Tramadol and Meperidine effect in Postanaesthetic Shivering

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Abstract
Postanaesthetic shivering is the existence of involuntary, spontaneous movements in skeletal muscles, giving rise to discomfort. Different drugs are identified to be effective on reducing this complication. The purpose of this study was to compare the effectiveness of tramadol and meperidine in controlling postoperative shivering. The present study was performed as a double blind clinical trial on patients suffering from shivering following a general anesthesia for a urologic operation. In the recovery room, the patients received 1mg/kg Tramadol or 0.5mg/kg Meperidine (IV in 30 seconds) based on a randomized table, if PAS of grade II or higher occurred. Shivering was reported to disappear in 40% following the use of tramadol and 53.3% after the consumption of meperidine. Both drugs were effective in reducing the severity of shivering; PAS, however, remained unchanged in a case in tramadol group and 2 in the meperidine group. Tramadol is as effective as the commonly used meperidine in tackling post-anesthetic shivering.

Key Words – Postanaesthetic Shivering – Meperidine – Tramadol – General Anesthesia

1 Introduction
Postanaesthetic shivering (PAS) is the existence of involuntary, randomized, spontaneous movements in skeletal muscles; giving rise to discomfort and unpleasant feeling [1]. It is known to be a frequent complication, reported in 40-70% of patients at recovery [2]. The origin of postoperative shivering is unclear. Several hypotheses have been raised to explain its occurrence. Perioperative hypothermia is the primary cause, which sets in due to anesthetic induced inhibition of thermoregulation; however, the muscular activity may be increased following anesthesia even in non hypothermic patients [3-5].
Pain, sympathetic overactivity, release of pyrogen products, adrenal inhibition, spinal reflex hyperactivity and respiratory alkalosis are other known causes [4]. Shivering results in a 200-500% increase in oxygen consumption index along with raised CO2 production, ventilation and cardiac output [6, 7]. Vasconstriction and increased vascular resistance leading to inadequate circulation especially in patients with atherosclerosis and therefore, aggravated cardiac ischemia are other complications following the condition [4].

Various medications help prevent postanaesthetic shivering. Meperidine is an analgesic, whose effect on reducing the postanaesthetic shivering is fully understood [8-10]; the effect of other medications such as morphine, fentanyl, and alfentanil, however, are not shown [10]. Tramadol is an opioid widely used during the postoperative periods because of its analgesics properties with the aim of controlling the pain and preventing the respiratory depression. Previous studies, however, have shown controversial results regarding its effectiveness in reducing postoperative shivering [2, 8, 11, 12]. As a result, the present study was designed to evaluate the impact of tramadol on postoperative shivering and to compare its effects with those of meperidine.

2 Materials and Methods

After being approved by the Institutional Ethics Committee of Tehran University of Medical Sciences, the study was performed as a double blind clinical trial on 60 patients suffering from shivering following a general anesthesia.

All the patients in physical status, ASA class I and II, who did not have any contraindication for receiving the specified drugs were enrolled in this study. They were selected from those willing to undergo a urology operation of less than 2 hours (except prostatectomy and transurethral resection (TUR) of the prostate, which are associated with an exchange of a great amount of fluid and blood). The patients in an emergent condition, and those having hyperthermia (oral T >37.5 °) or receiving any medication with a confounding effect on drugs prescribed in this study were excluded.

After signing an informed written consent, the subjects were divided in two groups randomly using random allocation software.

The patients' blood pressure, pulse oximetery, temperature and ECG changes were monitored all thorough the operation. All the patients received anesthesia similarly with midazolam 0.03 mg/kg and fentanyl 2 mcg/kg as premedication and nesdonal (Na-thiopental) 4 mg/kg and atracurium 0.5 mg/kg for induction. After tracheal intubation, anesthesia was maintained by N2O-O2 50% (total flow 3 lit) and isoflurane 1-1.5%. The temperature of the operating room was set to be between 22-24°C during the operation period and the injected fluids had the same room temperature.

The patients were extubated after the muscular relaxant effects of atropine were reversed following the administration of neostigmin 0.05 mg/kg and 0.02 mg/kg. The patients were under a close observation in the recovery room so that the responsible resident would be informed in case shivering would happen.

Table-1 outlines the classification of the severity of post anesthetic shivering. The patients received 1mg/kg Tramadol or 0.5mg/kg Meperidine (IV in 30 seconds), in case they displayed PAS of grade II or higher. The responsible resident used drugs in the syringes labeled as A or B based on a randomized table. These syringes were filled by a single technician who was not informed of the objectives of the study. Normal Saline was added in order that both syringes would have the same volume. The interval between the beginning and disappearance of shivering was also noted. Disappearance or any decline in the severity of the shivering was defined as a positive effect of the drug while nausea, vomiting, lethargy, decrease in arterial O2 saturation and other complications were defined as complication. The complications were gathered in an especial form. The patients were under observation for 30 minutes for possible shivering.

