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Investigating and comparing the effect of two different temperatures of Marcaine on shivering during and after cesarean section

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ABSTRACT

Background: Shivering is common in cesarean section under neuraxial anesthesia. This study was designed with the aim of investigating and comparing the effect of two different temperatures of marcaine (6 and 24 ºC) on shivering during and after cesarean section.

Materials and Methods: In this double-blind clinical trial study, 64 women candidates for cesarean were randomly divided into two groups (32): the group receiving marcaine with room temperature (24 ºC) and the group receiving marcaine with refrigerator temperature (6 ºC). Spinal anesthesia was performed in the sitting position in the space between L4-L5 and using a 25 G needle. The patient was placed in the supine position. The variables,

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shivering, central body temperature, systolic, diastolic and mean arterial blood pressure, heart rate, level of sensory block, use of pain reliever supplement and nausea and vomiting after anesthesia were recorded at specific times and compared between two groups. The obtained data were analyzed using SPSS version 22 software.

Results: There was no statistically significant difference between the two groups in terms of age distribution and gestational age. Shivering at 30, 45, 60, 75, 90, 105, 120 and 135 minutes after spinal anesthesia was significantly higher in the 6 degree group. In the 6 degree group, grade 3 and 4 tremors at all times, grade 2 at all times except minutes 10, 15, and 60, and grade 1 at all times except minute 75 had a greater and sometimes equal frequency compared to the 24 degree group. The average core body temperature was significantly lower in the 6 degree group at all times. The mean systolic blood pressure at 30 minutes, diastolic blood pressure at 5, 15, and 30 minutes, and mean arterial blood pressure at 20, 30, and 45 minutes after spinal anesthesia were significantly higher in the 6-degree group. The two groups had no statistically significant differences in terms of heart rate variables, level of sensory block, use of pain reliever supplements, and nausea and vomiting at any time.

Conclusion: According to the results obtained from the present study and similar studies, marcaine kept at the temperature of the operating room (24 degrees) compared to the temperature of the refrigerator (6 degrees) effectively reduces shivering during and after cesarean section.

Key words: Spinal Anesthesia; Chills; Marcaine; Temperature; Cesarean Section

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Investigación y comparación del efecto de dos temperaturas diferentes de Marcaína sobre los escalofríos durante y después de la cesárea

REUSMEN

Los escalofríos son comunes en la cesárea bajo anestesia neuroaxial. Este estudio fue diseñado con el objetivo de investigar y comparar el efecto de dos temperaturas diferentes de marcaína (6 y 24 ºC) sobre los escalofríos durante y después de la cesárea. En este estudio de ensayo clínico doble ciego, 64 mujeres candidatas a cesárea se dividieron aleatoriamente en dos grupos (32): el grupo que recibió marcaína a temperatura ambiente (24 ºC) y el grupo que recibió marcaína a temperatura de refrigerador (6 ºC).). La anestesia espinal se realizó en posición sentada en el espacio entre L4-L5 y utilizando una aguja de 25 G. Se colocó al paciente en decúbito supino. Las variables, escalofríos, temperatura corporal central, presión arterial sistólica, diastólica y media, frecuencia cardíaca, nivel de bloqueo sensorial, uso de suplementos analgésicos y náuseas y vómitos después de la anestesia se registraron en momentos específicos y se compararon entre dos grupos. Los datos obtenidos se analizaron utilizando el software SPSS versión 22.

No hubo diferencia estadísticamente significativa entre los dos grupos en términos de distribución de edad y edad gestacional. Los escalofríos a los 30, 45, 60, 75, 90, 105, 120 y 135 minutos después de la anestesia espinal fueron significativamente mayores en el grupo de 6 grados. En el grupo de 6 grados, los temblores de grado 3 y 4 en todo momento, los de grado 2 en todo momento excepto en los minutos 10, 15 y 60, y los de grado 1 en todo

