INTRAOPERATIVE KETAMINE FOR THE PREVENTION OF SHIVERING POST-TRANS URETHRAL RESECTION OF PROSTATE

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ABSTRACT

Objective: To assess the effect of intraoperative ketamine in preventing post-anesthetic shivering.

Methods: Eighty patients classified by the American society of anesthesiologists as class 2 and 3, scheduled for elective trans urethral resection of prostate under general anesthesia, were included in this study. Patients were assigned in a random manner to be given normal saline 0.9% as a placebo (group 1, n =37) or ketamine 25mg intravenously (group 2, n = 43) at the end of surgery prior to laryngeal mask airway removal. An anesthetist graded post- anesthetic shivering using a 5- point scale.

Results: The two groups did not differ significantly regarding patients demographics. Ketamine significantly reduced the incidence and severity of post-anesthetic shivering in comparison with placebo, on arrival in the recovery room and at regular intervals postoperatively.

Conclusion: Our results suggest that intraoperative ketamine is effective in the prevention of post- anesthetic shivering.

Key words: Trans urethral resection of prostate, Ketamine, Post-anesthetic shivering.

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Introduction

Post-anesthetic shivering is a rhythmic oscillating movement, predominantly involving the upper limbs, neck and jaw that develop in 5-70% of patients after general anesthesia [(1)]. This may be normal thermoregulatory shivering due to core hypothermia or may result from the release of cytokines by the surgical procedure. The core temperature usually decreases by 0.5- 1.5 ^{O}C. in the first hour after induction of anesthesia. All general anesthetics markedly impair normal autonomic thermoregulatory control. However, non- thermoregulatory shivering may also occur in normothermic patients due to certain anesthetics or post-operative pain [(2)].

Post-anesthetic shivering is very distressing and physiologically stressful for the patient after enjoying the comfort of modern anesthetics. In addition, shivering is a potentially serious complication especially in patients with coronary artery disease due to increased oxygen consumption (by 100-600%), circulatory catecholamines and intracranial pressure [(3)].

Several agents have been used for prevention of post-anesthetic shivering. Among the pharmacological agents, pethidine has been shown to be one of the most effective treatments [(4)]. Ketamine which is a competitive N-methyl-D – aspartate (N.M.D.A) receptor antagonist, has been shown to inhibit post-anesthetic shivering [(5)]. There have been few studies, which described the efficacy of ketamine for prophylaxis of post-anesthetic shivering [(6)].

Optimal dosage regimen is currently undetermined. The aim of this study was to assess the use of ketamine as part of a standardized general anesthetic technique at the end of surgery in an attempt to inhibit post-anesthetic shivering.

Methods

This study was conducted after receiving written

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informed consent from the patients at Queen Rania Al-Abdullah Urology Center during the period August 2004-September 2005. Eighty patients classified as ASA physical status 2 and 3 of male gender aged 60-75 years who underwent general anesthesia and scheduled for elective TURP with an expected duration of 80 – 120 min were selected. Patients with a history of convulsions or multiple allergies were not included. Research ethics committee approval was granted.

A standardized anesthesia technique was used. Heart rate, non-invasive blood pressure, O_2 saturation and end tidal CO_2 were monitored during and after surgery. The induction of general anesthesia included intra venous Propofol 2mg\kg and Fentanyl 2mcg\kg and Atracurium 0.5 mg\kg was administered for facilitating laryngeal mask airway placement, after which mechanical ventilation was adjusted to maintain end tidal CO_2 at 30 – 35 mm Hg. General anesthesia was maintained with N_2O 60% in O_2 using a circle system and Halothane 0.5 %, which was adjusted to keep mean arterial blood pressure and heart rate within 20% of baseline values. Increments of Atracurium 0.2 mg\kg were given if needed. Approximately at the end of surgery and before laryngeal mask airway removal, patients were randomly assigned to receive normal saline 0.9 % (group 1, n =37) or Ketamine 25 mg intravenously (group 2, n = 43). The treatment agents were presented by an anesthetist. Reversal of neuromuscular blockade was achieved and laryngeal mask airway (LMA) was removed. The duration of surgery was recorded. Intravenous fluids were not warmed. Patients were not warmed nor their temperatures were recorded during surgery. In the recovery room, all patients were administered O2 via a nasal cannula and covered with a cotton blanket. An anesthetist observed patients for shivering on admission to the recovery room (shivering 0), at 5min. (shivering 5), at 15 min (shivering 15) and at 25 min (shivering 25) after LMA removal.

The post-anesthetic shivering was classified according to the 5 point scale of Wrench at the previous time intervals (Table I) [7]. Post-anesthetic shivering was treated with rescue pethidine 25 mg intravenously if the shivering score was equal or more than 2. Differences between the two groups, regarding age, height, weight, ASA class and the incidence of shivering patients were recorded. Any possible side effects of the study agents were noted. No statistical analytic or data methods were used to test the differences.

Results

The two groups did not differ significantly with regards to demographics, anesthetics, surgical variables and ASA class (Table II) as TURP imposes such similarity. The post-operative hemodynamic parameters were similar in the two groups. Active warming was not required in group 2 but was needed in eight cases in group 1 of whom had shivering equal or more than 2 (33%).

