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Impacts of perioperative warming on vital findings and blood parameters of patients having cholecystectomy

Kolesistektomili hastalarda perioperatif ısıtmanın vital bulgular ve kan parametreleri üzerine etkisi

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ABSTRACT

This study was carried out to determine the effects of preoperative, preoperative, and postoperative warming on vital signs and blood parameters in patients undergoing laparoscopic cholecystectomy.

This study was carried out in operating room A of a research and practice hospital. Necessary permissions were obtained from the university research ethics committee, hospital, and patients. Eighty patients who had undergone medical operations in the hospital in the last six months were included in the sampling method. Body temperatures and physiological findings of the patients and room temperature were also given as percentages. Repeated measurements of variance and t-test evaluated postoperative physiological results of each patient.

The average body temperature of the patients was 36.36+ 2.81Â°C, and the average body temperature after the operation was 36.33+ 2.80Â°C ($p > 0.05$). The mean arterial pressure (MAP) of the patients before the operation was 102.64+11.529 mm Hg. The mean arterial pressure of the patients in the recovery room after the operation was 98.55+ 9.940. During the operation, the MAP was between 96 and 98 Hg. There was a significant difference in terms of the mean arterial pressure of the patients ($p < 0.05$). The average hemoglobin, lymphocyte, platelet counts, activated partial thromboplastin time levels, and values were within the normal range, and there was a significant difference in terms of importance and levels before and after the operation ($p < 0.05$). The average preoperative, preoperative and postoperative blood urea nitrogen (BUN) values of the patients were 13.79+ 6.126, 13.70+6.752, and 13.52+7.637, respectively. They were within the normal range, and there was no statistical difference ($p > 0.05$).

As a result, it can be said that keeping the preoperative, preoperative, and postoperative body temperatures of the patients positively affects blood pressure, respiration, and oxygenation and help to normalize these values. In addition, it keeps erythrocyte, hemoglobin, leukocytes, lymphocytes, thrombocyte, APTT, BUN, AST, ALT values within the normal range. It contributes positively to the healing process of the wound. In order to increase the accuracy of this study, it is recommended to conduct studies that include more control and experimental groups.

Keywords: Hypotermia, heating, cholecystectomy, laboratory findings.

ÖZET

Bu araştırma laparoskopik kolesistektomi uygulanan hastalarda preoperatif, preoperatif ve postoperatif ısınmanın yaşamsal bulgular ve kan parametreleri üzerine etkisini belirlemek amacıyla yapıldı.

Bu çalışma bir araştırma ve uygulama hastanesinin A ameliyathanesinde gerçekleştirildi. Üniversite araştırma etik kurulundan, hastaneden ve hastalardan gerekli izinler alındı. Son altı ayda hastanede tıbbi operasyon geçiren 80 hasta örnekleme yöntemi ile örneklemeye alındı. Hastaların vücut sıcaklıkları ve fizyolojik bulguları ile oda sıcaklığı da yüzde olarak verildi. Her hastanın ameliyat sonrası fizyolojik bulguları tekrarlayan ölçümlerde varyans ve t testi ile değerlendirildi.

Hastaların ortalama vücut ısısı 36.36+ 2.81Â°C ve operasyon sonrası ortalama vücut ısısı 36.33+ 2.80Â°C idi (p >0.05). Hastaların operasyon öncesi ortalama arter basıncı (MAP) 102.64+11.529 mmHg iken, operasyon sonrası derlenme odasındaki ortalama arter basıncı 98.55+9.940 olarak bulundu. Operasyon sırasında MAP 96 ile 98 Hg arasındaydı. Hastaların ortalama arter basıncı açısından anlamlı fark vardı (p<0.05). Ortalama hemoglobin, lenfosit, trombosit sayıları, Aktive Parsiyel Tromboplastin Zamanı düzeyleri ve değerleri normal aralıktaydı ve operasyon öncesi ve sonrası değerler ve düzeyler açısından anlamlı fark vardı (p < 0.05). Hastaların sadece ameliyat öncesi, ameliyat öncesi ve ameliyat sonrası ortalama kan üre nitrojen (BUN) değerleri sırasıyla 13.79+ 6.126, 13.70+6.752 ve 13.52+7.637 idi. Normal sınırlar içindeydiler ve istatistiksel olarak fark yoktu (p>0.05).

