

# Intrathecal Meperidine for Prevention of Shivering During Transurethral Resection of Prostate

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**Introduction:** The aim of this study was to investigate low-dose intrathecal meperidine for prevention or alleviation of shivering after induction of spinal anesthesia for transurethral resection of the prostate (TURP).

**Materials and Methods:** In a randomized controlled trial, 80 patients scheduled for TURP under spinal anesthesia were assigned into two groups of case and control. Spinal anesthesia was performed using 75 mg of hyperbaric lidocaine 5% plus meperidine, 15 mg, in the patients of the case group and the same dose of lidocaine plus normal saline in the patients of the control group. Shivering episodes were recorded during the operation and in the recovery room. Data on systolic blood pressure, heart rate, arterial oxygen saturation, and body temperature were collected before the induction of anesthesia; 5, 15, and 30 minutes after the induction; and in the recovery room.

**Results:** Maximum level of sensory block was similar in the patients of the case and control groups. Shivering was not seen in the patients who received meperidine, while in the control group, 11 (27.5%) experienced some degrees of shivering ( $P = .001$ ). Blood pressure, body temperature, and arterial oxygen saturation did not have a clinically significant change and they were not different between the two groups. Side effects of opioids were unremarkable.

**Conclusion:** Low-dose intrathecal meperidine is effective and safe in reducing the incidence of shivering associated with spinal anesthesia for TURP.

Keywords: transurethral resection of the prostate, meperidine, shivering, spinal anesthesia

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## INTRODUCTION

Hypothermia is one of the important complications of transurethral resection of prostate (TURP). Large volume of irrigating fluid at room temperature and its absorption can decrease the core temperature in the patients undergoing TURP. The consequence is shivering, particularly in older patients with impaired thermoregulatory mechanism. On the other hand, spinal anesthesia, the technique of choice in TURP, causes impairment of the thermoregulatory function of the autonomic system.<sup>(1)</sup> Shivering may occur in up to 56.7% of the patients undergoing various

surgeries with spinal anesthesia.<sup>(2)</sup> Most of the patients undergoing TURP are old and are likely to have both cardiovascular and pulmonary disorders (30% to 60%) and are, therefore, vulnerable to the complications such as shivering. Severe shivering increases  $O_2$  consumption and  $CO_2$  production; hence, cardiac output and minute ventilation should increase which are dangerous in patients with limited ventilatory and cardiac reserve.<sup>(3)</sup> As well as the undesirable cardiovascular effects, shivering can make surgical difficulties, dislodge clots, and increase postoperative bleeding.

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Intravenous administration of drugs such as meperidine, clonidine, ketanserin, magnesium sulfate, and physostigmine has been suggested for the treatment of shivering. Meperidine is unique among the opioids for its ability to effectively treat and prevent shivering.<sup>(4-6)</sup> In comparison to treatment, prevention of shivering has not been well investigated. Chen and colleagues suggested that a small dose of intrathecal meperidine might decrease the incidence of shivering and discomfort associated with anesthesia in a nonpregnant population.<sup>(2)</sup> In another study, Roy and associates showed that intrathecal meperidine with the dose of 0.2 mg/kg reduced the incidence and intensity of shivering associated with intrathecal anesthesia for cesarean section.<sup>(7)</sup> This double-blinded randomized controlled trial was performed to determine whether meperidine, 15 mg, plus lidocaine, decreases the incidence of shivering during spinal anesthesia for TURP surgery.

## MATERIALS AND METHODS

This study was approved by the ethics committee of Hamadan University of Medical Sciences. Between April 2005 and August 2005, we selected patients with physical status scores of I, II, and III (according to the classification of the American Society of Anesthesiologists) who were scheduled for TURP at Ekbatan Hospital in Hamadan, Iran. Patients with tremor, history of allergy, and conditions that contraindicated spinal anesthesia were excluded from the study. A total of 80 patients were selected and assigned into 2 experimental and control groups by simple randomization. Meperidine injection was prepared by an anesthesiologist not involved in the study. After taking written informed consents, basic information including age, systolic blood pressure, heart rate, and arterial oxygen saturation were recorded.

