (n= 69; 22.1%), urinary bladder (n= 47, 15.1%), pulmonary artery (n= 69, 22.1%), and skin (n= 6, 1.9%). The question "According to you, what should be the body temperature of the patient to be transferred from the recovery unit to the ward bed?" was answered as "36°C" by 193 (61.9%) of the participants and "above 37°C" by 98 (31.4%). Seven (2.2%) participants stated that the temperature was not important, and the remaining 14 (4.5%) participants did not answer this question. "Do you warm your patients in the perioperative period" question was answered as yes sometimes by 195 (62.5%) participants, yes always by 90 (28.9%) of them, and as no by 21 (6.7%) of the participants, and 6 (1.9%) physicians did not answer this question. The question "What are the methods that you use for patient warming during surgery?" was answered as forced-air warming devices by 132 (42.3%), increasing the ambient temperature by 68 (21.8%), warming the intravenous fluids by 41 (13.1%), electrical blankets by 39 (12.5%) and hot water bags by 25 (8.1%) and, 7 (2.2%) of the participants did not give an answer to this question.

The comparison of the answers of the participants about temperature monitoring and warming applications according to the hospitals they worked and the comparison of the approaches of the participants about the concepts about perioperative hypothermia and its consequences according to the positions of the physicians are presented in Table 2, Table 3 and Table 4.

Discussion

One of the most important reasons for perioperative hypothermia is the impairment of autonomic thermoregulation by the drugs used during anaesthesia. By impairment of thermoregulation, the temperature threshold for vasoconstriction changes, core to peripheral heat loss begins and continues until the equalization of the core and peripheral temperatures. This is called internal redistribution. After that, peripheral temperature shifts towards the ambient temperature. This cycle continues until vasoconstriction develops. Mild hypothermia develops as vasoconstriction occurs under anaesthesia

The prevention of perioperative hypothermia is an issue emphasized all over the world, as is in Turkey. A guideline on this subject is needed to be prepared in our country. Before preparing the guideline, the first step was to perform a survey study aimed at measuring the knowledge, attention and perceptions of an-

Table 1. Survey questions

PERIOPERATIVE HYPOTHERMIA QUESTIONNAIRE					
<i>Dear colleague, this questionnaire is aimed to understand the knowledge and applications of the anaesthetists about perioperative temperature management. At the most 10 minutes is required to answer the 14 questions of this questionnaire. Thank you very much for sparing your valuable time.</i>					
1- The type of hospital you work					
a) Education and research hospital b) Private hospital c) Government hospital d) University hospital					
2- What is your position in the hospital?					
a) Resident physician b) Specialist c) Academics d) other _____					
3- At which part of the hospital do you work?					
a) Intensive care unit b) Operating room c) other _____					
4- What should be the optimum ambient temperature in the place you work?					
a) 17-18°C b) 19-20°C c) 21-24°C					
5- According to you, what is perioperative hypothermia?					
a) Body temperature <37.5°C b) The body being cold c) Body temperature <36°C					
6- How often do you measure the body temperature of the patient in the operating room?					
a) Continuously monitored b) At 5 minute intervals c) At 15 minute intervals d) At 30 minute intervals e) Never					
7- How often do you measure the body temperature of the patient in the recovery unit?					
a) Continuously monitored b) At 5 minute intervals c) At 15 minute intervals d) At 30 minute intervals e) Never					
8- If you measure the body temperature, what is the measurement site you frequently use?					
a) Tympanic membrane b) Oesophagus c) Urinary bladder d) Rectum e) Axilla					
9- According to you, which of the following is the site giving the most accurate measurement of body temperature (the site showing the most accurate measurement of core temperature)?					
a) Tympanic membrane b) Oesophagus c) Urinary bladder d) Skin e) Pulmonary artery					
10- According to you, what should be the body temperature of the patient for transporting the patient from the recovery unit to the ward bed?					
a) Body temperature is not important b) 37.5°C c) 36°C					
11- Do you warm up the patients in the perioperative period?					
a) Yes, always b) Yes, sometimes c) No					
12- Which of the following do you use for warming the patient during surgery (you may choose more than one option)					
<input type="checkbox"/> Increase the ambient temperature <input type="checkbox"/> Hot water bags <input type="checkbox"/> Electrical blanket <input type="checkbox"/> Forced-air warming systems <input type="checkbox"/> Warming of the intravenous fluids					
13- What are the available heating techniques in the place you work? Are they sufficient in number and efficacy?					
14- Please state your opinion about the following by marking the alternatives ranging between “I certainly agree” and “I certainly disagree”					
	I Certainly disagree	I disagree	I don't have information on this subject	I agree	I Certainly agree
Perioperative hypothermia is an important problem for all patients	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Risk of hypothermia during surgery increases with the increase in ASA score	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medium and major surgeries carry a risk of hypothermia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia risk increases in combined general and regional anaesthesia application	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Operating room temperature is very important for the comfortable work of the surgical team	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perioperative hypothermia impairs drug metabolism	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Perioperative hypothermia prolongs the recovery period	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia increases oxygen requirement during surgery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia increases oxygen requirement during recovery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia increases the amount of bleeding during surgery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypothermia increases the risk for wound infection after surgery	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Anaesthesia induction should not be performed until the body temperature of the patient is 36°C.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Rapidly administered fluids and blood products should be warmed to 37°C	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Warming should be applied in all interventions exceeding thirty minutes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 2. The approaches of the participants to statements regarding hypothermia

