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Comparing the Efficacy of Dexmedetomidine and Meperidine in the Prevention of Post-Spinal Shivering in Patients Undergoing Cesarean Section

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ABSTRACT

Objective: To compare the effectiveness of Dexmedetomidine and Meperidine in prevention of post-spinal shivering in patients undergoing caesarean section.
Study Design: Quasi-experimental study.
Place and Duration of Study: Department of Anaesthesia, Combined Military Hospital, Bahawalpur Pakistan, from Jan to Jun 2022.
Methodology: One hundred patients between 18-40 years of age, ASA class II and III, undergoing elective cesarean section were observed by taking 50 patients in each group. Both groups were randomly allocated for pretreatment to either receive the 2ml of intravenous dose of 0.5ug/kg dexmedetomidine (Group-A) or 0.5mg/kg Meperidine (Group-B). Incidence of shivering at 0, 15 and 30 minutes, severity of shivering according to Tsai and Chu grade and requirements of rescue drug were noted.
Results: The shivering scores measured at 0, 15 and 30 minutes showed *p*-values of 0.07, 0.303 and 0.500, which were not significant for both groups. The groups were comparable to each other in terms of age as mean age in Group-A was 28.44±4.23 while it was 28.06±4.32 years in Group-B. Mean weight for Group-A was 73.32±7.69 kg, whereas it was 72.1±7.45 kg for Group-B. Rescue drug was not required in both Dexmedetomidine and Meperidine groups.
Conclusion: Intravenous dexmedetomidine (in the dose of 0.5ug/kg) is equally effective in preventing the post spinal shivering, in patients undergoing caesarean section as compared to intravenous meperidine (0.5mg/kg dose).

Keywords: Caesarean Section, Dexmedetomidine, Meperidine, Spinal Anesthesia.

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INTRODUCTION

Cesarean Section is one of the commonest surgeries carried out in operation theaters. Spinal Anesthesia is gold standard and routinely employed method of anesthesia for this procedure due to its maternal and fetal safety profiles.[1]

Post-anesthetic shivering is an uncomfortable and potentially hazardous complication with incidence reported up to 42% to 85% in different studies. If left untreated, it has wide range of hemodynamic consequences ranging from tachycardia, hypertension and increased oxygen consumption leading to tissue hypoxia and cardiac ischemia with lethal consequences. It leads to erroneous monitoring as well.

Common methods to counter shivering are increased operation room (OR) temperature, forced air warming blankets, warm intravenous (IV) fluids and drugs. Drugs used to prevent shivering include Clonidine, Meperidine, Ketamine, Magnesium Sulphate and Dexmedetomidine.[2]

Dexmedetomidine is thought to act upon primarily at the α2-drenoceptor, in the hypothalamus for its shivering prevention effects. It subdues the neuronal spontaneous firing response, reduces the central thermosensitivity and finally contracts the vasoconstriction and shivering set points.[3]

Despite its analgesic, sedative, antiemetic, and anti-shivering properties, dexmedetomidine increases the risk of certain side effects. Excessive sedation leading to somnolence, one of the most dangerous complications, has been reported resulting from an overdose of dexmedetomidine.[4] Moreover, the cost of dexmedetomidine is higher as compared to other anti-shivering agents making its use as a single agent more burdensome.

Meperidine exerts special anti-shivering effects unlike other opioids in equi-analgesic doses and this effect is related to its 10% activity on kappa receptors.

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It causes nausea, vomiting, sedation, tachycardia and also has addiction potential.[5]

The aim of this study was to study the effects Dexmedetomidine and Meperidine for control of post-spinal shivering in patients undergoing caesarean section in our setup.

METHODOLOGY

This quasi-experimental study was conducted in Operation Theater Combined Military Hospital, Bahawalpur Pakistan, from January 2022 till June 2022. The study was started after approval from hospital ethical committee certificate (IERB cert no. EC-04-2022).

Inclusion Criteria: Patients of either gender, aged between 18 to 40 years with American Society of Anesthesiologists (ASA) functional status II and II, undergoing spinal anesthesia for caesarean section were included.

Exclusion Criteria: Patients with severe hemodynamic compromise, ASA IV cases, patients with altered thermoregulatory mechanisms i.e. temperature more than 38C˚ or less than 36C˚, those with addiction to opioids, those who were part of any medical study in past 01 year, those with severe hypo or hyperthyroidism, and those with severe hepatic or renal dysfunction were excluded.

Using OpenEpi calculator, sample size of 100 patients estimated by using expected percentage of incidence of shivering in both groups i.e. exposed as 45% and non-exposed as 15%.[1] Sampling technique was non-probability, consecutive sampling. Informed, written consent was taken prior to data collection. Both groups were randomly allocated for pretreatment to either receive the 2ml of intravenous dose of 0.5ug/kg dexmedetomidine (Group-A) or 0.5mg/kg Meperidine (Group-B), as can be seen in Figure-1.