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momento excepto en el minuto 75 tuvieron una frecuencia mayor y a veces igual en comparación con los de 24 grados. grupo. La temperatura corporal central promedio fue significativamente más baja en el grupo de 6 grados en todo momento. La presión arterial sistólica media a los 30 minutos, la presión arterial diastólica a los 5, 15 y 30 minutos y la presión arterial media a los 20, 30 y 45 minutos después de la anestesia espinal fueron significativamente más altas en el grupo de 6 grados. Los dos grupos no tuvieron diferencias estadísticamente significativas en cuanto a las variables de frecuencia cardíaca, nivel de bloqueo sensorial, uso de suplementos analgésicos y náuseas y vómitos en cualquier momento. De acuerdo con los resultados obtenidos del presente estudio y estudios similares, la marcaína mantenida a la temperatura del quirófano (24 grados) en comparación con la temperatura del refrigerador (6 grados) reduce efectivamente los escalofríos durante y después de la cesárea.

PALABRAS CLAVE: Anestesia Espinal; Escalofríos; Marcaína; Temperatura; Cesárea

general and nouraxial anesthesia. The incidence of shivering after noraxial anesthesia is mostly 55% (3). Spinal anesthesia is still a widely used procedure for cesarean section. Because it provides many advantages such as quick onset, high success rate, minimal exposure of mother and fetus to drugs and minimal

INTRODUCTION

Shivering are involuntary muscle movements and contractions that the patient cannot control and are easily visible and recognizable, and if untreated, may continue for long minutes or even hours after the operation (1, 2). Shivering following surgery often occurs after

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the whole body and plays an important role in regulating body temperature (11). Although temperature regulation mechanisms can partially explain shivering in hypothermic patients. Different mechanisms, such as the function of N-methyl-di-aspartate (NMDA) and 5-hydroxytryptamine receptors, have been proposed to explain shivering in normothermic patients (3). Many studies have been conducted to treat shivering after spinal anesthesia. But there is little information about the cause of shivering and the best way to prevent it (12, 13). Some studies have shown that the temperature of the injected local anesthetic drug can contribute to shivering after spinal anesthesia (7, 14). The result of another study suggested the existence of heat-sensing mechanisms in the human spinal canal and the effect of warming epidural anesthetic solutions discomfort for the mother (4). Prevalence of shivering following spinal anesthesia in cesarean section has been reported as 40-70% (5, 6). Shivering is very uncomfortable for the patient and may affect their satisfaction and decisions for regional block in surgeries and especially subsequent cesarean sections (7). Shivering increases oxygen consumption, CO2 production, and sympathetic tone, and this is accompanied by an increase in cardiac output, heart rate, blood pressure, and intraocular pressure (8). These effects are particularly annoying in the gynecological population (9). Controlling the body's internal temperature depends on temperature-sensitive neurons that are located throughout the body inside and outside the central nervous system(10). The central nervous system, including the spinal cord, receives thermal signals from

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the group receiving marcaine kept at refrigerator temperature (6 ºC). For all patients, the same pretreatment procedures were performed. Before spinal anesthesia, patients were monitored and received Ringer's solution (5cc/kg). Oxygen was provided during anesthesia and the patients had a normal temperature in the range of 37ºC. Patients received a single dose of metoclopramide (10 mg) before cesarean section and were randomly divided into two mentined groups. For prevention of the possible temperature change of Marcaine (6ºC), the refrigerator was very close to the operating room. The drug was transferred to the operating room when the CSF sample was taken, and the syringes of this group were also kept in the refrigerator. The drugs were prepared by the anesthesiologist according to the existing random chart and given to the

before injection to reduce the incidence of shivering (15). On the othe hand, some studies concluded that shivering in extradural anesthesia is not alone caused by the cooling of the extradural space (16). So, there are conflicting opinions and there is no definitive answer. Therefore, this study was designed with the aim of investigating and comparing the effect of marcaine stored at operating room temperature (24 ºC) and refrigerator temperature (6 ºC) on shivering during and after cesarean section.