	No answer n (%)	I Certainly disagree n (%)	I disagree n (%)	I don't have information n (%)	I agree n (%)	I Certainly agree n (%)
Perioperative hypothermia is an important problem for all patients. n (312)	13 (4.3)	2 (0.7)	25 (7.5)	0	94 (30.3)	178 (57.2)
Risk of hypothermia increases with the increase in ASA score	118 (38)	9 (2.6)	4 (1.3)	28 (9.0)	78 (25.1)	75 (24.0)
Risk of hypothermia increases in medium and major surgeries	6 (1.9)	3 (1.0)	4 (1.3)	0	96 (30.7)	203 (65.1)
Hypothermia risk increases in combined general and regional anaesthesia application	15 (4.8)	0	55 (17.6)	45 (14.4)	118 (37.9)	79 (25.3)
Operating room temperature is very important for the comfortable work of the surgical team	2 (0.8)	65 (20.1)	0	10 (3.2)	167 (53.3)	68 (21.2)
Perioperative hypothermia impairs drug metabolism	11 (3.6)	0	6 (1.7)	5 (1.6)	120 (38.7)	170 (54.4)
Perioperative hypothermia prolongs the recovery period	26 (8.2)	4 (1.3)	4 (1.3)	2 (0.6)	66 (21.1)	210 (67.5)
Hypothermia increases oxygen consumption during surgery	20 (6.4)	9 (2.9)	28 (9.0)	16 (5.1)	92 (29.5)	147 (47.1)
Hypothermia increases the amount of bleeding during surgery	13 (4.2)	55 (17.3)	25 (8.0)	50 (16.0)	80 (25.6)	89 (28.8)
Hypothermia increases the risk for wound infection	11 (3.5)	56 (17.9)	19 (6.1)	76 (24.4)	70 (22.4)	80 (25.6)

Table 3. Temperature monitoring and patient warming applications according to the hospital types the participants worked

		Government hospitals n (%)	Training and research hospitals n (%)	Private hospitals n (%)	University hospitals n (%)	p
The most frequent site for body temperature measurements (n=253)	Axilla	23 (62.2)	32 (50.0)	6 (26.1) ^{a***}	33 (25.6)	0.001
	Oesophagus	9 (24.3) ^a	26 (40.6)	6 (26.1)	52 (40.3) ^{***}	0.001
	Rectal	1 (2.7)	1 (1.56)	1 (4.4)	9 (7.0)	-
	Urinary bladder	0	1 (1.6)	3 (13.0)	2 (1.5)	-
	Tympanic	4 (10.8)	4 (6.3) ^a	7 (30.4)	33 (25.6) ^{***}	0.001
How often do you measure the body temperature of the patient in the recovery unit (n=309)	Never	40 (80.0)	51 (67.1)	22 (68.8) ^a	103 (69.2) ^{***}	0.001
	At 15 minutes	0	11 (12.6)	6 (18.8)	6 (4.2)	-
	At 30 minutes	2 (4.0)	2 (1.4)	0	25 (17.2)	-
	At 5 minutes	4 (8.0)	6 (8.8)	0	7 (4.7)	-
	Continuously monitored	4 (8.0)	9 (10.1)	4 (12.4)	7 (4.7)	-
How often do you measure the body temperature of the patient in the operating room? (n=312)	Never	39 (76.5) ^a	45 (56.3)	15 (45.5) ^a	52 (35.1) ^{***}	0.001
	At 15 minutes	1 (2.0)	6 (7.5)	1 (3.0)	7 (4.4)	-
	At 30 minutes	3 (5.9)	7 (8.7)	2 (6.1)	9 (6.0)	-
	At 5 minutes	0	1 (1.3)	1 (3.0)	1 (0.6)	-
	Continuously monitored	8 (15.6) ^a	21 (26.2) ^a	14 (42.4)	79 (53.9) ^{***}	0.001