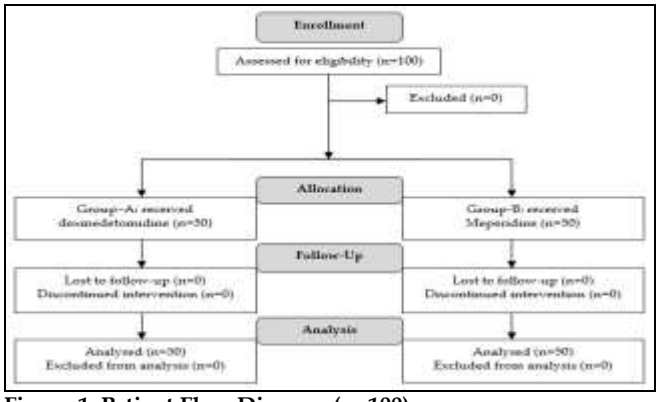

Figure-1: Patient Flow Diagram (n=100)

Standard ASA monitoring was applied to patients which included Electrocardiography (ECG), Non-Invasive Blood Pressure Measurement (NIBP), Respiratory Rate, Heart Rate, Oxygen Saturation (SaO2) and Temperature. Tympanic temperature was monitored throughout the surgery and at 0, 10 and 15 minutes in each patient. The temperature of the operation theatre, post anesthesia care unit and ICU was retained at 22˚C. Each patient was transfused with warmed (36CO) 800ml of ringer's lactate using an IV fluid warmer as preload. All patients were given subarachnoid block with 12mg of hyperbaric bupivacaine at the level of L4 spinal column and put in supine position with wedge under the left hip. Anesthetic levels were confirmed and surgery proceeded with regular monitoring of vital signs. The study was double blinded and the treating anesthetist was provided with preformed shivering medication unknown to him/her. After delivery of baby and clamping of cord, both groups were randomized to receive either 2ml of 0.5u/g of Dexmedetomidine or 2ml of 0.5mg/kg of Meperidine. Shivering was graded on a validated Tsai and Chu2 scale where 0 = shivering not seen, 1 = peripheral vasoconstriction without visible shivering or piloerection, 2 = muscular activity in only one muscle group, 3 = more than one muscle group showing activity but not widespread, and 4 = shivering in entire body.

Shivering incidence and severity were noted for all cases at 0, 15 and 30 minutes after administration of injection. All the patients were shifted to post anesthesia care unit after surgery then were shifted to the ward upon resolution of spinal block.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for data analysis. Frequencies and percentages were used to present descriptive data, along with mean and standard deviation. Chi square test/Fisher exact test was used to find association between variables. A p-value <0.05 was considered statistically significant.

RESULTS

Out of 100 patients studied, no patient had shivering at 30 minutes after spinal anesthetic. Mean age of all patients 29.67±3.83 years, while in Group-A it was 28.44±4.23 years, and 28.06±4.32 years in Group-B. This was statistically insignificant (p=0.71). Mean weight for Group-A was 73.32±7.69 kg, whereas it was 72.1±7.45 kg for Group-B, which was also statistically insignificant (p=0.092).

ASA status for Group-A was ASA II for 47(94%) patients and ASA III for 3(6%) patients, whereas in Group-B ASA II classified patients were 48(96%) and ASA III were only 2(4%) patients. Comparison of ASA status of patients of both groups is shown in Figure-2.

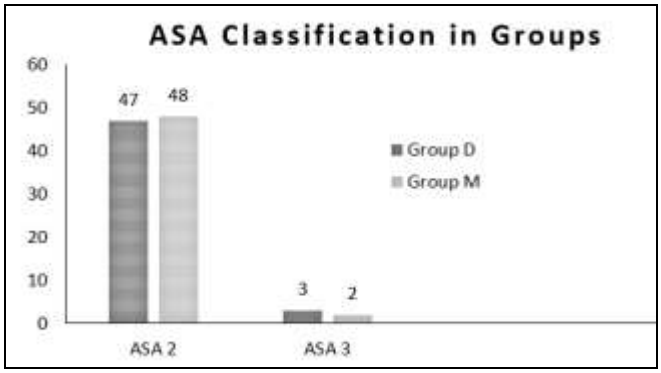

Figure-2: ASA Classification Distribution across Groups (n=100)

Shivering score were measured at intervals of O min, 15 mins and 30 minutes after anesthetic exposure. The scores obtained were compared between groups showed that at 0 minutes after anesthetic exposure, shivering score was 0 in 32(64%) patients in Group-A as compared to 40(80%) in Group-B. However, only 2(4%) patients in Group-A had shivering score of 4, requiring rescue anesthetic, as compared to 1(2%) in Group-B. Results are tabulated in Table-I below.