Sonuç olarak, hastaların preoperatif, preoperatif ve postoperatif vücut sıcaklıklarının sabit tutulmasının kan basıncı, solunum ve oksijenasyonu olumlu yönde etkilemesine ve bu değerlerin normalleşmesine yardımcı olduğu söylenebilir. Ayrıca eritrosit, hemoglobin, lökosit, lenfosit, trombosit, APTT, BUN, AST, ALT değerlerini normal değer aralığında tutar ve yaranın iyileşme sürecine olumlu katkıda bulunur. Bu çalışmanın doğruluk oranını artırmak için daha çok kontrol grubu ve deney grubu içeren çalışmaların yapılması önerilmektedir.

Anahtar kelimeler: Hipotermi, ısıtma, kolesistektomi, laboratuvar sonuçları.

INTRODUCTION

Hypothermia might, especially during and after general anaesthesia, result in excessive blood loss, which can, in return, necessitate blood transfusion and cause platelet function disorder. Blood parameters can, for that reason, change; patients can experience increased wound infection; oxygenation of the wound site can be prevented; wound healing can be longer; cardiac rhythm can change; pulse rate can change; myocardial ischemia can be experienced; and bradycardia and death might occur. Respiratory functions can be impaired; peripheral blood flow can increase pulmonary vascular resistance and oxygen demand can increase; CO2 excretion can be difficult; glomerular filtration rate, intestinal motility and peristalsis can slow down; stress hormones can be affected adversely; blood sugar can be affected; liver is adversely affected and drug toxicity might occur; brain blood flow can decrease; changes in consciousness, proteinuria and albuminuria can occur; and patients might need to stay in hospital more (1-10).

Since unintended postoperative hypothermia (the state in which body temperature is less than 36 degrees) is caused by the negative impact of anaesthetic drugs, which are used for a long period of time during operations, on body temperature, it is necessary to rewarm the body of a hypothermic patient in order to minimise potential complications (11).

Although hypothermia usually affects patients physiologically in long-term surgeries, patients are also affected by hypothermia in minimally invasive abdominal surgeries like laparoscopic procedures. In this respect, according to two studies focusing on heating the gases used in laparoscopic minimally invasive abdominal surgeries, it is recommended to give wet and warmed gases to adult patients (12).

It is important that, before, during and after a surgery, nurses giving care to patients should check patients' body temperatures, control loss of heat after anaesthesia and diagnose potential systematic problems that might occur as a result of loss of heat. Nurses should take precautions to protect patients' body temperatures, to warm their patients, to prevent loss of heat in the periphery of patients such as head and feet, to help patients to get dressed before and after a surgery and to cover patients with thermal insulation covers. By evaluating blood and fluid temperatures during and after an operation, nurses should help maintain patient normothermia (13).

In the research, it has been found that active warming, compared to heated cotton blankets, shortens the average time required to provide normothermia; however, a meaningful significant difference has not been observed. It has been found that active warming, compared to unheated cotton blankets, reduces the average time required to provide normothermia by up to one and half hours and that persons in the active warming group tend to shiver less than those in the unheated cotton blanket group. It has also been observed that hot air blowing systems, compared to systems circulating hot water, reduce the average time required to provide normothermia by approximately an hour. No statistical difference has been observed between cotton blankets and thermal insulation covers in terms of providing normothermia or reducing shivering, and no data has been found for cardiovascular complications or mean temperature differences.

In particular, it has clinically been reported that hot air blowing systems shorten the average time required to provide normothermia in patients with postoperative hypothermia. However, it has also been reported that no reliable or meaningful data has been

found about some clinical cases. Considering these, it is not clear whether active warming is beneficial or harmful. Highly reliable data on warming method is not either available. No clear result has, for that reason, been reached regarding the effects of other warming methods. However, it is a well-known fact that patients are negatively affected by hypothermia and that warming patients is a necessity (11).

This quasi-experimental study has been conducted in order to find the impacts of perioperative, intraoperative and postoperative warming on vital findings and blood parameters of patients having laparoscopic cholecystectomy. In this context, in accordance with the purposes stated, the accuracy of the following hypotheses has been aimed to be determined.