^ap<0.05 The source of the difference according to Bonferroni correction
^{***}p<0.001

anaesthesia and intensive care physicians. Among the 1308 physicians 312 of them answered the questionnaire and returned the form back.

Literature search performed before preparation of the questionnaire revealed no survey study on this subject.

Most of the participants were from university hospitals, and physicians working in operating rooms. According to these data, it may be suggested that, probably younger specialists working in the university hospitals, especially in the operating room are much more sensitive about patient body temperature and patient warming.

Table 4. The approaches of the participants to statements about hypothermia according to their positions in the hospital

		I Certainly disagree n (%)	I disagree n (%)	I don't have information n (%)	I agree n (%)	I Certainly agree n (%)	p
Perioperative hypothermia is an important problem for all patients (n=299)	Academics (n=67)	0	7 (9.7)	0	17 (25.4)	43 (64.9)**	0.001
	Specialist (n=125)	1 (0.8)	10 (8.0)	1 (0.8) ^a	38 (30.4)	75 (60.0)*	0.05
	Resident physician (n=98)	0 ^a	7 (7.2)	1 (1.0)	37 (37.7)	53 (54.1)*	0.05
	Other (n=9)	1 (11.2)	2 (22.2)	0	2 (22.2)	4 (44.4)	-
Hypothermia risk increases in combined general and regional anaesthesia application (n=297)	Academics (n=65)	0 ^a	11 (16.9)	1 (1.5)	30 (46.2)***	23 (35.4)	0.001
	Specialist (n=126)	2 (1.6) ^a	30 (23.8)	16 (12.7)	47 (37.3)***	31 (24.6)	0.001
	Resident physician (n=97)	2 (2.1)	14 (14.5)	25 (25.8)	33 (34.1)	23 (23.5)	-
	Other (n=9)	1 (11.1)	0	1 (11.1)	5 (55.5)	2 (22.3)	-
Perioperative hypothermia prolongs the duration of recovery (n=302)	Academics (n=67)	1 (1.5)	0	0	14 (20.9)	52 (77.6)***	0.01
	Specialist (n=125)	2 (1.6)	23 (1.6)	0 ^a	21 (16.2)	79 (63.8)**	0.01
	Resident physician (n=100)	1 (1)	0 ^a	2 (2)	71 (71)***	26 (26)	0.001
	Other (n=9)	1 (11.2)	0	1 (11.1)	4 (44.4)	3 (33.3)	-
Hypothermia increases oxygen requirement during recovery (n=299)	Academics (n=67)	1 (1.5)	5 (7.7)	0 ^a	17 (24.6)	44 (66.2)*	0.05
	Specialist (n=125)	3 (2.5) ^a	11 (8.4)	6 (5.0)	39 (30.8)	66 (53.3)*	0.05
	Resident physician (n=98)	4 (4.0)	12 (12.3)	10 (10.2)	37 (37.8)	35 (35.7)	-
	Other (n=9)	1 (11.2)	1 (11.1)	0	2 (22.2)	5 (55.5)	-
Hypothermia increases the amount of bleeding during surgery (n=299)	Academics (n=67)	2 (3.1) ^a	12 (17.3)	7 (10.9)	13 (20.3)	33 (48.4)**	0.01
	Specialist (n=125)	12 (9.6) ^a	33 (26.4)	15 (12.0)	27 (21.6)	38 (30.4)**	0.01
	Resident physician (n=98)	11 (11)	37 (37.7)**	26 (27.8)	14 (14.4)	9 (9.1) ^a	0.01
	Other (n=9)	1 (11.2)	2 (22.2)	3 (33.3)	1 (11.1)	2 (22.2)	-
Hypothermia increases the risk for wound site infection after surgery (n=299)	Academics (n=67)	3 (4.6) ^a	6 (9.2)	12 (16.9)	18 (26.2)	28 (43.1)*	0.05
	Specialist (n=125)	6(4.8) ^a	22 (17.5)	35 (28.6)*	29 (22.9)	33 (26.2)	0.05
	Resident physician (n=98)	9 (8.9) ^a	26 (26.8)	27 (27.8)*	20 (20.9)	16 (15.6)	0.05
	Other (n=9)	1 (11.2)	1 (11.1)	1 (11.1)	3 (33.3)	3 (33.3)	-