MATERIALS AND METHODS

In this double blind clinical trial study, 64 women candidates for cesarean surgery were included in the study. This number was divided into two groups (32 patints in each group: group 1: the group receiving marcaine kept at operating room temperature (24 ºC) and group 2:

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cases where analgesic supplement was needed, Fentanil (1-2 mic/kg) was used IV. The parameters recorded during the study included: shivering with degrees one to four (based on the Crosley and Mahajan shivering scale), core body temperature (using an OMRON brand tympanic thermometer), level of sensory block (using the Pinprick test with a blunt 21G needle at the level of dermatomes T4, T5 (near the nipple), T2 and T3 (above the nipple level) and dermatomes lower than T5 (below the nipple level), systolic, diastolic, mean arterial blood pressure and heart rate (based on monitor), the need for pain reliever and nausea and vomiting supplements. The were recorded every five minutes for the first twenty minutes, then every ten minutes until thirty minutes, and finally every 15 minutes until the end of the recovery time. The level of sensory block anesthesia resident who performed the spinal block, and therefore the anesthesia resident was unaware of the temperature of the injected marcaine. Spinal anesthesia was performed in a sitting position in the space between L4-L5 using a 25 G Quincke needle and 0.5% marcaine (AstraZeneca Company) at a speed of approximately 0.2 ml/sec. Then the patient was placed in the supine position. After receiving spinal anesthesia, patients are treated with IV ephedrine (5 mg) in case of hypotension in the form of >100 mmHg systolic blood pressure or >30% decrease in mean arterial pressure from baseline. In cases of shivering with intensity ≥3 according to Crosley and Mahajan shivering scale, they were treated with 25 mg pethidine IV. In case of moderate to severe nausea and vomiting, metoclopramide was injected IV at the rate of 10 mg, and in

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Klomogrove-Smirnov statistical test was used, and descriptive statistics were used to determine the mean and standard deviation indicators. $P < 0.05$ was considered statistically significant.

RESULTS

Totaly, 64 women candidates for caesarean section were included in this study and were divided into two groups receiving marcaine kept at operating room temperature (24 ºC) and the group receiving marcaine kept at refrigerator temperature (4 ºC). The two studied groups were compared in terms of demographic variables including age and gestational age (Table 1). Based on this table, the two groups had no statistically significant difference in terms of age distribution and gestational age.

was recorded every five minutes for the first twenty minutes and then every ten minutes until thirty minutes. Shivering severity was evaluated according to the specific shivering scale for neuraxial anesthesia defined by Crosley and Mahajan (36), as follows: 0: no shivering, 1: No muscle activity is visible but there is peripheral vasoconstriction or flexibility or bot, 2: Muscle activity in only one muscle group, 3: Moderate muscle activity in more than one muscle group but no general tremor, and 4: Intense muscle activity that involves the whole body

DATA ANALYSIS METHOD

The collected data were analyzed with spss (version 22). To evaluate the normality of the data distribution, the

Table 1. Comparison of demographic variables (age and gestational age) between the two

groups

Variable	Groups		P value
	24ºC	**6ºC**	
Age	32	30/78	0/608
Gestational age	38/46	38/28	0/391

Two groups were compared in terms of sensory block level variables at the mentioned times after spinal anesthesia (Table 2).

Table 2. Comparison of sensory block level after spinal anesthesia between two groups

Duration after spinal anesthesia (min)		Groups		P value
		24ºC	**6ºC**	
5	T4, T5	18	15	0.734
	T2, T3	8	9	
	lower than T5	6	8	
10	T4, T5	15	18	0.717
	T2, T3	13	10	
	lower than T5	4	4	
15	T4, T5	15	18	0.717
	T2, T3	13	10	
	lower than T5	4	4	
20	T4, T5	15	18	0.717
	T2, T3	13	10	
	lower than T5	4	4	
30	T4, T5	15	18	0.717
	T2, T3	13	10	
	lower than T5	4	4	

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compared in terms of shivering variable at the mentioned times after spinal anesthesia (Table 3).

