Objective: Administration of warm intravenous (IV) fluid infusion and use of forced air warmers is the most easy and physiologically viable method for maintaining normothermia during surgery and postsurgical periods. This study was conducted to assess the effect of combination of active warming (AW) methods namely warm IV fluid infusion and forced air warming versus forced air warming only (WA) on maternal temperature during elective C-delivery under spinal anesthesia. Materials and Methods: A total of 100 patients scheduled for elective c-section were grouped into those who received both warmed IV fluid infusion and forced air warmer (Combination of active warming WI = 50) and those who received only forced air warmer (WA = 50). Core body temperature and shivering incidence were recorded using a tympanic thermometer from prespinal till the end of surgery every 10 min and in postanesthesia care unit (PACU) at 0, 15, and 30 min. Results: Core temperature showed statistically significant difference in 15, 35, 45, and 55 min between air warmer and warm infusion groups and in PACU at 0, 15, and 30 min, it was statistically significant ($P = 0.000$) among WI group (mean temperature = 36.79°C) when compared to WA group (mean temperature = 35.96°C). There was a lower incidence of shivering in WI compared to WA group, which is statistically significant. Conclusion: Combination of warm Intravenous fluid infusion and Forced air warming is better than forced air warming alone. In maintaining near normal maternal core body temperature during elective cesarean section following spinal anesthesia. Combined warming method also reduces shivering incidence.

Keywords: Apgar, cesarean section, forced air warmer, hypothermia, shivering, warm intravenous fluid infusion

Résumé

Objectif: L’administration d’une perfusion de liquide intraveineux chaud (IV) et l’utilisation de réchauffeurs à air forcé sont les plus faciles et les plus viables sur le plan physiologique méthode pour maintenir la normothermie pendant la chirurgie et les périodes post-chirurgicales. Cette étude a été menée pour évaluer l’effet de la combinaison des méthodes de réchauffement actif (AW), à savoir la perfusion de liquide IV chaud et le réchauffement à air forcé par rapport au réchauffement à air forcé uniquement (WA) sur la mère la température pendant la livraison élecitve de C sous anesthésie rachidienne. Matériel et méthodes: Un total de 100 patients programmés pour un stage électif les césariennes ont été regroupées dans celles qui ont reçu à la fois une perfusion de liquide IV chauffée et un réchauffeur à air forcé (combinaison de réchauffement actif WI = 50) et ceux qui n’ont reçu qu’un réchauffeur d’air forcé (WA = 50). La température corporelle centrale et l’incidence des frissons ont été enregistrées en utilisant un thermomètre tympanique du présplinal jusqu’à la fin de la chirurgie toutes les 10 min et dans l’unité de soins postanesthésiques (PACU) à 0, 15 et 30 min. Résultats: La température centrale a montré une différence statistiquement significative en 15, 35, 45 et 55 min entre les patients recevant un réchauffement actif et ceux recevant un réchauffement à air forcé. Conclusion: La combinaison de perfusion de liquide chaud et réchauffement à air forcé est meilleure que le réchauffement à air forcé seul pour maintenir la température corporelle de la mère pendant la césarienne élecitive suivant l’anesthésie rachidienne. La méthode combinée réchauffement réduit également l’incidence des frissons.
groups of rechauffement de l’air et de perfusion chaude et dans le PACU à 0, 15 et 30 min, il était statistiquement significatif (P = 0,000) dans le groupe WI (température moyenne = 36,79 ° C) en comparaison au groupe WA (température moyenne = 35,96 ° C). Il y avait une incidence plus faible de frissons dans WI par rapport au groupe WA, qui est statistiquement important. **Conclusion:** La combinaison de la perfusion de liquide intraveineux chaud et du réchauffement forcé de l’air est meilleure que le réchauffement forcé de l’air seul. Dans maintien d’une température corporelle maternelle près de la normale pendant la césarienne élective après anesthésie rachidienne. Réchauffement combiné La méthode réduit également l’incidence des frissons.