For induction of spinal anesthesia, all of the patients received ringer lactate solution (15 mL/kg). Oxygen was administered by face mask. All intravenous fluids were warmed up to 37°C and the operating room temperature was maintained at 22°C to 25°C. Spinal anesthesia was performed in the sitting position at the L3-L4 or L4-L5 interspaces with a midline approach using 25-gauge Quincke needle. In the case group, drugs for spinal anesthesia consisted of

hyperbaric lidocaine 5%, 75 mg, plus meperidine, 15 mg, while in the control group, the same dose of lidocaine plus normal saline was administered. After spinal anesthesia induction, the patients were secured in the supine position and the standard TURP was performed. Supplemental oxygen (5 L/min) was administered by a simple face mask during the operation and the recovery time.

Systolic blood pressure, heart rate, and arterial oxygen saturation were measured and recorded intermittently before induction, intra-operatively (5, 15, and 30 minutes after the induction of the anesthesia), and in the recovery room. Axillary temperature was measured with a single calibrated mercury thermometer 3 minutes before induction, 30 minutes after induction, and in the recovery room by an anesthesiologist blinded to the study design. Maximum level of sensory block was evaluated by pinprick. The incidence and severity of shivering were recorded during the operation and in the recovery room.

Hypotension was defined as a decrease in the systolic blood pressure to less than 90 mm Hg or 20% less than the baseline value, which was treated with 5 mg to 10 mg of intravenous ephedrine. Pruritus was treated with 25 mg of intravenous diphenhydramine, and intravenous metoclopramide, 10 mg, was administered for nausea and vomiting. Shivering was graded with a scale described by Crossley and Mahajan as follows<sup>(8)</sup>: zero, no shivering; 1, piloerection or peripheral vasoconstriction but no visible shivering; 2, muscular activity in only one muscle group; 3, muscular activity in more than one muscle group but no generalized shivering; and 4, shivering involving the whole body.

The collected data were analyzed by the Epi Info 6 software (Epi Info, the Centers for Disease Control and Prevention, Atlanta, Georgia, USA). The chi-square test was used to compare qualitative variables, and repeated-measures analysis of variance was used to compare trends in numeral variables during the study course. A *P* value of less than .05 was considered statistically significant.

## RESULTS

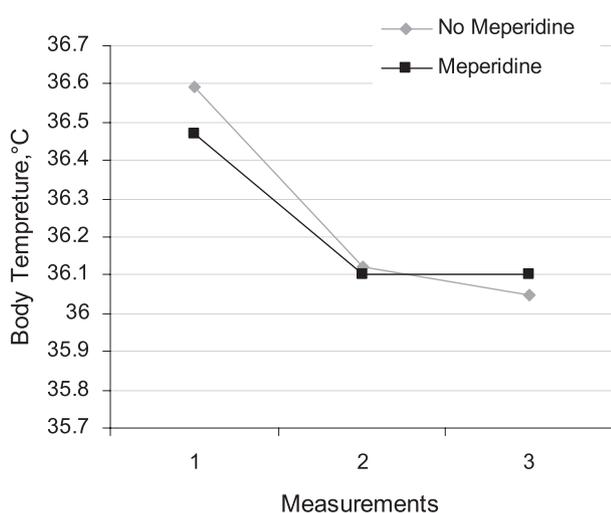
All of the 80 patients in the experimental and control groups completed the study and none

Demographic and Baseline Clinical Data of Patients With and Without Meperidine Injection