Two groups did not have a statistically significant difference in terms of the level of sensory block in any of the investigated times. Two groups were

Table 3. Comparison of shivering variable after spinal anesthesia between two study groups

Duration after spinal anesthesia (min)		24ºC	**6ºC**	P value
5	No shivering	32	32	1.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	0	
	Muscle activity in only one muscle group	0	0	
	Moderate muscle activity in more than one muscle group but no general tremor	0	0	
	Intense muscle activity that involves the whole body	0	0	
10	No shivering	31	32	0.317
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	0	
	Muscle activity in only one muscle group	1	0	
	Moderate muscle activity in more than one muscle group but no general tremor	0	0	
	Intense muscle activity that involves the whole body	0	0	
15	No shivering	31	30	0.558
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	1	
	Muscle activity in only one muscle group	1	0	
	Moderate muscle activity in more than one muscle group but no general tremor	0	1	
	Intense muscle activity that involves the whole body	0	0	
20	No shivering	31	27	0.080
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility	0	0	

	or both			
	Muscle activity in only one muscle group	1	1	
	Moderate muscle activity in more than one muscle group but no general tremor	0	2	
	Intense muscle activity that involves the whole body	0	2	
30	No shivering	29	20	0.010
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	2	
	Muscle activity in only one muscle group	1	2	
	Moderate muscle activity in more than one muscle group but no general tremor	0	1	
	Intense muscle activity that involves the whole body		7	
45	No shivering	28	7	0.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	4	
	Muscle activity in only one muscle group	1	3	
	Moderate muscle activity in more than one muscle group but no general tremor	1	6	
	Intense muscle activity that involves the whole body	2	12	
60	No shivering	22	6	0.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	1	2	
	Muscle activity in only one muscle group	5	4	
	Moderate muscle activity in more than one muscle group but no general tremor	2	8	
	Intense muscle activity that involves the whole body	2	12	
75	No shivering	22	5	0.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	3	2	
	Muscle activity in only one muscle group	2	7	
	Moderate muscle activity in more than one muscle group but no general tremor	3	10	
	Intense muscle activity that involves the whole body	2	8	

90	No shivering	20	7	0.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	2	2	
	Muscle activity in only one muscle group	5	5	
	Moderate muscle activity in more than one muscle group but no general tremor	1	9	
	Intense muscle activity that involves the whole body	1	5	
105	No shivering	19	5	0.000
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	1	3	
	Muscle activity in only one muscle group	1	4	
	Moderate muscle activity in more than one muscle group but no general tremor	1	4	
	Intense muscle activity that involves the whole body	0	4	
120	No shivering		8	0.031
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both		2	
	Muscle activity in only one muscle group		3	
	Moderate muscle activity in more than one muscle group but no general tremor		2	
	Intense muscle activity that involves the whole body		1	
135	No shivering	7	4	0.035
	No muscle activity is visible but there is peripheral vasoconstriction or flexibility or both	0	0	
	Muscle activity in only one muscle group	0	4	
	Moderate muscle activity in more than one muscle group but no general tremor	0	0	
	Intense muscle activity that involves the whole body	0	0	

terms of the shivering variable at 30, 45, 60, 75, 90, 105, 120 and 125 minutes

The results showed that the two groups had statistically significant differences in

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except the 75th minute had a greater frequency in the group reciaved marcaein 6 ºC compared to the group reciaved marcaein 24 ºC . The central body temperature was compared with the help of a thermometer at the mentioned times after spinal anesthesia (Table 4).

after spinal anesthesia. In the group reciaved marcaein 6 ºC, shivering was significantly higher than the group reciaved marcaein 24 ºC. Shivering with grade 3 and 4 in the 6 degree group at all times, grade 2 at all times except 10, 15 and 60 minutes, and grade 1 at all times

Table 4. Comparison of central body temperature variable after spinal anesthesia between two groups

Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	35/95	35/73	0/014
10	35/86	35/59	0/002
15	35/73	35/51	0/010
20	35/78	35/22	0/000
30	35/62	35/07	0/000
45	35/57	35/00	0/000
60	35/42	34/94	0/000
75	35/51	34/97	0/000
90	35/62	35/01	0/000
105	35/69	35/23	0/000
120	35/80	35/29	0/002
135	35/98	35/63	0/002

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reciaved marcaein 6 ºC significantly lower than the group reciaved marcaein 24 ºC. The comparison of systolic and diastolic blood pressure between the two groups is summarized in Tables 5 and 6.