^ap<.005 The source of the difference according to Bonferroni correction

*p<0.05, **p<0.01, ***p<0.001

Majority of the participants marked the optimum ambient temperature as 21-24°C. Most of the participants gave the correct answer, below 36°C, to the question "What is perioperative hypothermia?" When the answers to these two questions are evaluated, it was observed that although the definition of hypothermia was known, the necessity of assessing ambient temperature for the prevention of hypothermia was ignored. Also, majority of the participants stated that they had never measured the body temperature of the patients in the recovery unit. When this answer was evaluated together with the answer to the previous question, it is evident that perioperative hypothermia risk was accepted, however sufficient monitoring was not carried out for prevention and sufficient ambient temperature was not attained.

While axillary region was the mostly used site in body temperature measurements, the site showing the closest value to core temperature was indicated as oesophagus. The necessary body

temperature for the transport of the patient to the ward bed was mostly answered as 36°C. The group who stated that they warm their patients answered the question as "yes sometimes". Risk of hypothermia increases with the increase in ASA scores, and more than half of the participants replied that they certainly agreed to the question "Does hypothermia risk increase in medium to major surgeries?" This shows us that although the participants have knowledge on perioperative hypothermia and patient warming, there are deficiencies in application.

Approximately half of the participants marked that they used forced air warming systems for patient warming, however some of them indicated that they used hot water bags. In the studies on patient warming, the recommended methods are forced air warming systems and electrical resistive blankets. Hot water bags are not recommended as warming methods as they may lead to burn injuries (6-8).

Besides, it was observed that patient warming methods showed significant differences according to hospital types. This shows that, different type of hospitals have different facilities.

The participants who agreed that hypothermia risk was increased by the combined use of general and regional anaesthesia were more than those who were absolutely certain about this issue. This is indeed an intriguing result. It is known that regional blocks lead to a decrease in the temperature via vasodilatation (1). However, approximately ¼ of the participants expressed that they did not agree with this opinion or stated that they did not have knowledge on this subject.

It was accepted by the majority of the participants that perioperative hypothermia impair drug metabolism, prolong recovery period, and increase oxygen consumption in the operating room and recovery unit. However, the necessity of the regulation of ambient temperature of the operating room to allow better working conditions for the surgical team had a very high acceptance rate. Whereas, the opinion that perioperative hypothermia increase bleeding was accepted by less than half of the participants. This may result from a false perception. It can be thought that hypothermia-induced vasoconstriction decrease bleeding. However, the reason for bleeding in hypothermia can be shortly summarized as dysfunction of coagulation factors and platelets, and increase in blood viscosity (2, 3).

Not a few of the participants stated that they had no information about the fact that hypothermia increases the risk for wound infection after surgery. When we review the answers, it can be said that there is a lack of knowledge on this subject. Impaired perfusion associated with hypothermia, besides impairing the healing of the wound, increases the risk of infection (1).

Less than half of the participants agreed the statement that body temperature should be above 36°C before anaesthesia induction, a similar percentage of the participants indicated that they did not agree with this idea and they did not have information on this subject. These answers may be interpreted, as the belief that hypothermia can only occur intraoperatively is common. However, perianesthesia period starts 1 hour before anaesthesia induction. In order to prevent internal redistribution rapidly developed by the impairment of thermoregulation system, core and peripheral temperatures should be equalized. It may be very difficult or even impossible to prevent heat loss in patients with low body temperature during anaesthesia induction (5, 9).

While more than half of the participants agreed with the idea that intravenous fluids, blood and blood products administered to patients should be warmed, a very few of the participants replied that they used fluid warming devices to the question "what do you use for warming the fluids? According to this, it can be concluded that this method is not used due to either the difficulty of this warming technique or the necessity of additional technical facilities or the perception that it is not important in practice.