Variable	Study Group	Control Group
Number of patients	40	40
Age, y	72.7 ± 9.3	70.0 ± 9.9
Operative time, min	50.2 ± 14.2	56.4 ± 19.2
Median highest blocked segment (range)	T8 (T6 to T11)	T8 (T7 to T11)
Mean baseline systolic blood pressure, mm Hg	133.0 ± 21.2	142.8 ± 23.1
Mean baseline heart rate, /min	71.6 ± 9.9	75.3 ± 16.5
Mean baseline arterial oxygen saturation, %	94.8 ± 3.2	94.6 ± 1.9

of them excluded from the analyses. There were no differences between the groups regarding the basic data including age and baseline systolic blood pressure, heart rate, arterial oxygen saturation, and body temperature. The operative time and maximum sensory level block were also similar in the two groups (Table). Eleven patients (27.5%) in the control group had some degrees of shivering while none of the patients in the experimental group experienced shivering ( $P = .001$ ). Evaluation of the shivering severity was not possible since shivering was not found in one of these groups.

Comparison of the patients' body temperature showed a decrease in both groups without any significant difference ( $P = .46$ ; Figure 1). Pruritus was not reported in any of the patients. Nausea was seen in 2 patients (5.0%) of each group ( $P = .69$ ) and vomiting occurred in 2 patients (5.0%) with meperidine and 1 (2.5%) in the control patients ( $P = .50$ ). Hypotension did not occur in any of the

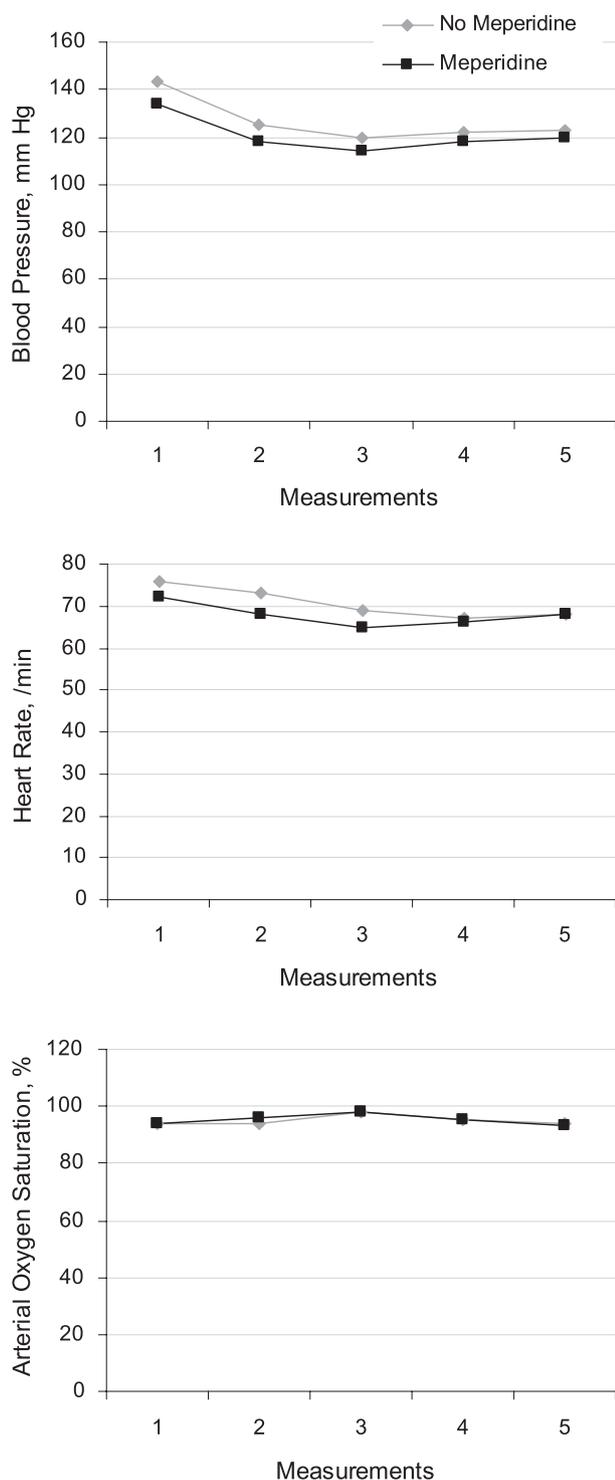


**Figure 1.** Changes in the body temperature in the patients who underwent spinal anesthesia with and without meperidine. Measurements are: 1, before anesthesia induction; 2, half an hour after induction; and 3, in the recovery room.