Based on this table, the central body temperature of the two groups had statistically significant differences in all the investigated times. The average central body temperature in the group

Table 5. Comparison of systolic blood pressure variable after spinal anesthesia between two groups

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Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	110/47	105/16	0/292
10	117/28	112/84	0/352
15	121/25	119/34	0/638
20	121/72	117/75	0/224
30	123/25	114/46	0/048
45	122/66	115/94	0/068
60	117/56	118/03	0/953
75	117/97	117/91	0/845
90	121/07	115/79	0/298
105	119/65	118/55	0/928
120	119/94	119/71	0/834
135	117/00	115/88	0/913

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Table 6. Comparison of diastolic blood pressure variable after spinal anesthesia between two groups

Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	63/53	54/81	0/023
10	67/59	61/56	0/178
15	65/03	57/90	0/017
20	62/87	59/09	0/170
30	61/84	54/56	0/009
45	66/13	60/81	0/054
60	67/03	66/28	0/766
75	70/38	70/15	0/936
90	72/29	67/10	0/068
105	70/25	67/14	0/425
120	70/57	70/12	0/806
135	72/29	69/50	0/871

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differences in terms of diastolic blood pressure at 5, 15, and 30 minutes after spinal anesthesia, and the average diastolic blood pressure in the group reciaved marcaein 6 ºC higher than the group reciaved marcaein 24 ºC. Mean arterial pressure was also compared between two groups (Table 7).

Based on the results, the two groups had statistically significant differences in terms of systolic blood pressure at 30 minutes after spinal anesthesia, and the average systolic blood pressure in the group reciaved marcaein 6 ºC higher than the group reciaved marcaein 24 ºC. Two groups had statistically significant

Table 7. Comparison of mean arterial pressure variable after spinal anesthesia between the two groups

Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	82/78	76/09	0/081
10	86/50	81/94	0/116
15	88/13	83/19	0/214
20	86/88	81/69	0/042
30	85/28	76/63	0/002
45	87/06	82/13	0/049
60	87/22	86/03	0/658
75	88/84	87/66	0/624
90	89/57	85/79	0/168
105	91/90	87/23	0/136
120	89/69	89/50	0/268
135	87/75	90/00	0/156

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reciaved marcaein 6 ºC higher than the group reciaved marcaein 24 ºC. The comparison of heart rate between the two groups are summarized in Table 8.

Two groups had statistically significant differences in terms of mean arterial pressure at 20, 30, and 45 minutes after spinal anesthesia, and the mean mean arterial blood pressure in the group

Table 8. Comparison of heart rate variable after spinal anesthesia between the two groups

Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	105/87	112/90	0/271
10	105/46	112/25	0/276
15	101/06	102/43	0/814
20	104/31	100/40	0/429
30	99/65	97/56	0/604
45	93/96	94/06	0/982
60	92/50	93/46	0/833
75	88/93	89/78	0/851
90	88/06	87/75	0/943
105	85/59	83/95	0/737
120	86/57	84/50	0/708
135	88/71	90/12	0/871

times. The use of analgesic supplements in patients of both groups at the mentioned times was also investigated,

Two groups did not have a statistically significant difference in terms of the heart rate variable at any of the examined

9. and the results are summarized in Table

Table 9. Comparison of the use of analgesic supplement after spinal anesthesia between two groups

Duration after spinal anesthesia (min)	24ºC	**6ºC**	P value
5	0	0	1/000
10	0	0	1/000
15	0	0	1/000
20	0	0	1/000
30	0	0	1/000
45	0	0	1/000
60	1	1	1/000
75	1	1	1/000
90	0	1	0/491
105	1	1	1/000
120	0	0	1/000
135	0	0	1/000

compared between the two groups (Table 10). Based on the results of table, the two groups had no statistically significant difference in terms of nausea and vomiting in the investigated times.

There was no statistically significant difference between the two groups in terms of the use of pain reliever supplements in the examined times. The variable of nausea and vomiting was also

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Table 10. Comparison of nausea and vomiting variables after spinal anesthesia between two groups

Duration after spinal anesthesia (min)	24ºC	6ºC	P value
1	0	0	1/000
5	5	7	0/375
10	4	5	0/500
15	1	3	0/306
20	1	2	0/500
30	0	3	0/119
45	1	2	0/500
60	0	0	1/000
75	0	0	1/000
90	0	1	0/491
105	0	1	0/491
120	0	0	1/000
135	0	0	1/000

higher temperature of marcaine led to a decrease in the incidence and severity of shivering in the studied patients. Ponte et al. investigated the relationship between anesthetic temperature and shivering in epidural anesthesia. In this study, 40 elective cesarean patients under epidural