MATERIAL and METHOD

This research is quasi-experimental study. The research data were collected from the Research and Application Centre at XXX between 1 October 2017 and 31 March 2018. According to the data obtained from the archive section of the Research and Application Centre at XXX Centre, 100 patients underwent laparoscopic gallbladder surgery. All the patients, who were between 40 and 65 and accepted to be part of the study, were included in this study. The population of the study included patients who were planned to undergo gallbladder surgery with laparoscopy in the Research and Application Centre Operating Room at XXX. By using the sample calculation formula, 80 patients were included in the sample of the study. In this calculation, the population of the study was 100, and the level of reliability of the research was %95. The following formula was taken into account while calculating the sample.

Socio-demographic data, operation duration, operating room temperature, physiological findings about pre-warming, intra-warming and post-warming were collected by means of registration forms. These forms were prepared through a detailed search of the literature. Through the socio-demographical data form, information about the following questions was collected: name and surname of patient; participant number; age of patient; operation duration; type of anaesthesia; type of surgery; operating room temperature; duration of anaesthesia; temperature of solutions used (IV solutions, washing solutions, blood transfusion); duration of hunger before operation; duration of air blowing system application; duration of awakening following anaesthesia; shivering after operation; perioperative and postoperative complications; types of complications (haemorrhage, urinary tract infections, acute renal failure, pneumonia, wound infection, pulmonary atelectasis, systemic sepsis, mortality and so on); and duration of postoperative stay in the hospital.

Perioperative physiological changes in the patient; laboratory findings in the registration form; perioperative physiological values; body temperature; blood pressure; mean arterial pressure (MAP); pulse rate; respiratory rate; oxygen saturation; Glasgow coma scale; and room temperature were evaluated. Laboratory findings, haemoglobin (Hb), erythrocyte (KK), leukocyte (WBC), bleeding time, blood urea nitrogen values (BUN) were also evaluated. During the operation, physiological changes in the patient; laboratory findings in the registration form; physiological changes in the 0th, 15th and 30th minutes of the operation; blood pressure; MAP; pulse rate; respiratory rate; oxygen saturation; body temperature; and room temperature were monitored.

Laboratory findings, haemoglobin (Hb), erythrocyte (KK), leukocyte (WBC), lymphocyte, platelet (PLT), alanine aminotransferase (ALT), aspartate aminotransferase (AST), bleeding time, blood urea nitrogen values (BUN) were also monitored. Laboratory findings, hemoglobin (Hb), erythrocyte (KK), leukocyte (WBC), lymphocyte, platelet (PLT), alanine aminotransferase (ALT), aspartate aminotransferase (AST), bleeding time, blood urea nitrogen values (BUN) were recorded. The variables of the research: the independent variable was warming, while the dependent variables of the research were vital findings (blood pressure, pulse, respiration, saturation) and blood parameters (Hb, erythroid, leukocyte, lymphocyte, BUN, AST, ALT, bleeding time and APTT).

Those with congestive heart disease, intestinal inflammation like ulcerative colitis, hypo or hyperthyroidism, respiratory, kidney, liver and pancreatic failures, and bile tumor were not included in the research, which is among the limitations of the research. Since it was thought that the current status of those patients would negatively affect physiological parameters, those patients were excluded.

The official permission for the research was obtained from the Clinical Research Ethics Committee (Protocol Bo: 2.2016.03, date 21.10.2016) of XXX University and from the Chief Physician of the Research and Application Centre at XXXX Hospital, XXX University. Before starting the research, in order to show that there were no ethical issues or problems, necessary permissions were obtained from the patients and from the Chief Physician of the Research and Application Centre at XXX Hospital, XXX.

The objective and process of the research were explained to the patients who accepted to be part of the research, and the written consent forms regarding the voluntary participation of the patients in the research were also collected. Patients were informed about that, if they agreed to participate in the research, their perioperative, intraoperative and postoperative physiological results such as tension values and respiratory, pulse and blood rates would be recorded. The patients were also informed about that the research aimed to find out the impacts of intraoperative warming and that their treatment process would not be affected at all. The research process flow chart was

as in Figure 1. In order to maintain their body temperatures, the patients were covered with warm towels and blankets before the operation. During the operation, IV infusion and irrigation fluids were kept at 37 degrees. No blood transfusion was performed during the operation. The perioperative and intraoperative operating room temperature was kept at 21 degrees.