The results were entered in SPSS version 11.5 and analyzed. Demographic information, anesthetic duration, the initiation and disappearance time of shivering was compared using a t-test, whereas for the severity and the complications chi square and non-parametric tests were utilized.

2.1 Statistics

The minimum of required sample size was calculated based on the findings retrieved from a previously published report [12] which reported PAS to cease by 87% and 93% in patients receiving Tramadol and Meperidine, respectively.

3 Results

Sixty patients were enrolled in this study (30 cases in each group), 32 of which were male and 28 were female. The mean age of the patients was 36.2±16.3, and 40% of them were in 25-34 years age group. There was not a statistically significant
difference between the mean age, gender, length of anesthesia between the two groups (Table 2).

Shivering was reported to disappear in 40% following the use of tramadol and 53.3% after the consumption of meperidine. Both drugs were reported effective in reducing the severity of shivering; PAS, however, remained unchanged in a case in tramadol group and 2 in the meperidine group (Table-3).

The mean length of anesthesia and the duration of PAS (the interval between the initiation and the disappearance of shivering) was 91.1± 41.1 and 6.5± 4.0 minutes, respectively. The mean interval between the injection of the drug injection (tramadol and meperidine) and the disappearance of the shivering was reported to be 2.18 and 2.25 minutes, respectively. Table 4 outlines these results in each group. There was no significant difference between the initiation time of PAS (interval between operation and initiation of shivering), duration of PAS (interval between drug administration and disappearance of shivering) and the severity of shivering between the two groups.

Complications such as nausea and vomiting were reported in 9 patients in the tramadol group while only 4 in the other group were reported to have lethargy and respiratory depression, neither of which needed re-intubation.

4 Discussion

Postanesthetic shivering is a common complication reported in 5 to 65% of cases undergoing general anesthesia [13]. A decrease in the core temperature secondary to sympathetic block, leading to peripheral vasodilatation, increased cutaneous blood flow, and subsequent increased heat lost via skin, is considered as one of the rationales contributing to the condition [14]. Various strategies such as the use of reflective blankets, cutaneous forced-air warming devices, warm humidified anaesthetic gases and radiant heat are adopted to lower the incidence of the condition [15-17]. The use of drugs such as Nefopam, Tramadol, Physostigmine, Morphine, Fentanyl, and Pethidine are considered as an alternative but effective solution; it, however, is associated with side-effects such as nausea, vomiting and respiratory depression [18-20].

Opioids such as morphine and tramadol are the main drugs used to prevent and treat the condition [18, 21, 22].

The present study showed that patients experience more postanaesthetic shivering after receiving tramadol compared to meperidine; the difference, however, was not significant. Additionally, the severity of the condition is also slightly higher in the very group.

The results of this study are in contrast with previous researches, many of which had considered tramadol as an appropriate alternative for meperidine. In a study performed by Bhatnagar et al, they showed a significant decrease in shivering in 10 minutes following the operation, using intravenous tramadol 1mg/kg compared with meperidine 0.5mg/kg (12 out of 15 patients VS. 4 out of 15). Reoccurrence of shivering was not reported in patients receiving tramadol. In the mentioned study, intravenous tramadol 1mg/kg was suggested to be more effective than 0.5 mg/kg meperidine in controlling the postoperative shivering [11]. Other studies also reported the greater antishivering and analgesic properties of tramadol in treating PAS when compared to meperidine [23-26].

In another study, Kranke et al studied the antishivering efficacy of different doses of IV tramadol (0.5, 1, 2, and 3 mg/kg), indicating that the efficacy of the drug improved in higher doses. Comparing patients who received tramadol and meperidine, they showed that there was no difference in the reoccurrence rate of shivering and the resultant complications between the two groups. Retreatment was also less required in these 2 groups compared with the controls [9].

Tsai et al also showed tramadol to be an effective drug in the treatment of shivering following epidural anesthesia in pregnant women because of its low affinity for opium receptors and modulatory effects on central monoaminergic tracts. The anti shivering effects of tramadol (0.5mg/kg), meperidine (0.5mg/kg), and amitriptiline (15-20mg) were evaluated in this study. Response to treatment (disappearance of shivering in 15 minutes after drug injection) was reported in 93, 87, and 13% of patients receiving meperidine, tramadol and amitriptiline, respectively. The interval between drug injection and disappearance of shivering was 5.1±3.6, 4.2±2.3 in those receiving tramadol and meperidine, respectively. Lethargy was more frequently seen in patients receiving meperidine (33% VS. 7% and 0 in those receiving tramadol and amitriptiline). As a result, meperidine and tramadol revealed a rapid response in cutting off the shivering, while tramadol resulted in less lethargy [12].