DISCUSSION

This study aimed to evaluate and compare the effect of marcaine at two different temperatures (6 and 24 ºC) on shivering during and after cesarean section in women under spinal anesthesia. According to the obtained results, the

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The results of this group showed that warming the anesthetic agent can reduce the incidence of shivering in patients under anesthesia (17). The result of this study was also similar to our study. Workhoven et al. investigated the effect of warm intravenous fluids versus room temperature fluids to reduce shivering in cesarean delivery under epidural anesthesia. Of the 44 studied women, 22 received warm fluids and 22 received room temperature fluids. The incidence shivering in patients received warm and room temperature fluids was 64 and 14%, respectively (18). In our study, the effect of intrathecal anesthetic was investigated instead of intravenous fluids, but the results of both studies were similar. Temperature sensitivity of the spinal cord has been studied through in vitro experiments with local changes in the temperature of the spinal cord. These anesthesia were divided into two groups. Marcaine 37 ºC was used in one group and Marcaine 4 ºC in the other group. Two patients in Marcaine 37 ºC and nine patients Marcaine 37 ºC had shivering. This difference was statistically significant. This reserchers stated that there are heat-sensing mechanisms in the human spinal canal and epidural anesthetic solutions should be warmed to body temperature before injection to reduce shivering (16). Although the anesthetic injection site was different in this study, the result confirmed our study. Walmsley et al evaluated 30 patients' candidates for tubal ligation under extradural anesthesia. All patients first received bupivacaine (4 ºC) and shivering was reported in 47%. Eight patients with considerable shivering were given warmer marcaine (up to 41°C). The shivering stopped in 3 of these patients.

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and third injections were given randomly (hot or cold) after shivering by a cooling blanket, but there was no specific effect on the severity of shivering. This showed that shivering in extradural anesthesia is not caused by cooling of the extradural space alone (16). The results of this group were inconsistent with the results of our study. In the study of this group, saline was used instead of local anesthetic, the injection site and temperature of saline were different from our study. The difference between the results of our study and Ponte's group could be due to these differences. Najafi Anarki et al. randomly divided 78 candidates for caesarean section under spinal anesthesia into two groups: The warm group received 2cc of Marcaine (0.5%) at room temperature and 10mic of fenanyl, and the cold group received 2cc marcaine (0.5%) at refrigerator temperature and studies indicated that local changes in the temperature of the spinal cord cause vascular movements and shivering. On the other hand, invivo experiments on animals have confirmed the existence of intrinsic temperature-sensitive neurons in the spinal cord (19, 20). Temperature-sensitive neurons in one area of the central nervous system connect to temperature-sensitive neurons in other areas, forming a temperature-sensitive neural network that is hierarchically organized in the central nervous system (21-23). Ponte et al. evaluated the hypothesis that cooling the extradural space may induce shivering by giving 3 injections of 80 cc of warm or cold saline to four healthy volunteers in which core temperature and electromyographic activity of four muscles were recorded. The first injection (always cold) did not cause shivering in any case. The second

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al. study, we compared the marcaine with room (24 ºC) and refrigerator (6ºC) tempraturs. We showed that the shivering was significantly higher in refrigerator marcaine. Regarding other variables, our study had similar results. In our study, systolic blood pressure at 30 minutes, diastolic blood pressure at 5, 15, and 30 minutes, and mean arterial pressure at 20, 30, and 45 minutes after spinal anesthesia in refrigerator marcaine was significantly higher than other group. Shivering causes vasoconstriction and high blood pressure (14), this can justify the higher blood pressure in the refrigerator marcaine. Elsharkawy et al. studied 120 patients (40-70 years old) candidates for orthopedic surgery under spinal anesthesia. They were randomly divided into three groups: group 1, received 3 cc of lobubivacaine (0.5%) with a temperature of "24" ℃, group 2, eceived 10mic of fentanyl. The incidence of shivering was 8.3% in the warm group and 39.1% in the cold group, which was significant. In this study, the time for the highest level of sensory block, the highest blocked segment, the amount of bleeding, heart rate, newborn Apgar, and nausea and vomiting at separate times did not have a significant difference between the two groups, and the need for an additional dose of analgesic agent was not observed in any of the groups. Systolic and diastolic blood pressure was higher in the cold group (14). According to the drug brochure, marcaine should not be stored at a temperature higher than 25℃ and freezing of the drug should also be avoided. Since in some operating rooms of hospitals, due to the lack of proper cooling system, especially in hot seasons, marcaine is kept in the refrigerator. Similar to Najafi Anarki et