patients. Comparison of hemodynamic changes for each interval showed that the decreasing trends in systolic blood pressure and heart rate were similar in both groups and there were no differences in these parameters during the study course between the two groups ( $P = .13$  and  $P = .38$ , respectively; Figure 2). Use of supplemental oxygen resulted in increasing the arterial oxygen saturation during the operation, and its cessation caused a decrease in this variable at the end of the recovery period. Trends in arterial oxygen saturation were similar in the two groups and the values measured were similar ( $P = .91$ ; Figure 2).

## DISCUSSION

Prevention of shivering is beneficial for the patients who undergo surgical operation, especially for the elderly. Although irrigation with warmed solutions can reduce the risk of hypothermia and shivering in TURP, it may increase bleeding because of vasodilatation.<sup>(2)</sup> On the other hand, intravenous injection of meperidine for the treatment of shivering can result in side effects such as hemodynamic changes, respiratory depression, nausea, vomiting, pruritus, and other opioid-related complications. However, systemic absorption and the resultant effects are unlikely if the intrathecal meperidine is administered in a low dose. On the basis of the findings in this study, low-dose intrathecal meperidine is not associated with the side effects. Decreases in systolic blood pressure and heart rate were noted in the patients of both study and control groups that were probably due to the sympathetic block effect of spinal anesthesia. In a previous study, intramuscular injection of meperidine, 25 mg, reduced shivering from 56.7% to 10% in the patients with spinal anesthesia.<sup>(9)</sup> Also, in 2 studies by Chen and associates and Roy and colleagues, it was found that adding meperidine to the anesthetic compound reduced shivering in the patients who



**Figure 2.** Changes in the systolic blood pressure, heart rate, and arterial oxygen saturation before and after the induction in the patients who underwent spinal anesthesia with and without meperidine. Measurements are: 1, before anesthesia induction; 2, five minutes after induction; 3, fifteen minutes after induction; 4, 30 minutes after induction; and 5, in the recovery room.

underwent spinal anesthesia.<sup>(2,7)</sup> In the study of Roy and colleagues, administration of low-dose intrathecal meperidine was not associated with any side effects.<sup>(7)</sup> It seems unlikely that the antishivering effect of low-dose intrathecal meperidine was due to its systemic absorption.<sup>(7)</sup>

Meperidine is a combined  $\mu$ -receptor and  $\kappa$ -receptor agonist. It seems that intravenous meperidine is much more effective in the treatment of shivering than the equi-analgesic doses of other  $\mu$ -opioid agonists, and the antishivering effect of meperidine seems to be mediated by the  $\kappa$ -receptor agonist activity.<sup>(10-13)</sup> The same level of sensory block in the two groups of our study emphasizes that firstly, there were equal potential effects of block height on the development of hypothermia and shivering, and secondly, intrathecal meperidine did not influence sensory block height. However, regarding the reducing effects of other types of medications such as  $\alpha$ 1-adrenergic agonists, serotonin antagonists, and propofol on shivering, it is suggested that a nonopioid mechanism can be involved.<sup>(14)</sup> Physostigmine as an effective treatment of shivering brings up the cholinergic mechanism. It is believed that central inhibition on thermoregulatory control is the mechanism of prevention of shivering by these drugs.<sup>(14)</sup> Perhaps, meperidine is much more effective in the treatment of shivering due to its interaction with thermoregulation, besides its opioid effect.

## CONCLUSION

According to our results, adding a low dose of meperidine (15 mg) to the intrathecal anesthetic mixture for TURP reduces the incidence of shivering without increasing the side effects. Further studies are needed to replicate our results.

## CONFLICT OF INTEREST

None declared.

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