**Mots-clés:** Apgar, césarienne, réchauffeur d’air forcé, hypothermie, frissons, perfusion de liquide intraveineux chaud

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**INTRODUCTION**

In cesarean delivery, hypothermia characterized by lowering of core body temperature to <36°C is one of the common complications related to anesthesia and surgery.[1] Hypothermia following regional anesthesia during cesarean section maybe due to infection, hypovolemia, endocrinopathy, Patient exposure to cold temperature in operation theater, iatrogenic causes, decreased metabolism, and direct inhibition of thermoregulation by the administered anesthetics.[2] We routinely use forced air warmer for maintaining core body temperature during cesarean deliveries in our institution. We also observed that it is not giving desired response or comfort to all our patients. Hence, we decided to use simple warm intravenous (IV) fluid instead of cold IV saline stored in operation theater in addition to the forced air warmer.

There is evidence of severe outcomes associated with perioperative hypothermia such as increased risk of wound infection, increased intraoperative blood loss, necessity for blood transfusion, increased incidence of cardiac events, postoperative shivering, prolonged hospitalization, blood coagulopathy, and more chances of thermal discomfort which is associated with hypothermia. Spinal anesthesia also exposes the patients to more risk of being affected by core hypothermia as compared to epidural anesthesia during cesarean delivery.[3,4]

There are three main reasons that are responsible for causing hypothermia following administration of spinal anesthesia. First, spinal anesthesia causes heat redistribution from core to the periphery.[5] Second, lack of vasoconstriction affects thermoregulation beneath the level of spinal block that causes increase in loss of heat from the body. The third reason is the altered mechanism of thermoregulation during spinal anesthesia resulting in 0.5° decrease, below the threshold level of vasoconstriction and shivering.[4]

This postanesthetic shivering often stretches the surgical incisions to aggravate pain that have a negative impact on monitoring techniques such as electrocardiogram, blood pressure (BP), and oxygen saturation. Shivering is a reflex protective in nature that increases body heat production by muscle contraction, however, it is miserable for the expecting mothers undergoing cesarean delivery because it increases intraocular and intracranial pressures which incur more complications.[5] Side effects include increased consumption of O₂ causing lactic acidosis and production of carbon dioxide. Shivering, pain, nausea, and vomiting are reasons for discomfort and dissatisfaction in patients who undergo cesarean section, which increase the risk of postoperative complications.[7]

Prevention of shivering is the ideal way to avoid intraoperative and postoperative complications. Shivering is generally prevented physically by surface warming and pharmacologically by administration of medicines such as pethidine, tramadol, clonidine, and ketamine. Administration of warm IV fluid infusion and use of forced air warmers is the most easy and physiologically viable method for maintaining normothermia during surgery and postsurgical periods.

As far as cesarean section is considered, spinal anesthesia is the most common and safe technique as compared to general anesthesia. This is because spinal anesthesia got certain merits such as rapid onset, high rate of success, less fetal side effects, and minimal maternal discomfort or adverse effects.[8] A review of about 21 studies inferred that spinal anesthesia too have side effects of shivering, which is evident from the occurrence of 55% incidences of shivering in neuraxial anesthesia.[9] Some patients even point occurrences of postoperative chills and its complications such as aggravation of postoperative pain as the most worst experiences they suffered during hospitalization. The most adoral way for preventing postoperative chills is to prevent the causative factor such as hypothermia.

Various past studies have illustrated that warmed IV fluid infusion or intraoperative force air warming during cesarean delivery had failed to prevent hypothermia of the mother,[9] however some other studies advocated for active warming (AW) for cesarean section, which maintains core body temperature at normal level, thus ameliorating shivering.[10-12] Several additional studies supported the use of AW modalities, that is, forced air warming and warm IV fluid infusion.[13,14] The study conducted by Horn et al. compared women applied with AW modalities to those without AW support during cesarean delivery. The result favored the group with AW modalities as this group showed more than 1°C increase in temperature than the non-AW group. On the contrary, Fallis et al.[14] were unable to replicate the AW-favoring inferences in patients under spinal anesthesia except the forced air warming modality. In both of the above studies, the control group and the treatment group were administered with warmed IV fluids. Henceforth, evaluation of forced air warming in relation to warm IV fluids is done. These mixed findings facilitated further evaluation of the efficacy of combined warmed IV fluids and forced air warming to prevent hypothermia in cesarean section, who have been given spinal anesthesia. The efficacy of these maternal
warming methods on shivering and its complications was re-evaluated using various parameters for mothers and Apgar score method in infants following delivery.

We tested the hypothesis that AW methods such as forced air warming or warm IV saline help in preventing maternal hypothermia and shivering during cesarean section under spinal anesthesia.