Statistical analysis

In the evaluation of the research data, all the socio-demographic data were given in percentages. Body temperature, physiological findings and room temperature were given in percentages. Room temperature and the perioperative body temperature and physiological findings of each patient were evaluated by using variance and t test. Exact p-value is $p<0.05$. Software of statistical analysis was statistical package for the Social Sciences (SPSS) Statistics V22.

RESULTS

The average age of the patients was 52.18 + 12.64 (min: 30, max: 72). %60 of them were women. All the patients underwent anaesthesia and laparoscopic cholecystectomy. There was a patient who developed a complication (bleeding) during the operation, and that patient was not included in the sample. The body mass index of %50 of the patients was normal; only %3.8 of the patients had a low body mass index. All the patients were warmed through the use of hot air blowing system during the operation, and the average duration of the operation was 74.55 +23.40 minute (min: 40, max:120). The average duration of general anaesthesia was 56.17+23.46 minute (min:20, max:128). Some drugs and fluids such as Propofol 2 mg / kg, Esmeron 0.6 mg / kg, Fenatanil 1mcgr / kg, Aritmal 0.5 mg / kg, Ultiva infusion (0.01-0.05 mvgr / kg) were used for general anaesthesia. IV infusion fluids and other irrigation fluid delivered to the patients during the operation were kept at 37 degrees, and no blood transfusion was performed. The perioperative room temperature was 21.21+0.38°C (min:20, max:22). The operating room temperature during the operation was 21.45 +0.52 °C (min:20, max: 22). The perioperative body temperature was 36.33+0.294 °C (min: 36, max:37). The duration of the postoperative awakening of the patients was 9.06 +2.76 (min: 4, max:16). When the shivering conditions of the patients were examined, it was found that there was no patient who was shaking in the wake-up room (Table 1).

Table 1: Evaluation of socio-demographical data.

Socio-Demographical Data		Number	Percentage (%)
Age		52.18 ± 12.64 (min: 40, max: 72)	
Gender	Female	48	60
	Male	32	40
Mass Body Index	Normal	40	50
	Fat	37	46.3
	Thin	3	3.7
Duration of Operation (Those warmed through hot air blowing system during operation)		74.55 ±23.40 minute (min: 40,max:120)	
Average temperature of IV Infusion fluid		Kept at 37 °C	
Intraoperative Temperature of Irrigation Fluids		Kept at 37 °C	
Temperature of Blood Transfusion		Not Performed	
Perioperative Operating Room Temperature		21.21± 0.38 °C (min:20, max:22)	
Intraoperative Operating Room Temperature		21,45 ± 0.52 °C (min:20, max: 22)	
Perioperative Body Temperature of Patients		36.33± 0.294°C (min: 36,max:37)	
Duration of Postoperative Awakening		9.06 ± 2.76 (min: 4, max:16)	
Postoperative Shivering		No Patient Shivered After Operation	

All the infusion fluids delivered to the patients were kept at 37°C. The patients were warmed through hot air blowing system during the operation. The room temperature was 21 degrees. No shivering was observed before and after the operation. The perioperative body temperature of the patients was 36.36+2.81°C (min:35.8, max:37.1), while their postoperative body temperatures were similar 36.33+ 0.294°C (min: 36, max:37). The results of the variance analysis on repeated measures showed that there was no significant difference among the perioperative, intraoperative and postoperative body temperatures of the patients ($p=0,640$, $p>0.05$). The mean arterial pressure (MAP) value of the patients was 102.64+11.529 mm Hg (min:83, max: 142), while it was 98.55+ 9.940 (min:68, max:134) in the wake-up room. During the operation, the mean arterial pressure value was between 96 and 98 Hg. The results of the variance analysis on repeated measures showed

that there was a significant difference among the average arterial pressures (p=0.007, p<0.05). The average perioperative pulse rate of the patients was 85.55+12.064 minute (min:56, max: 120). It was 84.90 + 9.850 minute (min:56, max: 108) in the wake-up room. In the 5th, 15th and 30th minutes of the operation, the pulse rates of the patients were 82 and 84 per minute. The results of the variance analysis on repeated measures showed that there was no significant different among all the pulse rates of the patients (p=0,064, p >0.05). The perioperative respiratory rate of the patients was 17.55+1.645 minute (min:13, max: 20). During the operation, the patients were intubated in continuous mandatory ventilation (CMV) mode. After the operation, the patients were conscious in the wake-up room, and their average respiratory rate was 17.38+1.610 minute (min:12, max: 20). According to the results of the independent t-test, there was no significant difference among all the respiratory rates of the patients (p=0,424, p>0.05). The oxygen saturation rate of the patients was %96.73+2.06 (min:88, max:100). During the operation, the patients were intubated. The postoperative oxygen saturation rate was %96.73+1.559 (min:90, max:99). According to the results of the independent t-test, there was no significant difference among the oxygen saturation rates of the patients (p=0,424, p>0.05) (Table 2).

