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Original Research Article

Comparison the Efficacy of Ketamine on the Patients Undergoing Elective Surgery for Prevention of Postoperative Shivering

Md. Rasheduzzaman[1*], Md. Moshfiqur Rahman[2], Kibria Kabir[3], Wazed Amin[4], Pranab Kumar Debnath[5], Muhammad Sulaiman Kabir[6], Qazi Md. Salahuddin (Rijon)[7], Titul Kumar Saha[8]

[1,2]Junior Consultant (Anaesthesia), Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh
[3]Junior Consultant (Anaesthesia), Kapasia Upazilla Health Complex, Kapasia, Gazipur, Bangladesh
[4]Anesthesiologist, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh
[5]Assistant Professor (Anesthesiology), OSD, DGHS, Mohakhali, Dhaka, Bangladesh (Attached: - Netrokona Medical College, Netrokona, Bangladesh)
[6]Junior Consultant (Anaesthesia), OSD, DGHS, Mohakhali, Dhaka, Bangladesh (Attached:-Jamalpur 250 bad General Hospital, Jamalpur, Bangladesh)
[7]Junior Consultant (Anaesthesia), OSD, DGHS, Mohakhali, Dhaka, Bangladesh (Attached:-Kurmitola General Hospital, Dhaka, Bangladesh)
[8]Junior Consultant (Anaesthesia), OSD, DGHS, Banani, Dhaka, Bangladesh (Attached:-Netrokona District Hospital Netrokona, Bangladesh)

***Corresponding Author**
Md. Rasheduzzaman
Junior Consultant (Anaesthesia), Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh

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Abstract: ***Introduction:*** Patients frequently suffer from shivering following surgery. The shivering experienced by the patients may be a natural, thermal regulatory response to central hypothermia or as a result of the release of cytokines during the surgical process. This is unpleasant and occurs following surgery in 30-65% of patients who have received general anesthetics. Shivering increases the muscular activity, O_2 consumption, CO_2 production and may result in hypoxaemia, hypercarbia and lactic acidosis. It is not only uncomfortable but also cold sensation which is even worse feeling than pain sensation. ***Objective:*** To assess the Comparison the efficacy of ketamine on the patients undergoing elective surgery for prevention of postoperative shivering. ***Material & Methods*:** In this prospective study was conduct at the dept. of Anaesthesia, Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh from January to June-2021. Fifty (50) patients included in our study. The inclusion criteria were women aged between 30-65 years and ASA-PS classes I and II. Patients preoperative period were fasted at least 6 hrs and on arrival at OT I/V line was inserted; pulse, BP respiratory rate and SpO2 were recorded. ***Results:*** In our study fifty two (52) patients demographic data concerning the patient age, weight as well as duration of anaesthesia and type of surgery were comparable in two groups which are fairly matched. In preoperative situation in Group A mean pulse rate was 79 ±2.4, in Group B 82 ±1.5, mean anterial pressure 92.71±1.05 (Group A), 94.01±1.14 (Group B), SpO2 99±0.56 Group A, 98 ±0.26 (Group B) which showed no significant difference between the groups. In the postoperative period, incidences of shivering were 80.07% & 50% in Group-A and Group-B which are highly significant between the groups P<.001 Cardiovascular parameters SAP, DAP, MAP and SpO_2 between the groups were not significant P>.05. The study showed that patients of Group-B were less

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shivering with good recovery. ***Conclusion:*** In concluded that the post-operative shivering are the most common complaints. The aetiology of postoperative shivering is multifactorial including anesthetic, patients and surgical factors. Antishivering prophylaxis may be justified in patients who are at great risk of developing post-operative shivering after general anaesthesia. The incidence of major side effects is not significant in ketamine group and contributes to some extent to post-operative analgesia.

Keywords: Ketamine, Elective Surgery, Postoperative Shivering.