Table-I: Comparison of Shivering across Groups after Zero Minutes following Anesthetic Exposure (n=100)

Shivering Score	Group-A (n=50) n(%)	Group-B (n=50) n(%)	*p*-value
0	32(64%)	40(80%)	0.076
1	7(14%)	4(8%)	
2	8(16%)	4(8%)	
3	1(2%)	1(2%)	
4	2(4%)	1(2%)	

At 15 minutes after anesthetic exposure, shivering score was 0 in 47(94%) patients in Group-A as well as in Group-B. Likewise both groups had 0 patients showing a score of 4. However, only 2(4%) patients in Group-A had shivering score of 3 as compared to 1(2%) in Group-B. *p*-value was 0.303 as results are tabulated in Table-II below.

Table-II: Comparison of shivering between Groups at 15 minutes following Anesthetic Exposure (n=100)

Shivering Score	Group-A (n=50) n(%)	Group-B (n=50) n(%)	*p*-value
0	47(94%)	47(94%)	0.303
1	0(0%)	2(4%)	
2	1(2%)	0(0%)	
3	2(4%)	1(2%)	
4	0(0%)	0(0%)	

At 30 minutes after anesthetic exposure, shivering score was 0 in 49(98%) patients in Group-A as well as in Group-B. Likewise both groups had 0 patients showing a score of 4. However, only 1(2%) patient in both groups had shivering score of 2 showing equal efficacy as time of anesthetic exposure passed (Table-III).

Table-III: Comparison of shivering between Group-A and B at 30 min (n=100)

Shivering Score	Group-A (n=50) n(%)	Group-B (n=50) n(%)	*p*-value
0	49(98%)	49(98%)	0.500
1	1(2%)	1(2%)	
2	0(0%)	0(0%)	
3	0(0%)	0(0%)	
4	0(0%)	0(0%)	

DISCUSSION

There have been multiple studies internationally comparing the effects of variety of drugs with variable outcomes.[6] Many studies have used alone vs placebo, compared multiple intervals and different drugs for incidence and prevention of shivering. Our study evaluated the effects of intravenous Dexmedetomidine (0.5ug/kg) for shivering after spinal anesthesia in comparison with intravenous meperidine (0.5mg/kg). The incidence of shivering was comparatively decreased in patients of both groups. In a study conducted by Cao *et al.*, showed that both dexmedetomidine and meperidine are effective in preventing postoperative shivering.[5,6] In a similar study conducted in Guangzhou, Yu *et al.*, showed equal efficacy with dexmedetomidine as compared to meperidine when used in patients undergoing combined spinal epidural anesthesia for caesarian section.[7]

There are multiple studies promoting superiority of one drug over the other with marginal benefits. One such meta-analysis comparing 6 RCTs, Miao *et al.*, concluded that 5ug intrathecal dosage of dexmedetomidine was efficacious in preventing postoperative shivering as compared to placebo.[8] A study conducted by Prasad *et al.*, in our eastern neighborhood concluded similar to our results that both drugs are effective in treatment of shivering but dexmedetomidine taking less time for cessation of shivering.[9]

Since the frequency of caesarian section and use of spinal anesthesia are both common worldwide, there have been numerous studies comparing various agents to establish the best one. A similar study from

Iran concluded that prophylactic dexmedetomidine was better in reducing incidence of postoperative shivering.[10] Ameta *et al.*, also proved dexmedetomidine to have better profile against this adverse effect as compared to other agents like ketamine and tramadol.[11]

Abdel-Ghaffer *et al.*, compared three different doses of dexmedetomidine and had varying responses with each dose, proving efficacy of dexmedetomidine as a sole agent.[12] One more study conducted China proved the efficacy of dexmedetomidine to tramadol for reduction of shivering incidence after spinal anesthesia.[13]

One study demonstrated that spinal anesthesia in caesarian section is a risk factor for shivering.[14] Similar to our study, albeit in urological setup, Moeen *et al.*, showed equally efficacious dexamethasone as intrathecal meperidine in reduction of shivering equated to placebo for prostate surgery under spinal anesthesia.[15] In a meta-analysis published in a Turkish journal, Hameed *et al.*, established efficacy of dexmedetomidine for controlling the intraoperative shivering.[17] Likewise a study led by Lamontagne *et al.*, in Montreal, Canada does show the efficacy of dexmedetomidine in reducing the incidence of shivering at 15 minutes after spinal anesthesia.[18] A study with contrasting results was by Gholinataj *et al.*, which showed that intrathecal meperidine was more efficacious in preventing post-spinal shivering as compared to intravenous ketamine.[19]

LIMITATION OF STUDY

This study has some limitations including a small sample size and inclusion of only those patients who were entitled for treatment in military setup, both of which reduce generalisability.

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CONCLUSION

Intravenous dexmedetomidine (in the dose of 0.5ug/kg) is equally effective in preventing the post spinal shivering, in patients undergoing caesarean section as compared to intravenous meperidine (0.5mg/kg dose).

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

SN & SA: Data acquisition, data analysis, critical review, approval of the final version to be published.

SR & AAM: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

IA & MAA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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