Table 2: An evaluation of vital findings (VF) of patients before, during and after operation.

Vital findings and room temperature	Preoperative VF of patients	VF of patients in the 5th minute of the operation	VF of patients in the 15th minute of the operation	VF of patients in the 30th minute of the operation	Postoperative VF of patients at wake-up room
Body Temperature	36.36± 2.81°C (min:35.8, max:37.1)	36.34± 2.292 °C (min:35.7, max:37.)	36.37±3.02°C (min:35.8, max:37)	36.36±3.35 °C (min:34.8, max:37)	36.33± 2.80°C (min:35.8, max:37.2)
		p=0,640	p >0.05	F =0,562	
Shivering	No	No	No	No	No
Room Temperature	21,45 ± 0.52 C (min:20, max: 22)	21,45 ± 0.52 C (min:20, max: 22)	21.36± 0.490 C (min:20, max: 23)	21.26±0.381 (min:21, max: 23)	21.26±0.381 (min:21, max: 23)
	(All infusion fluids delivered to patients were kept warm at 37°C)				
Blood Pressure Mean Arterial Pressure (MAP)	102.64±11.529 mm Hg (min:83, max: 142)	98.49±13.86 mmHg (min:37, max: 151)	98.00± 11.342 mmHg (min:58, max: 130)	96.23±10.447 (min:62, max: 135)	98.55± 9.940 (min:68, max: 134)
		p=0.007	p <0.05	F=3.913	
Pulse Rate	85.55±12.064 min (min:56, max: 120)	84.15±11.624 min(min:42, max: 118)	84.14±10.820 min (min:52, max: 117)	82.16±10.457 min (min:54, max: 102)	84.90 ± 9.850 min (min:56, max: 108)
		p=0,064	p >0.05	F =2.358	
Respiratory Rate	17.55± 1.645 min (min:13, max: 20)	Intubated - CMV mode*	Intubated - CMV mode*	Intubated - CMV mode*	17.38±1.610 min (min:12, max: 20)
		p=0,424	p >0.05	t =0,562	
Oxygen Saturation	%96.73±2.06 (min:88, max:100)	Intubated - CMV mode*	Intubated - CMV mode*	Intubated - CMV mode*	%96.73±1.559 (min:90,max:9)
		p=0,424	p >0.05	t=0,323	

The evaluation of the perioperative and postoperative body temperatures and blood parameters of the patients was given in Table 3. Before and after the operation, the patients were warmed, and there was no significant difference among the perioperative and postoperative body temperatures of the patients (p=0,452, p>0.05). The perioperative haemoglobin level of the patients was 13,31+1.613 gr/dL (min: 10, max:16), while the postoperative haemoglobin level of the patients was 12.57+1.699 gr/dL (min:9, max:15,9). This was the normal haemoglobin level, and there was no significant difference among the haemoglobin values (p=0.000, p<0.05). The perioperative erythrocyte level of the patients was 4.66+0.601million/µL (min: 4, max:6), while the postoperative erythrocyte level of the patients was