The incidence of free post anesthetic shivering (no shivering) on arrival in the recovery room (shivering 0) was: 67% in group 1, 96% in group 2. The incidence of severity of post-anesthetic shivering at 5 min (shivering 5), 15 min (shivering 15) and 25 min (shivering 25) after LMA removal was significantly less in group 2 than in group 1 (Table III). In group 1, 24 (64%) patients shivered at grade equal or more than 2, and were subsequently treated with pethidine 25 mg intravenously. In group 2 only 6 patients (13%) reached grade equal or more than 2, and also were treated with pethidine. At 25 min post operatively, there were no major differences between the two groups (Group 1: 97%, 3%, O%, O%. O%. Group 2: (91%, 7%, 2%, 0%, 0%).Significant difference has been concluded between the two groups yet no statistical difference or P-value has been done to justify the difference. None of the patients needed a second dose of pethidine for a shivering grade equal or more than 2 within the 25 min period. The incidence of adverse side effects was clinically not significant.

None of the patients had episodes of O_2 desaturation or respiratory depression during the study. No hallucinations, hypertension, or nystagmus were seen in any of the patients. The score of severity of post-anesthetic shivering was significantly less in the Ketamine group compared with placebo group treated patients in almost all interval times but it is important to mention however that shivering grade 1 and 2 was more in group 2 than group 1 at 25 min postoperatively. All patients in both groups didn't suffer from the fourth degree of the Wrench scale at all time intervals.

Discussion

Several drugs have been suggested to prevent post-anesthetic shivering, but the ideal one has still not been found. In this study we evaluated the efficacy of Ketamine for the prevention of post-anesthetic shivering following TURP. The major finding was that there was significant difference between the efficacy of Ketamine and placebo.

Ketamine, a competitive NMDA receptor antagonist, inhibits post-operative shivering. It is likely that NMDA receptor antagonists modulate thermoregulation at a number of levels. It probably controls shivering by non-shivering thermo genesis either by action on the hypothalamus or by the beta-adrenergic effect of nor epinephrine [8].

In our study 6 patients still had grade equal or more than 2 shivering after Ketamine prophylaxis and were treated successfully with intravenous pethidine. Pethidine administration as a rescue medication for shivering was effective in these six patients, probably

because pethidine and Ketamine have different mechanisms of action. Another explanation could be that this dose of ketamine was not optimum. We chose a dose of 25 mg ketamine as this is the minimum dose used in adults causing no loss of consciousness [9]. In their study, D.D al, *et al*, used ketamine 0.5mg/kg, after which 3 patients of 30, reached shivering grade 2 or more. None of the patients required a second dose of pethidine for shivering grade 2 or more within the 30 min period.

Although none of our patients had hallucinations when ketamine was given at the end of surgery under general anesthesia, this very well known side effect of ketamine should always be kept in mind. As far as we know, this study is one of few in which ketamine had been used prophylactically. This study has been done by other workers reaching the same conclusions. Post-anesthetic shivering is a common phenomenon, and in our placebo group, the incidence was 67%, a figure that is in accord with other studies. P. Singh *et al*, reported an incidence of 75% in their study.

Intraoperative hypothermia is the major risk factor for post-anesthetic shivering. Further risk factors are the pain, release of pyrogenic mediators during surgery, administration of volatile anesthetics, blood loss and duration of surgery [10].

Post-operative shivering can be treated by skin surface warming, radiant heat application or pharmacological agents [11, 12].

Prophylactic administration of ketamine is effective for prevention of post-operative shivering in patients with bradycardia, hypotension, respiratory depression, nausea, vomiting and allergic reactions to pethidine without producing significant side effects. Further studies may find the optimal dose of ketamine in reducing more the incidence of post-operative shivering.

Conclusion

This study strongly supports the use of intraoperative ketamine at the end of surgery before LMA removal for prevention of post-anesthetic shivering. Consequently, our research has strengthened the role of ketamine in preventing post-T.U.R.P.shivering.

Table I. Scoring of severity of post-anesthetic shivering

Score	Feature
0	No shivering
1	One ore more of: piloerection, peripheral vasoconstriction, peripheral cyanosis without other cause. but without visible muscular activity.
2	Visible muscular activity confined to one muscular group
3	Visible muscular activity in more than one muscle group
4	Gross muscular activity involving entire body

Table II. Patients demographics of the treatment groups

Variable	Group 1, n = 37	Group 2, n =43
Age Range	69 y (60-75)	67 y (60 – 75)
Weight (kg) Range	70 kg (54-87)	74 kg (54 – 87)
Height (cm) Range	164 (155-183)	169 (155 – 183)
ASA (2,3) Range	20, 17	23, 20
Duration of surgery Range	91 min (80- 120)	100 min (80 – 120)

Table III. Incidence of severity of post anesthetic shivering

	Group 1, n = 37					**Group 2, n = 43**				
Score	0	1	2	3	4	0	1	2	3	4
Sh. 0	25	3	1	8	0	41	1	1	0	0
Sh. 5	20	4	5	8	0	39	3	1	0	0
Sh. 15	29	6	2	0	0	38	2	3	0	0
Sh. 25	36	1	0	0	0	39	3	1	0	0

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