Nearly half of the participants looked positively on the idea that warming should be applied in all interventions exceeding thirty minutes. Again, while half of the participants agreed with the necessity of perioperative warming of the patients, more than half of them stated that hypothermia risk increases in medium and major surgeries. When these answers are evaluated together, it can be seen that although they corroborate each other, those that apply intraoperative warming constitute only near a half of the participants. A small proportion of the participants believed that patients need not be warmed. Although the participants stated that medium and major surgeries increase the risk for hypothermia, a lower percentage of the participants agreed with the idea that patients should be warmed in surgeries exceeding 30 minutes. The fact that medium and major surgeries take more than 30 minutes should not be forgotten.

When the answers were compared according to the education levels of the participants, it can be seen that the answers of the academics and the specialists were more accurate. Regarding the statements on hypothermia and warming, the answers marked by the specialists were more accurate.

When the answers were compared according to the hospital types the participants worked, it can be said that those working in university hospitals and training and research hospitals are more sensitive about perioperative hypothermia and patient warming. Private hospitals were the last at the rank. This might be attributed to the fact that fewer medium and major surgeries are performed in private hospitals.

Conclusion

It is obvious that there is a necessity of preparing a guideline for the prevention of perioperative hypothermia at the national level. The physicians and the allied health personnel in government hospitals and private hospitals should be informed about passive and active warming techniques used to prevent perioperative hypothermia and their perception of perioperative hypothermia should be increased. Although the situation seems to be better in the university and training and research hospitals, it is observed that there are still deficiencies in practice.

Conflict of Interest

No conflict of interest was declared by the authors.

Peer-review: Externally peer-reviewed.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of İstanbul University Cerrahpaşa Faculty of Medicine (18.10.2012, 36050).

Author Contributions

Concept - G.M.K., Y.D., FA.; Design - G.M.K., Y.D., T.U.; Supervision - Y.D., FA.; Data Collection and/or Processing - E.E., B.E., E.S., H.A., FA.; Analysis and/or Interpretation - G.M.K., Y.D., T.U., Ç.T., E.E., B.E., FA.; Literature Review - G.M.K., FA., H.A., E.S., Ç.T.; Writer - G.M.K., Y.D., E.E.; Critical Review - Y.D., FA.

References

1. Frank SM, Tran KM, Fleisher LA, Elrahmany HK. Clinical importance of body temperature in the surgical patient. *J Thermal Biol* 2000; 25: 151-5. [\[CrossRef\]](#)
2. Fossum S, Hays J, Henson MM. A comparison study on the effects of prewarming patients in the outpatient surgery setting. *J Perianesth Nurs* 2001; 16: 187-94. [\[CrossRef\]](#)
3. Bräuer A, Quintel M. Forced-air warming: technology, physical background and practical aspects. *Curr Opin Anaesthesiol* 2009; 22: 769-74. [\[CrossRef\]](#)
4. Taniguchi Y, Lenhardt R, Sessler DI, Kurz A. The effect of altering skin-surface cooling speeds on vasoconstriction and shivering thresholds. *Anesth Analg* 2011; 113: 540-4.
5. Hart SR, Bordes B, Hart J, Corsino D, Harmon D. Unintended perioperative hypothermia. *Ochsner J* 2011; 11: 259-70.
6. Bräuer A, Bovenschulte H, Perl T, Zink W, English MJ, Quintel M. What determines the efficacy of forced-air warming systems? A manikin evaluation with upper body blankets. *Anesth Analg* 2009; 108: 192-8. [\[CrossRef\]](#)
7. Matsuzaki Y, Matsukawa T, Ohki K, Yamamoto Y, Nakamura M, Oshibuchi T. Warming by resistive heating maintains perioperative normothermia as well as forced air heating. *Br J Anaesth* 2003; 90: 689-91. [\[CrossRef\]](#)
8. Pikus E, Hooper VD. Postoperative rewarming: are there alternatives to warm hospital blankets. *J Perianesth Nurs* 2010; 25: 11-23. [\[CrossRef\]](#)
9. Developed by the National Collaborating Centre for Nursing and Supportive Care. The management of inadvertent perioperative hypothermia in adults. NICE Clinical Guideline 65, National Institute for Health and Clinical Excellence, April 2008. ISBN: 1-84629-687-0.