4.527+0.634 million/μL (min:3.22, max:6.28). There was a significant difference among the erythrocyte levels (p=0.000, p <0.05). During the operation, the erythrocyte level was lower, but it still within the normal value range. The perioperative and postoperative leukocyte counts of the patients were successively 8.05+1.744 mm^3 (min:4, max:11), 8.05+1.701 mm3 (min: 4.34, max: 11.32), 8. 13+1.600 mm^3 (min: 4.46, max: 11.12). There was no significant difference among the leukocyte counts, and the leukocyte counts were within the normal count range (p=0.420, p >0.05). The perioperative lymphocyte value of the patients was .32+0.926 mm^3 (min:1, max:5), while the postoperative lymphocyte value of the patients was 2.19+0.895 mm^3 (min:1, max:5). There was a significant difference among the lymphocyte values, and they were within the normal value range (p=0.017, p<0.05). The perioperative platelet count of the patients was 245.06 mm^3 (min:139, max:422), while the postoperative platelet count of the patients was 222.50 mm^3 (min:117, max:555). This was within the normal count range, and there was a statistically significant difference among the platelet counts (p=0.000, p<0.05). The perioperative blood urea nitrogen (BUN) value of the patients having laparoscopic bile duct surgery was 13.79+6.126 (min:6, max:36), while it was 13.52+7.637 (min:6, max:55) after the operation. It was within the normal value range, and there was no statistically significant difference among the blood urea nitrogen values (p=0.497, p>0.05). The perioperative activity partial thromboplastin time (APTT) of the patients was 30.16+4.201 (min:21, max:55), while it was 29.48+4.029 (min:20, max:56) after the operation. The values were within the normal range, and there was a statistically important difference (p=0.000, p<0.05). The perioperative and postoperative aspartate aminotransferase (AST) values of the patients were within the normal range. During the operation, the aspartate aminotransferase (AST) values of the patients were 30.16+4.201 (min:21, max:55), 29.48+4.029 (min:20, max:56). There was no statistically difference among them (p=0.470, p>0.05). During the operation, alanine aminotransferase (ALT) values of the patients were 29.97+18.840 (min:11, max:94), 28.78+17.000 (min:11, max:90). They were within the normal range, and there was no statistically significant difference (p=0.645, p>0.05) (Table 3).

Table 3: Body temperature and blood values of patients before, during and after operation.

Body temperature and blood values	**Before operation**	**After operation**	**t value**	**P value**
Body temperature	36.36±2.81°C (min:35.8,max:37.1)	36.33± 2.80°C (min:35.8, max:37.2)	0.756	0,452 p>0.05
Haemoglobin	13,30±1.613 gr/dl (min: 10, max:16)	12.57±1.699 gr/dl (min:9, max:15,9)	6.404	**0.000 p<0.05***
Erythrocyte	4.66±0.601million/μL (min: 4,max:6)	4.527±0.634 million/μL (min:3.22,max:6.28)	3.837	**0.000 p<0.05***
Leukocyte	8.05±1.744 mm^3 (min:4,max:11)	8. 13±1.600 mm^3 (min: 4.46,max: 11.12)	0.811	0.420 p>0.05
Lymphocyte	2.32±0.926 mm^3 (min:1,max:5)	2.19±0.895 mm^3 (min:1,max:5)	2.27	**0.017 p<0.05***
Platelet	245.06 mm^3 (min:139,max:422)	222.50 mm^3 (min:117,max:555)	4.074	**0.000 p<0.05***
BUN	13.79± 6.126 (min:6,max:36)	13.52±7.637 (min:6,max:55)	0.692	0.497 p>0.05
APTT	30.16±4.201 (min:21,max:55)	29.48±4.029 (min:20,max:56)	5.031	**0.000 p<0.05***
ALT	35±20.979 (min:9,max:99)	35.35±21.237 (min:11,max:97)	0.464	0.645 p>0.05
AST	29.97±18.840 (min:11,max:94)	28.78±17.000 (min:11,max:90)	0.728	0.470 p>0.05
Body temperature and blood values	**Before Operation**	**After Operation**	**t value**	**P value**

Blood Urea Nitrogen (BUN), Activated Partial Thromboplastin Time (APTT), Alanine aminotransferase (ALT) Aspartate aminotransferase (AST)

DISCUSSION

Postoperative body temperature of patients drops and patients, subsequently, experience hypothermia because anaesthetic agents affects hypothalamus which controls body temperature, patients need to wear surgical clothing which is not thick, temperature of operating room is lower than an average room temperature and fluids delivered to patients in an operating room are not warmed (11,13,14). Therefore, in this research, the perioperative, intraoperative and postoperative body temperatures of the patients were aimed to be protected through hot air blowing system. Those patients who were warmed during the operation were at a constant normthermic level. Due to minimal blood loss and hydration during the operation, the perioperative body temperature of the patients was 36.36 °C, while the postoperative body temperature was 36.33 °C, which means the body temperatures of the patients were protected. Besides, the perioperative, intraoperative and postoperative room temperatures of the patients were between 21.45 and 21.26 degrees. All the fluids were warmed up to 37 °C and then delivered to the patients. All of the interventions which were not used in a typical laparoscopically performed bile duct surgery were performed and benefited in this research.