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hypobaric and increases the height of the block (25, 26). This can justify the acceleration of the onset of block in groups 30 and 37 in this study, although in our study no significant difference in the level of block was observed in the investigated time intervals in the two groups of marcaine 6 and 24 ºC. Mandhari et al. divided 100 patients (average age of 20-35 years) candidates for lower segment cesarean surgery into two groups: Room temperature group, received 2 cc of marcaine 0.5% and 20 mic of fentanyl received at a temperature of "22-23℃', Body temperature group, received 2 cc of 0.5% marcaine and 20 mic of fentanyl at a temperature of "5.37℃'. Shivering was observed in 31 patients (62%) and 7 patients (14%) in room temperature and body temperature groups, respectively. The intensity of shivering "≥3" was seen in 15 people 3 cc of lobubivacaine (0.5%) with a temperature of "30" ℃, and group 3, eceived 3 cc of lobubivacaine (0.5%) with a temperature of "37" ℃. The onset and extent of shivering and the level of sensory and motor block were measured in three groups. These reserchers shoed that the increasing the temperature of lobopivacaine up to 30 or 37 ºC led to prolong of the time of onset of shivering and the time of the first need for analgesic supplement (24). Despite the difference between this study and our study in terms of age distribution, type of operation, type of anesthetic and temperature, similar results were obtained regarding the effect of anesthetic temperature on the degree of shivering. Local anesthetics are isobaric at 24°C but slightly hypobaric at 37°C. An increase in temperature, for example, heating the anesthetic to body temperature, causes

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temperature moderately causes spinal block sephalic movement, but it is not clear whether this factor or other factors contribute to the subsequent level difference (27). Mandhari et al. showed that the warming of bupivacaine to body temperature caused its more limited cephalic movement, although the difference was not clinical significant. In our study, there was no significant difference in the time intervals at the block level between the two groups. Rashid et al (2020) investigated the effect of bupivacaine 0.5% and mic20 fentanyl with two different temprature (37 and 22 ºC) on the incidence of shivering in patients undergoing cesarean section. This group found that the incidence of shivering was 14 and 64% in the groups 37 and 22ºC, respectively. They concluded that the temperature of the injected anesthetic agent plays an (30%) and 5 people (10%) in the room temperature and body temperature groups, respectively. Warming of bupivacaine to body temperature moderately induces spinal block saphalic movement, but it is not clear whether this or other factors contribute to the subsequent level difference (35). The results of this study confirmed our study. In our study, shivering in the group recieved marcaein 6 ºC were significantly higher than in the group reciaved marcaein 24 ºC, and the 3- and 4-degree shivering were more frequent and sometimes equal compared to the the group reciaved marcaein 24 ºC at all times. Also, the group reciaved marcaein 6 ºC had significantly higher systolic, diastolic and mean arterial blood pressure at several times. While there was no significant difference in the rest of the time. Warming 0.5% bupivacaine to body

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stored and consumed at the temperature of the operating room (24 ºC).

important role in the occurrence of shivering in patients undergoing cesarean section (28). The result of this study was similar to our study. In our study, marcain with two differebt temperature (6 and 24 ºC) were compared. Data showed that shivering (grade 1-4) 6-degree group were significantly higher than the 24-degree group. Therefore, using marcain with a higher temperature reduces the amount and intensity of shivering.

CONCLUSION

Based on the results, marcaine (24 ºC) effectively reduces shivering during and after cesarean section compared to the marcaine (6 ºC). In addition, no side effects were observed compared to Marcain at refrigerator temperature. Therefore, since this drug is stored in the refrigerator in some centers, it is recommended that this drug should be

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