**Materials and Methods**

It is a observational study done after approval by the institutional ethics committee from September 2017 to June 2019, and the study involved full-term pregnant women who would undergo low-risk cesarean section under spinal anesthesia in the age group of 18–40 years. Pregnant women in labor, those with a fever, those with a history of recent infection, those with a history of hypertension, those with multiple cesarean sections, and pregnant women with a history of blood disorder and corresponding blood transfusion were grossly excluded from the study. With 95% confidence level and 80% power with reference to core body temperature, with mean difference of 0.06 and standard deviation (SD) of 0.11, the sample size was calculated as 50 per group, i.e., 100.

\[
n = \frac{2(Z_a + Z_b)\times \sigma^2}{d^2}
\]

where \(Z_a = 1.96\) with 95% confidence interval
\(Z_b = 0.84\) at 80% power
\(\sigma = \text{standard deviation} = 0.11\)
\(d = \text{mean} = 0.06\).

A total of 100 patients selected for prospective, comparable observational study were randomly allocated to two groups of 50 each, using sealed envelope method.

Preanesthetic checkup was done for all patients and standard fasting guidelines were adhered to. Vital signs (heart rate, BP, and peripheral O\(_2\) saturation) were monitored using standard noninvasive monitors and measurements were taken at regular intervals throughout the procedure. The patient’s core temperature has to be measured with infrared tympanic thermometer at prespinal and every 10 min till end of the surgery and at 0, 15, and 30 min in postanesthesia care unit (PACU). Ear temperature was measured using BRAUN RT6500US Thermoscan tympanic membrane temperature measurement equipment. Three readings were recorded, and the average value of three measurements was taken for accuracy. Warm disposable sleeves were used for all patients and readings were taken by the same operator in the same ear.

Group WI patients were preloaded with 10 ml/kg IV fluid of ringer lactate solution stored in a warming cabinet at 38°C just 15 min prior to spinal anesthesia and simultaneously the forced-air warmer was administered to the patients lower half of the body. Group WA patients were started on forced air warmer set at 38°C administered to the lower half of the body 15 min prior to spinal block. All the patients received 0.5% bupivacaine (hyperbaric) injected intrathecally in left lateral position using 25 G Quincke spinal needle at L\(_{3,4}\), interspinous spaces to achieve sensory blockade up to T5 level. Intraoperative Hypotension (>20% decrease in mean arterial pressure from baseline for one or more measurements) was treated with vasopressors (phenylephrine) and IV fluids. Shivering incidence was noted intra- and postoperatively, and scores were given as follows 0 – no shivering, 1 – peripheral vasoconstriction or piloerection or peripheral cyanosis without any visible muscular activity, 2 – muscular activity in only one muscle group, 3 – muscular activity is visible in two or more muscle groups, and 4 – muscular activity that includes the whole body. APGAR score of infants was determined by pediatricians 1 min and 5 min after the birth of the child through cesarean section.

Statistical analysis was done using Statistical Package for the Social Sciences version 20.0 (IBM, Armonk, New York, USA). Descriptive statistics were made use of to summarize demographic and outcome data. Data were expressed as mean ± SD and numbers (%) appropriately. Independent sample t-test was used for two groups’ comparisons. The categorical data were analyzed using a Chi-square test. \(P < 0.05\) was considered statistically significant.

**Table 1: Patient characteristics**

|                | WA (n=50) | WI (n=50) |
|----------------|-----------|-----------|
| Age (years)    | 30.88±4.19| 31.12±3.92|
| Weight (Kg)    | 63.68±7.12| 64.98±7.17|
| Height (cm)    | 160.74±6.54| 160.22±6.69|
| BMI            | 24.67±2.62| 25.32±2.48|

BMI=Body mass index, SD=Standard deviation, WA=Forced air warmer, WI=Warm IV fluid + Forced air warmer

**Table 2: Difference in core body tympanic temperature (°C) pre- and post-spinal between warm air and warm infusion groups (n=100)**

|                | WA (n=50) | WI (n=50) |
|----------------|-----------|-----------|
| Prespinal      | 37.36±0.12| 37.31±0.23|
| Postspinal     | 37.15±0.11| 37.20±0.25|
| 5 min          | 36.98±0.13| 37.00±0.32|
| 15 min         | 36.68±0.18| 36.79±0.31|
| 25 min         | 36.50±0.28| 36.52±0.35|
| 35 min         | 36.21±0.36| 36.51±0.52|
| 45 min         | 36.08±0.36| 36.73±0.42|
| 55 min         | 36.06±0.36| 36.73±0.42|

*Significant. **Highly significant. SD=Standard deviation, WA=Forced air warmer, WI=Warm IV fluid + Forced air warmer
The primary objective of the study is to compare the effect of combination of AW modalities on the maternal core body temperature intra and postoperatively. The secondary objective of the study is to assess intra- and postoperative shivering in both groups and neonatal outcomes by Apgar score method (1 and 5 min).