The blood pressure values of the patients were given as mean arterial pressure (MAP). The average perioperative MAP value was 102.64. Considering the recent studies in the literature, the fear of surgery, as an adaptation of anxiety and stress towards surgery, might have increased the reaction of the sympathetic nervous system (15). After the operation started and the patients underwent general anaesthesia, the MAP value of the patients was 98.49 mm Hg in the 5th minute of the operation while it was 98.00 mm Hg in the 15th minute and 96.23 mm Hg in the 30th minute. In the wake-up room, the MAP value was 98.55 mm Hg. The patients were warmed before, during and after the operation and did not shiver after the operation. The MAP values of the patients remained within physiological limits since patient normothermia was maintained. It was thought that warming the patients positively contributed to this process. The pulse rate of the patients was 85.55/minute before the operation. After the operation started and the patients underwent general anaesthesia, it was 84.15 in the 5th minute, 84.14 in the 15th minute and 82.16 in the 30th minute. In the wake-up room, the pulse rate was 84.80/minute. During the operation, the pulse rate of the patients was within the normal physiological limit. There was no significant difference among the repeated measures ($p>0.05$). It was thought that warming the patients, preventing blood loss and warming fluids and keeping them at 37 degrees positively contributed to the process in which the pulse rates of the patients did not change even after the anaesthesia. Hypothermia increases the release of noradrenaline, which causes peripheral vasoconstriction and, therefore, hypertension, and the pulse rate is adversely affected (14,16). It is thought that patients will be protected from hypertension and the pulse rate will be within its normal range when body temperature is kept in its normal range (17). It can be said that there is a similarity between the results in the relevant literature and the pulse values in this study.

Respiratory value of the patients having laparoscopic bile duct surgery were 17.55/minute preoperatively and 17.38/minute postoperatively, and the oxygen saturation rate was %96.73 before and after the surgery. There was no significant difference between these values before and after the surgery. Kiley et al in their book, states that respiratory rates of patients decreases and even stops when they experience hypothermia, which is, indeed, a scientific fact. In this study, the respiratory patterns of the patients were preserved since they did not experience hypothermia (18). The patients had normal respiratory and oxygenation rates before and after the operation. This study, therefore, has similarities with the results of the research of Stocks and et al. All the patients were warmed through air blowing system, and their body temperatures were kept at 36 degrees before and after the operation.

The preoperative haemoglobin value of the patients was 13.31, while it was 12.96 in the 15th minute of the operation. The postoperative haemoglobin value of the patients was 12.57. In addition, the preoperative erythrocyte value of the patients was 4.66 while it was 4.65 in the 15th minute of the operation. The postoperative erythrocyte value of the patients was 4.52. It was thought that such small changes in these values might be related to minimal bleeding and hydration given to the patients during the surgery. According to these findings, it can be said that warming patients prevents haemoglobin and erythrocyte values from deceasing below the normal range. According to a study carried out by Karkout, et al., hemodilution given to patients during an operation reduces haemoglobin level (19). Besides, Barkun et al. report that erythrocyte and haemoglobin values of patients with bleeding decreases progressively (20). It is clear that the haemoglobin and erythrocyte values given in both studies decrease with the effect of bleeding or dilution, which supports the findings of our research. Keeping body temperature within a normal range might also prevent the decrease of these values.

The preoperative leukocyte value of the patients was 8.05, while it was 8.05 in the 15th minute of the operation. It was 8.13 in the wake-up room. The lymphocyte value was 2.32, 2.13 and 2.19 during the operation. Reduction in the activity of enzymes in hypothermia prolongs the inflammatory process in the wound. The healing time of the wound is prolonged. The susceptibility to infection increases. The number of leukocytes increases in infection and inflammation. In our study, the leukocyte and lymphocyte values of the patients, who were warmed, were within the normal blood values. This situation is thought to

prevent delay in wound healing. The results of our study have similarities with the study of Demiraslan (13).

