RESEARCH ARTICLE

The Prophylactic Administration of Intravenous Paracetamol for Control of Shivering During and After Cesarean Section Under Spinal Anesthesia

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Background: Shivering refers to a series of repetitive involuntary movements of the skeletal muscles commonly occurring during spinal anesthesia. Regional anesthesia (both spinal and Epidural) reduces vasoconstriction and shivering threshold to 6 degrees Celsius above the surface of the block. The aim of this study was to determine the effect of prophylactic administration of intravenous paracetamol in controlling shivering during and after cesarean section under spinal anesthesia.

Methods: In a double-blind randomized clinical trial in the Department of Anesthesiology of Tabriz on patients undergoing cesarean section with spinal anesthesia, the effect of prophylactic administration of paracetamol IV in controlling shivering during and after cesarean section under spinal anesthesia was evaluated.

Results: The mean gestational age of patients was 37.94±1.07 weeks in paracetamol group and 37.58±2.07 weeks in the control group (p=0.278). The mean shivering scores of patients in paracetamol group were 0.72±0.80 in the operating room and 1.32±1.05 in recovery room (P<0.001). The mean shivering scores of patients in control group were 1.16±1.07 in the operating room and 2.28±1.45 in recovery room (P<0.001). The mean increase of shivering score in patients was 0.60±0.98 in paracetamol group and 1.12±1.46 in the control group. The mean increase of shivering score in patients in paracetamol group was significantly less than the control group (p=0.041).

Conclusion: In the present study, the prophylactic use of intravenous acetaminophen reduced the rate of increase of shivering in patients after spinal anesthesia. Postoperative complications in patients in paracetamol group was less than the control group, however, this difference was not statistically significant.

Keywords: Shivering; Paracetamol; Spinal anesthesia; Cesarean section

Shivering is referred to series of frequent involuntary movements in skeletal muscles which occur usually in spinal anesthesia. It is usually a thermoregulatory response to cold temperature. Although it can be induced by other reasons, several causes of hypothermia or reduced central temperature lower than 36oC are unavoidable during general and regional anesthesia (RA). During RA, the autonomic regulation is impaired and results in reduced central temperature. Patient cannot sense hypothermia but starts shivering, it means serious clinical paradox [1-2]. Shivering is a state same as tremor with unknown cause. The researchers defined two types of shivering. It is documented based on electromyographic studies as follows: (1) phase tonic has true shivering– like tonic pattern which composed of 4 to 8 cycles per minute (waxing and waning) and referred to as normal pattern and simple response of thermoregulatory to intraoperative hypothermia and (2) Phasic pattern by frequency of 5 to 7 Hz same as generalized clonus. Colonic pattern is modulated by history of pathologic responses of spinal cord involving clonus , nystagmus and hyperactive deep reflexes. Etiology of tremor and different responses of patients were unknown but surgical pain can be key factor [1-3]. Regional anesthesia can reduce threshold of vasoconstriction and shivering as 6 oC above block level (i.e. change of central control rather than peripheral control). The reduction of threshold is proportional with number of blocked spinal segments. Other reasons are administration of sedative drugs, reduced rate and peak of shivering response than normal subjects, impaired thermal behavior. The major results of these disorders are intra and postoperative shivering and hypothermia [1-5]. Incidence of shivering after SA is reported 20 to 60% [2-6]. Currently, prophylactic administration of intravenous paracetamol is used for control of intra and post- operative shivering after spinal anesthesia [7-9]. The aim of this trial was evaluation of paracetamol effect on prevention of shivering in intra and postoperative periods.

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Methods

These two blinded randomized clinical trials were conducted in Alzahra teaching hospital on 100 patients (ASA I and II) who were undergoing C/S. We obtained informed consent. The samples were randomized by blocks permuted and based on randomization software. Pilot study showed failure rate of intervention and control groups were 0.15 and 0.4, respectively. Therefore, by consideration of power = 0.8, sample size was determined 50 cases in each group. Inclusion criteria were as follows: pregnant women 16 to 45 aged years who undergoing C/S with ASA I and II. Pregnant women with ASA III and higher, contraindication of NSAIDs administration such as peptic ulcer, coagulopathies, renal failure, liver failure and history of allergic reaction to drugs (e.g. local anesthetics), contraindication of SA were excluded from study. Patients who experienced failure of SA or block level lower than the desired level or any undesired event were excluded from study.

After entrance to OR, all necessary monitoring (i.e. blood pressure, heart rate, Sao2) were performed. Also, axillary and tympanic temperatures were measured. Temperature of OR was maintained between 22 to 24 oC and two layers surgical drapes were used. Intravenous fluids were maintained at 22 to 24 oC. After recording of basic vital signs, 10 mL/kg Ringer's solution was infused and then, spinal anesthesia was performed in L3 –L4 or L4 – L5 intervertebral space with Quincke needle - 25 gauge and 2.5 to 3 mL bupivacaine 0.5%. Paracetamol group (e.g. Brand Apotel, 1000 mg, Company uni pharma) received infusion of 1gr paracetamol in 100 mL normal saline for 15 to 20 minutes after newborn delivery and control group received infusion of 100 mL normal saline in coded syringes. The interviewer and drug administer were blinded to contents of syringes (paracetamol or normal saline). During surgery, vital signs were measured every 2 minutes until delivery and then, every 5 minutes until end of surgery. When blood pressure declined more than 20 % of baseline, 5 to 10 mg ephedrine IV was injected and repeated, if necessary. Body temperature was recorded every 15 minutes up to recovery. Mahjon and Crossely scale was used (0 = without shivering; 1 = presence of one or more symptoms including vasoconstriction, cold extremities, hair sting, peripheral cyanosis without specific reason; 2= movements in one muscle group; 3= movements in more than one muscles group; 4= severe movements in whole body). For severity of shivering was score 3 or 4. 0.5 mg/kg meperidine was administered for control of shivering.SA and drug administration were performed by anesthesiologist. Demographic data and other variables were recorded. Data was analyzed in software of Spss 17 by descriptive statistical methods, frequent measurements test, t- test was used for independent groups or Man Whitney and qui square or Fisher's exact (calculation of RR with confidence interval 95).