**RESULTS**

A total of 100 pregnant woman were selected based on the inclusion criteria, and randomly allocated into two groups: warming alone (WA) and WI, with fifty patients in each group. There was no significant difference among patients in both study groups based on patient characteristics [Table 1].

Thirty-three percent of the total belonged to the age group of 30–31 years. *t*-test result shows that there is no significant difference in age distribution between the groups [Figure 1].

Table 2 shows that there was a significant difference in ([P = 0.041, P = 0.001, P = 0.000, and P = 0.000]) core body temperature at 15, 35, 45, and 55 min between WA and

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**Table 3: Difference in tympanic temperature (°C) postanesthesia care unit 0, postanesthesia care unit 15, and postanesthesia care unit 30 between warm air and warm infusion groups (n=100)**

| Tympanic temperature (°C) | Mean±SD | t | P   |
|---------------------------|---------|---|-----|
| WA (n=50)                 | WI (n=50)|   |     |
| PACU 0                    | 35.98±0.36 | 36.74±0.51 | −8.575 | 0.000** |
| PACU 15                   | 35.95±0.36 | 36.81±0.50 | −9.771 | 0.000** |
| PACU 30                   | 35.97±0.36 | 36.83±0.50 | −9.878 | 0.000** |

**Highly significant. PACU=Postanesthesia care unit, SD=Standard deviation, WA=Forced air warmer, WI=Warm IV fluid +Forced air warmer**

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**Table 4: Shivering incidence prespinal, postspinal, 5 min, 15 min, 25 min, 35 min, and 55 min between warm air and warm infusion groups**

|                | No, n (%) | Yes, n (%) | Total, n (%) | χ² (P)  |
|----------------|-----------|------------|--------------|---------|
| Prespinal      |           |            |              |         |
| WA             | 50 (50.0) | 50 (50.0)  |              | -       |
| WI             | 50 (50.0) | 50 (50.0)  |              |         |
| Postspinal     |           |            |              |         |
| WA             | 50 (50.0) | 50 (50.0)  |              | -       |
| WI             | 49 (49.5) | 49 (49.5)  |              |         |
| 5 min          |           |            |              |         |
| WA             | 50 (50.0) | 50 (50.0)  |              | -       |
| WI             | 49 (49.5) | 49 (49.5)  |              |         |
| 15 min         |           |            |              |         |
| WA             | 50 (50.0) | 0 (0.0)    | 50 (50.0)    | 6.383 (0.012**) |
| WI             | 44 (46.8) | 6 (100.0)  | 50 (50.0)    | (0.012**) |
| 25 min         |           |            |              |         |
| WA             | 38 (55.9) | 12 (37.5)  | 50 (50.0)    | 2.941 (0.086) |
| WI             | 30 (44.1) | 20 (62.5)  | 50 (50.0)    | (0.086) |
| 35 min         |           |            |              |         |
| WA             | 26 (49.1) | 24 (51.1)  | 50 (50.0)    | 0.040 (0.841) |
| WI             | 27 (50.9) | 23 (48.9)  | 50 (50.0)    | (0.841) |
| 45 min         |           |            |              |         |
| WA             | 23 (35.9) | 27 (75.0)  | 50 (50.0)    | 14.063 (0.000**) |
| WI             | 41 (64.1) | 9 (25.0)   | 50 (50.0)    | (0.000**) |
| 55 min         |           |            |              |         |
| WA             | 41 (45.1) | 9 (100.0)  | 50 (50.0)    | 9.890 (0.002**) |
| WI             | 50 (54.9) | 0 (0.0)    | 50 (50.0)    | (0.002**) |

**P<0.01, WA=Forced air warmer, WI=Warm IV fluid +Forced air warmer**
WI groups, respectively. At 15, 35, 45, and 55 min, WI has higher mean 36.79 ± 0.31, 36.51 ± 0.52, 36.73 ± 0.42, and 36.73 ± 0.42 core body temperature when compared to WA group with mean 36.68 ± 0.18, 36.21 ± 0.36, 36.08 ± 0.36, and 36.06 ± 0.36, respectively [Table 2].