Saha et al reported that tramadol significantly reduces the incidence and severity of shivering following open and laparoscopic cholecystectomy operation [27]. Heid et al, similarly, reported that intraoperative administration of tramadol is an effective medication in lowering the incidence and extent of postoperative shivering with out
influencing the pain perception in lumbar disc surgery [28].

Talakoub et al, moreover, reported both tramadol and meperidine to be effective in treating postspinal shivering in women undergoing cesarean section [14]. In line with these findings, the present revealed no significant difference between the postoperative shivering control rate and the resulted complications following the use of tramadol and meperidine, suggesting that despite the fact that tramadol can help reduce postanaesthetic shivering it does not provide the patient with additional benefits compared to the commonly used meperidine.

These findings are on the contrary to previous studies in which various doses of tramadol have shown promising effects in reducing postanaesthetic shivering. Different individuals are reported to show various responses to opiums, so the difference between the findings of the present study and those of previous researches can be contributed to the differences between Iranians and other populations in whom the researches were conducted. Moreover, the difference in the type of operations for which the patient was anesthetized can be another reason leading to the differences.

It is recommended to perform larger studies to compare the real effects of various doses of tramadol with meperidine on postanaesthetic shivering.

Considering the fact that all studies carried out in this field have chosen adults as their target population, so it is recommended to perform a similar study on children in order to evaluate the effect of these drugs on this age, as well. Moreover, the temperature changes were not recorded in the present study, so it is recommended to keep a record in these changes in the following studies.

5 Acknowledgment

We are indebted to the Research and Development Center of Amir Alam Hospital for their support.

References


Tables-
Table 1- The severity score of postanaesthetic shivering [14]

<table>
<thead>
<tr>
<th>PAS</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>No shivering</td>
<td>0</td>
</tr>
<tr>
<td>Peripheral vasoconstriction associated with sensation of coldness,</td>
<td>1</td>
</tr>
<tr>
<td>without any visible shivering</td>
<td></td>
</tr>
<tr>
<td>Muscular contraction in a group of muscles</td>
<td>2</td>
</tr>
<tr>
<td>Muscular contraction in more than a group of muscles but not</td>
<td>3</td>
</tr>
<tr>
<td>generalized</td>
<td></td>
</tr>
<tr>
<td>Generalized shivering</td>
<td>4</td>
</tr>
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</table>
Table 2 – Demographic Data of the patients enrolled in each group

<table>
<thead>
<tr>
<th></th>
<th>Meperidine (n=30)</th>
<th>Tramadol (n=30)</th>
<th>P- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>17.9 ± 36.3</td>
<td>14.7 ± 36.1</td>
<td>0.962 *</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>17 (28.3%)</td>
<td>15 (25%)</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>13 (21.6%)</td>
<td>15 (25%)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>67.1 ± 8.67</td>
<td>70.1 ± 10.5</td>
<td>0.78</td>
</tr>
<tr>
<td>Duration of PAS (min)</td>
<td>25.1 ± 93.2</td>
<td>37.3 ± 89.0</td>
<td>0.699 *</td>
</tr>
<tr>
<td>Initiation of PAS (min)</td>
<td>6.2 ± 3.8</td>
<td>6.8 ± 4.2</td>
<td>0.520 *</td>
</tr>
<tr>
<td>Severity of PAS</td>
<td>2.9 ± 1.1</td>
<td>3.1 ± 0.8</td>
<td>0.726 **</td>
</tr>
</tbody>
</table>

* independent t-test
** X 2
Table 3- PAS severity before and following drug administration

<table>
<thead>
<tr>
<th>PAS severity</th>
<th>Tramadol (%)</th>
<th>Meperidene (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Before drug administration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>10 (33.3)</td>
<td>8 (26.6)</td>
</tr>
<tr>
<td>2</td>
<td>11 (36.7)</td>
<td>12 (40)</td>
</tr>
<tr>
<td>3</td>
<td>7 (23.3)</td>
<td>6 (20)</td>
</tr>
<tr>
<td>4</td>
<td>2 (6.7)</td>
<td>4 (13.3)</td>
</tr>
<tr>
<td>0</td>
<td>12 (40)</td>
<td>16 (53.3)</td>
</tr>
<tr>
<td><strong>Following drug administration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>13 (43.3)</td>
<td>11 (36.7)</td>
</tr>
<tr>
<td>2</td>
<td>4 (13.3)</td>
<td>1 (3.3)</td>
</tr>
<tr>
<td>3</td>
<td>1 (3.3)</td>
<td>2 (6.7)</td>
</tr>
</tbody>
</table>
Table 4 – Outcome in each group

<table>
<thead>
<tr>
<th></th>
<th>Meperidine (n=30)</th>
<th>Tramadol (n=30)</th>
<th>P- Value</th>
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<tr>
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