In this study, the platelet counts and APTT values of the patients having laparoscopic gallbladder surgery were within the normal range before, during and after the operation. There was no bleeding in patients whose bleeding time did not prolong. Considering that hypothermia would prolong bleeding time (13, 21), it was observed that the patients, who were warmed, did not experience bleeding.

In our study, the kidney and liver functions of the patients were monitored through BUN, AST and ALT values. These values were within the normal range before, during and after the operation. It can be said that the kidney and liver functions of the patients were not adversely affected because the patients did not undergo hypothermia. The results of our study have similarities with the study of Demiraslan (13). In conclusion; keeping body temperature within the normal rage before, during and after the operation positively affects blood pressure, pulse rates, respiratory values and oxygenation and helps to keep these values within the normal range. Keeping body temperature within the normal rage before, during and after the operation keeps erythrocyte, haemoglobin, leukocyte, lymphocyte, platelet, APTT, BUN, AST and ALT values within the normal range and positively contributed to wound healing.

Conclusion

Considering the results of this research, the H1 Hypothesis was accepted (H1: warming patients before, during and after the operation keeps vital findings and blood parameters within the normal range. Considering the results of the research, it was found out that warming patients through hot air blowing system positively contributed to patients' vital findings and blood parameters. More studies are needed in order to reinforce the results of this research. It is also suggested that those studies should have experimental and control groups. It is significant to warm patients even if they undergo a short-term operation like laparoscopic cholecystectomy. (Figure 1).

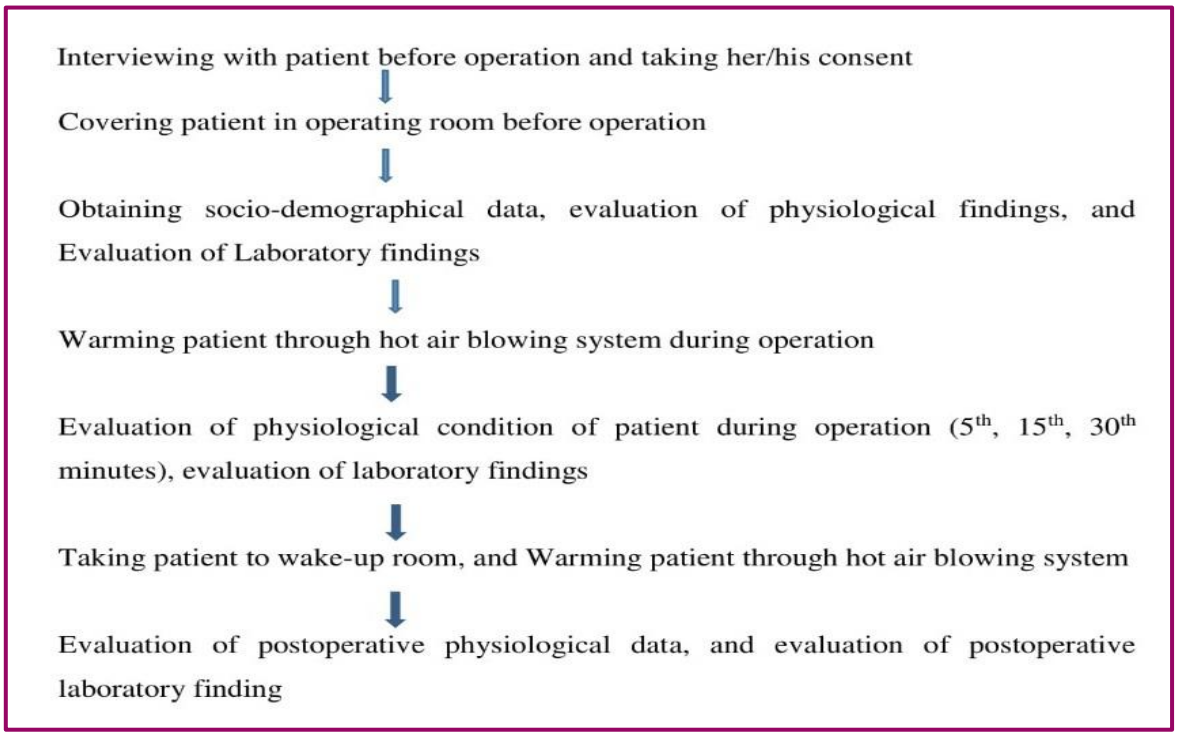

Figure 1: Research process flow chart.

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