Results

In our study, the mean age of paracetamol group and control group was 27.96± 6.09 and 29.68± 6.49 years old (p-value = 0.175). ASA score of paracetamol group and control group was 1.16 ± 0.37 and 1.24 ± 0.43, respectively (p-value = 0.322). The mean age of pregnancy of paracetamol group and control group was 37.94 ± 1.07 and 37.58 ± 2.07 weeks and there was not any significant difference between two groups (p- value = 0.278). The mean of shivering score in paracetamol group in OR and recovery room was 0.72 ± 0.8 and 1.32 ± 1.05, respectively. There was significant difference between shivering score in OR and PACU in paracetamol group (p-value < 0.001). The mean of shivering score in control group in OR and recovery room was 1.16 ± 1.07 and 2.28 ± 1.45, respectively. There was significant difference between shivering score in OR and PACU in control group (p-value < 0.001). The mean increased score of shivering in paracetamol and control group was 0.6 ± 0.98 and 1.12 ± 1.46, respectively. This value was significantly lower in paracetamol group (p- value = 0.041). In (Table 1, 2, 3), we summarized systolic, diastolic and body temperature values during different times.

Table 1- Systolic pressure values in two groups

Variable (mmHg)	Paracetamol group	Control group	P-value
Basic systolic pressure	122.54±10.16	123.48±13.51	0.695
Post anesthetic pressure	102.08±14.75	112.64±19.12	0.003
Post anesthetic pressure after 5 minutes	105.52±9.93	108.14±15.26	0.311
Systolic pressure in recovery room	108.60±9.86	111.92±10.93	0.114

Table 2- Diastolic pressure values in two groups

Variable (mmHg)	Paracetamol group	Control group	P-value
Basic diastolic pressure	76.52 ±11.50	77.10 ±12.02	0.806
Post anesthetic diastolic pressure	56.38± 12.80	66.22± 15.37	0.001
Post anesthetic diastolic pressure after 5 minutes	58.72± 9.71	60.02 ±13.62	0.584
Diastolic pressure in recovery room	60.60± 11.21	65.06 ±11.59	0.053

Table 3- Body temperature values in two groups

Variable (oC)	Paracetamol group	Control group	P-value
Basic body temperature	35.26±4.61	36.13±0.59	0.125
Post anesthetic body temperature	35.65±.67	35.82±0.64	0.184
Post anesthetic body temperature after 5 minutes	35.50±.67	35.58±.65	0.548
body temperature in recovery room	35.20±.65	35.33±0.57	0.291
body temperature after exist of recovery room	35.00±.72	35.14±0.53	0.251

Discussion

Spinal anesthesia is a selective anesthesia method in C/S due to low maternal mortality and morbidity rate and neonatal depression [1-7]. During regional anesthesia, the autonomic regulation of temperature is impaired and resulted to reduce central temperature. The patient will start shivering and hypothermic disease appears [1]. Spinal anesthesia reduces threshold of vasoconstriction in above of blocked level which is proportional with blocked spinal segments. The concurrent administration of sedative drugs, reduced rate and peak shivering response than in normal subjects, abnormal regulation of thermal behavioral are other reasons of hypothermia in intra and post-operative period [1, 7]. Shivering is common complication of SA with an incidence of 20 to 60% [3,4,6]. This event had adverse effects on monitoring of ECG, blood pressure and heart rate. Also, it is associated with high consumption rate of oxygen and production of carbon dioxide [3,7]. It can increase prevalence of wound infection, bleeding and sometimes, heart ischemic events [3,10]. Etiology of tremor and various responses of patients remain unknown, but surgery plays key role [1,3]. Several methods and drugs were used for prevention and treatment of shivering such as warming [3,9], intrathecal fentanyl, sufentanyl [5,7], IV midazolam, ketamine, meperidine and currently, IV ondansetron and granicetrone [7,11]. In our study, intravenous acetaminophen was used for prevention of shivering after SA. In one survey, authors compared 40 patients who underwent C/S by extradural block and they used clonidine with placebo (normal saline) for elimination of shivering, 75% of cases had appropriate response to clonidine [12]. Sia et al (1998) studied 100 patients who received SA for knee arthroscopy, they compared clonidine with placebo over 90 minutes and concluded clonidine has dose depended response [13]. Gholami et al in their prospective randomized double-blind controlled clinical trial on 110 pregnant women with physical Status I or II, aged 18–40 years, who were scheduled for elective cesarean section under general anesthesia concluded that prophylactic use of IV paracetamol during surgery is effective for the prevention of postoperative shivering [14]. In the present study, we used acetaminophen IV for reducing of shivering and found positive effects for it. Further studies are needed to confirm these results.

Conclusion

We found relatively new option for prevention of shivering after SA. Acetaminophen is a drug with low side effects on breast- feeding, cost- effective and almost always is available in many of ORs. By this drug, we can raise patient satisfaction and reduce adverse side effects of SA. We believe to need other studies involving a larger population.

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