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The effectiveness of active warming for women undergoing elective caesarean section on maternal shivering: A meta-analysis.

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Abstract

Objective: To explore the effectiveness of active warming for women undergoing elective caesarean section on maternal shivering.
Methods: We searched Medline and Embase databases to identify publications evaluating the efficacy of active warming for women undergoing elective caesarean section on maternal shivering. 11 studies that fulfilled the specified criteria entered into analysis.
Results: The result of our analysis showed active warming could reduce the incidence of shivering in patients undergoing caesarean section with spinal anesthesia compared with no active warming control group (OR 0.55, CI (0.39, 0.77)).
Conclusions: Our analysis suggests that active warming could reduce shivering in patient undergoing caesarean section with spinal anesthesia compared with no warming.

Keywords: Active warming, Caesarean section, Shivering, Meta-analysis.

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Introduction

Shivering is a frequent event after cesarean section under spinal anesthesia. Shivering is known to have many potentially detrimental effects including increased oxygen consumption, carbon dioxide production and cardiac work, as well as causing maternal discomfort [1]. The exact etiology of shivering is unknown, the best way to prevent and treat shivering after spinal anesthesia is unclear. Currently there are no routine warming during caesarean delivery to prevent shivering, Despite several studies investigating active warming during caesarean delivery, there is still no consensus regarding whether it decreases shivering, The objective of this meta-analysis was to evaluate the effectiveness of active warming on maternal shivering after caesarean delivery under spinal anesthesia.

Methods

Search strategy and selection criteria

This analysis was performed according to the PRISMA guideline [2], Medline and Embase database were carefully searched to identify relevant publications indexed between January 1980 and October 2016, using following key words including "caesarean/cesarea" or "obstetric" and "warming" or 'temperature", abstracts were reviewed and the articles which focus on warming during caesarean section were obtained in full version. We conducted a review for the references of identified studies and limited the language in English. Attempts were made to contact the corresponding authors if further unpublished data were needed.

Any randomized controlled study that met the inclusion criteria with reduction of shivering as an outcome was considered. The review included adults undergoing elective cesarean section under spinal anesthesia, receiving active warming including forced air warming devices, warmed intravenous fluids, warmed mattresses and warmed coverings to prevent shiver.

Data extraction

Three reviewers independently extracted data from each study. Results were compared and any disagreements were resolved by consensus. The extracted data included: first author, year, method of warming (including forced air warming devices, warmed intravenous fluids, warmed mattresses and warmed coverings), anesthetic technique, incidence of shivering in active warming group and control group.

Statistical analysis

Data were collected and analysed using STATA software (version 12.0 STATA Corp., College Station, TX). We considered an I^2 statistic of 50% or more as indicative of a considerable level of heterogeneity, if I^2>50%, the random effects model was used [3]. Otherwise, the fixed effect model was used. For dichotomous outcomes, the Odds Ratio (OR) and 95% Confidence Interval (CI) were calculated (OR<1 favored warming).

Results

Literature search

Our initial literature search identified 738 studies, finally, 11 studies were included in our analysis [4-14], and a total of 647 patients were enrolled in these studies: 343 patients in the active warming group and 304 in the control group. Basic characteristics of the 11 studies are shown in Table 1.

Table 1. *Characteristics of the 11 studies.*

Author	Method of warming	Active warming group	Shivering	Control group	Shivering
Kishore [4]	Fluid	35	16 (45.71%)	35	18 (51.42%)
Chakladar [5]	Resistive warming mattress	58	10 (17.2%)	58	8 (13.8%)
Jorgensen [6]	Warm saline	57	8 (14%)	56	14 (25%)
Bernardis [7]	Thermal gown	20	2 (10%)	20	8 (40%)
Cobb [8]	IV fluid and forced-air warming	22	10 (45.5%)	22	17 (77.3)
Horn [9]	A forced-air cover	19	0	21	5 (24%)
Chung [10]	Forced-air warming and intravenous warmed fluids	30	5 (16.7%)	15	8 (53.3%)
Woolnough [11]	Fluid	50	16 (32%)	25	11 (44%)
Butwick [12]	Forced air-warming unit	15	4 (27%)	15	7 (47%)
Horn [13]	Forced air heating	15	2 (13.3%)	15	9 (60%)
Workhoven [14]	Warm fluid	22	3 (14%)	22	14 (64%)

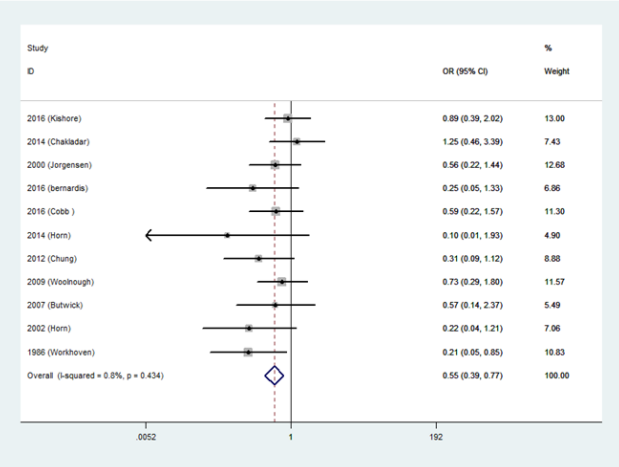

Figure 1. *Effectiveness of active warming on the incidence of shivering.*

Discussion

This meta-analysis included 11 RCTs within the specific population of women undergoing cesarean section. We limited subjects undergoing elective cesarean section with spinal anesthesia who were given active warming including forced air warming devices, warmed intravenous fluids, warmed mattresses and warmed coverings, our meta-analysis was

Findings from the meta-analysis investigating the effectiveness of active warming on the incidence of shivering are shown in Figure 1. When data were pooled across studies, we found a reduction in the incidence of active warming group (OR 0.55, CI (0.39, 0.77)). Heterogeneity wasn't observed (P=0.434; I^2=0.8%). We used the fixed effects model for the analysis.

aimed to explore the efficacy of active warming for women undergoing elective caesarean section on maternal shiver. The result of our analysis showed active warming could reduce the incidence of shivering in patients undergoing caesarean section with spinal anesthesia compared with no active warming control group.

The mechanism of shivering during regional anesthesia is not understood. For many years it has been the clinical practice to warm air, fluid, mattress or covering, the rationale for active warming is to preserve core temperature and to reduce shivering and discomfort. The effectiveness of active warming strategies in this population was confirmed by this review. Active warming provided clinical value in reducing shivering even if it was used for relatively short periods. In this article, different active warming methods involved, we couldn't conclude that which warming method was better than another warming method, as they were not directly compared with each other. Future studies could explore the optimal warming method and to assess whether the combination of methods had an advantage over a single one. Our meta-analysis suggested that either warming methods could reduce shivering compared with no warming.

In summary, based on the results from this meta-analysis we recommended that active warming should be used for caesarean delivery in order to reduce the incidence of maternal

shivering, further studies are needed to evaluate which warming method is more effective, whether the combination of warming methods is more effective than a single one, and how long pre-anesthetic warming must be set up to prevent shivering.

Conflicts of Interest

The authors had no conflicts of interest to declare in relation to this article.

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