Table 3, shows that there was a significant difference ($P=0.000$) in core body temperature at PACU 0, PACU 15, and PACU 30 between WA and WI groups. In PACU 0, WI had a high mean of 36.74 ± 0.51 when compared to WA with a mean of 35.98 ± 0.36, while in PACU 15, WI had a high mean of 36.81 ± 0.50 when compared to WA with a mean of 35.95 ± 0.36 and in PACU 30, WI had a high mean of 36.83 ± 0.50 when compared to WA with a mean of 35.97 ± 0.36 [Table 3].

Table 4 reveals comparable incidence of shivering during prespinal, postspinal, 5 min, 25 min, and 35 min, between WA and WI groups. At 15 min, 6 patients (12%) in the WI group ($P = 0.012$) had shivering compared to none in the WA group. There was significantly higher shivering incidence in WA group at 45 min (54% vs. 18% $P=0.000$) and 55 min (18% vs. 0% $P = 0.002$) when compared to the WI group.

Table 5 depicts the comparison between shivering incidence at PACU at PACU 0, PACU 15, and PACU 30 min. The incidence of shivering was significantly high among the WA group at 0, 15, and 30 min compared to the WI group.

APGAR was assessed at 1 and 5 min [Figures 2 and 3] after birth to assess how well the newborn tolerated the birthing process, and how they adjust to outside environment. Majority 21 (42%) of the WI group babies scored an APGAR 1 min score of 9 and only 2 (4%) scored an APGAR of 7. On the other hand, majority (22 (44%)) of the WA group babies scored an APGAR 1 min of 8 and only 5 (10%) scored an APGAR 1 min of 7. Though the difference was not significant ($P = 0.214$), it is obvious that, babies born of WI group performed better in terms of 1 min APGAR score when compared to WA group. Similarly, there was no significant difference ($P = 0.065$) in terms of 5 min APGAR score among both groups, however, 22 (44%) babies born of the WI group scored an APGAR score of 10 when compared to only 11 (22%) among the WA group.

Figure 4 reveals the difference in heart rate (in min) baseline, prespinal and postspinal between warm air and warm infusion group were analyzed using the independent sample $t$-test. Form the above outcomes, it is depicted that there is no difference in heart rate (in min) baseline, prespinal and postspinal between WA and WI group ($P > 0.05$).

Figure 5 reveals the difference in systolic blood pressure (SBP) (in min) baseline, prespinal and postspinal between warm air and warm infusion group were performed using the independent sample $t$-test. There was a significant difference in SBP with 45 min between WA and WI group. In 45 min warm air has high mean 115.70 ± 4.66 when compared to warm infusion group with mean 112.56 ± 8.92. There was no significant difference in SBP baseline, prespinal and postspinal.
postspinal, 5 min, 10 min, 15 min, 20 min, 25 min, 30 min, 35 min, 40 min, 50 min, 55 min and 60 min between WA and WI group ($P > 0.05$).

**Figure 6** reveals the difference in diastolic blood pressure (DBP) (in min) baseline, prespinal and postspinal between warm air and warm infusion group were performed independent sample $t$-test. From the above findings, it is revealed that, there is no significant difference in DBP (in min) baseline, prespinal and postspinal between WA and WA Groups ($P > 0.05$).

**DISCUSSION**

Neuraxial block impairs thermoregulatory control and decreases the shivering threshold. Decrease in core body temperature after spinal block results mainly due to core to peripheral redistribution of body heat. Maternal hypothermia which is characterized as temperature $<36^\circ$C, after elective c-delivery under regional spinal anesthesia, induces discomfort and increases postoperative morbidity such as increased BP, heart rate, oxygen consumption, and pain.$^{[15]}$ Neonatal hypothermia which occurs as a result of maternal hypothermia results in increased respiratory distress, hypoglycemia, and mortality.$^{[10]}$ We used forced warm air or combination of forced warm air and warm IV fluid to maintain core body temperature of pregnant women undergoing cesarean section under spinal anesthesia.

Though several evidence-based studies and meta-analysis conducted previously concluded that the use of AW methods such as forced air warmers or IV fluid warmers helps prevent maternal and infant hypothermia.$^{[13,17-20]}$ few studies by Butwick et al.,$^{[21]}$ Goyal et al.,$^{[19]}$ and Fallis et al.$^{[14]}$ have disproved the fact that intraoperative active warmers such as forced air warmers or IV fluid warmers applied to lower segment of the body did not help reduce the incidence of perioperative hypothermia or postoperative shivering, and studies by Chung et al.$^{[15]}$ which compared either of the AW methods have disproved that either of the forced air warmers or IV fluid warmers does not provide thermal comfort nor improve neonatal outcome. In addition, due to paucity of data available on the combination effect of these AW methods on the mean maternal and infant skin temperature, thermal comfort, and incidence of shivering, our study was planned to assess the effect of combination of AW methods namely warm IV fluid infusion and forced air warming versus forced air WA on maternal temperature during elective C-delivery under spinal anesthesia.

Based on our inclusion and exclusion criteria, 100 patients were included as the study population, of which 50 each were grouped into those who received both warmed IV fluid infusion and forced air warmer (WI = 50) and those who received only forced air warmer (WA = 50). In our study population, 33% of the total belonged to the age group of 30–31 years, however, there was no significant difference between the two groups in terms of age. Heart rate, SBP, DBP, and SPO$_2$ among the two groups (WA and WI) were monitored which showed no significant difference ($P > 0.05$) between the two groups (WA and WI). Similar findings were reported by Oshvandi et al.$^{[15]}$ where infusion of warm ($37^\circ$C) isotonic saline resulted in normal heart rate and BP when compared to controls who received IV fluid at room temperature ($21^\circ$C) following induction of spinal anesthesia.

On comparing the tympanic temperature at PACU at 0, 15, and 30 min, it was obvious that the temperature increased significantly ($P = 0.000$) among the WI group (mean temperature = 36.79°C) when compared to the WA group (mean temperature = 35.96°C), hence we summarize that combination of AW methods is better in maintaining normal maternal temperature during elective C-delivery post administration of spinal anesthesia.

Spinal anesthesia completely blocks the sensory perception in the legs along with lowering of shivering threshold. When shivering incidence was compared among the two groups (WA and WI) at PACU 0, 15, and 30 min, the total number of patients who experienced shivering among WI group was 7 (14%), which was significantly low when compared to the WA group, i.e. 28 (56%) (Chi-square = 17.361). Our findings were in line with those of Oshvandi et al.$^{[15]}$ but contrary to Goyal et al.$^{[19]}$ and Woolnough et al.$^{[22]}$ where it was reported that, when warm infusions are used alone, they help maintain the core maternal temperature and promote maternal thermal comfort, but do not help reduce the incidence of shivering.

Finally, APGAR was assessed at 1 and 5 min after birth of the baby to assess how well they tolerated the birthing process and how they adjust to outside environment. The difference was not significant ($P = 0.214$), in terms of 1 min APGAR score ($P = 0.065$) in terms of 5 min APGAR score among both groups. Our findings were in line with those of Yokoyama et al.$^{[23]}$ and Horn et al.$^{[13]}$ where prewarmed IV fluids or forced air warmers resulted in higher 1 min APGAR score and umbilical arterial or vein pH when compared to nonwarmed fluid or passive insulation (blanket) group.

Hence, overall, we can summarize that, there was no significant difference in terms of SBP and DBP between both the groups. Group which received both warm IV fluid infusion and forced air warming (WI) had better maternal temperature control and low incidence of shivering when compared to group which was exposed only to forced air warming (WI) during elective C-delivery postadministration of spinal anesthesia. Moreover, the babies born of warm IV fluid infusion and forced air warming (WI) group performed better (APGAR 1 min and APGAR 5 min) than those born of forced air warming. Therefore, we conclude that combination of AW methods such as warm IV fluid infusion and forced air warming performed better than forced air warming alone in reducing hypothermia among maternal undergoing elective C-delivery postadministration of spinal anesthesia. A proper control group was not present in our study because of ethical issues. However, we suggest a larger study in this direction. We suggest use of
any one method of AW method during cesarean section under spinal anesthesia.

**Conclusion**
Combined warming method preserves maternal core body temperature well and reduces the shivering in patients undergoing cesarean section under spinal anaesthesia. hence we recommend the use of active warming methods in operation theatre.

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**Conflicts of interest**
There are no conflicts of interest.

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