INTRODUCTION

Patients frequently suffer from shivering following surgery. The shivering experienced by the patients may be a natural, thermal regulatory response to central hypothermia or as a result of the release of cytokines during the surgical process [1]. This is unpleasant and occurs following surgery in 30-65% of patients who have received general anesthetics [2]. Postoperative shivering increases metabolism and oxygen consumption in patients by up to 400 times [3]. Patients then suffer from acidosis due to the increased production of Carbon Dioxide (CO_2). The incidence of post-operative shivering is 6-65% in GA and 30% in regional anaesthesia. Etiology of Post-operative shivering in multifactorial. Different methods are available for prevention of Post-operative shivering. Multimodal approaches like warming, O_2 therapy, correction of metabolic abnormalities, drugs opioids, benzodiazepine, clonidine, corticosteroids, ketamine, nefopam, doxapram, are used to prevent and for management of postoperative shivering [4,5]. Shivering also causes arterial hypoxia and is associated with an increased risk to patients with myocardial infarction [6]. Among which drugs are more popular mode. Intravenous ketamine .5mg/ kg 20 min before completion of surgery will abolish shivery in most subjects [7]. The physiological stress that shivering causes can lead to an increase in cardiac output, plasma catecholamines, as well as intracranial and intraocular pressures [8, 9]. Shivering is an involuntary oscillatory mechanical movement. It interferes with blood pressure, electro-cardio graph (ECG), and pulse oximetry measurements. It is also unpleasant and uncomfortable for patients [10]. Shivering, which causes the muscles to stretch around the surgical incision, can increase postoperative pain [11]. Ketamine is a competitive N-methyl-D-aspartate (NMDA) receptor, antagonist. It is involved in the regulation of heat. In rats, NMDA agonist increases the rate of neuronal discharge in the anterior hypothalamic preoptic region. The NMDA receptors act by modulating serotonergic and noradrenergic neurons in the locus ceruleus [10]. Ketamine probably regulates shivering by producing non-vibration-induced heat, acting on the hypothalamus and beta-adrenergic effects [11]. Several studies have shown that ketamine is effective as a prophylactic drug for postoperative shivering [12].

MATERIAL & METHODS

In this prospective study was conduct at the dept. of Anaesthesia, Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh from January to June-2021. Fifty (50) patients included in our study. The inclusion criteria were women aged between 30-65 years and ASA-PS classes I and II. Patients preoperative period were fasted at least 6 hrs. and on arrival at OT I/V line was inserted; pulse, BP respiratory rate and SpO_2 were recorded. After 5 minutes preoxygenation induction was facilitated by suxamethonium 1.5 mg. kg^{-1}, General anaesthesia was maintained by halothane. 5%, N2o 70 % in O_2. The assessment of shivering was carried out by independent anaesthesiologist who is unaware of grouping. If a score>2, 25mg ketamine was given intravenously as rescue medication. BP, Pulse rate, SpO_2 were measured during induction and 10, 15, 20 & 40 min after extubation. All patients received diclofenac suppository rectally at the end of operation. Post anaesthetic recovery score was graded by using Aldrete score and Patients were carefully observed for adverse effects like hallucinations, restlessness, drowsiness and dream. All data analysis SPSS windows version 19.

RESULTS

In our study fifty two (52) patients' demographic data concerning the patient age, weight as well as duration of anaesthesia and type of surgery were comparable in two groups which are fairly matched. In preoperative situation in Group A mean pulse rate was 79 ±2.4, in Group B 82 ±1.5, mean anterial pressure 92.71±1.05 (Group A), 94.01±1.14 (Group B), SpO2 99±0.56 Group A, 98 ±0.26 (Group B) which showed no significant difference between the groups (Table-1).

Table-1: Comparison of the demographic data and control states of the study population (N=52)

Parameter	Group-A	Group-B	P value
	N =26	N =26	-
Age in years	36.3±12	37.4±10	-
Sex, M : F	12:14	13:13	-
Body weight in (Kg)	53.3±12	55±8.5	-
Pulse/minute	79 ± 2.4	82 ± 1.5	> 0.05
MAP (mm of Hg)	92.71 ± 1.05	94.01 ± 1.14	> 0.05
SpO2	99 ± 0.56	98 ± 0.26	> 0.05
Duration of Surgery in minutes	87.5±43	82.5±41	-

Values are expressed in mean ± SEM unpaired students t-test, P-> 0.05 not significant MAP = mean arterial of pressure, SpO2 = Arterial oxygen saturation.

Table-2: Pulse and mean arterial pressure at different point of observation of two groups (N=52)

Recovery minute	Heart rate/Minute		MAP	
	Group A	Group B	Group A	Group B
5 minute	92.82 ± 1.04	94.0±0.08	94.51 ± 0.92	102.42±0.98
10 minute	83.27 ± 0.98	87.82±1.04	89.42 ± 0.91	92.36±0.94
15 minute	82.26 ± 0.74	85.22±0.99	88.71 ± 0.88	89.16±0.94
20 minute	82.06 ± 0.73	82.84±1.01	88.71 ± 0.88	88.36±0.80
40 minute	82.07 ± 0.72	80.92±0.91	88.24 ± 0.74	88.04±1.12
60 minute	81.82±0.24	93.04±0.99	98.74±0.96	101.8±1.03

Values are expressed in mean ± SEM

Table-2 shows that the recovery 5 minutes after the end of surgery when ketamine was administered the heart rate in Group 'A' was 92.82 ±1.04 and in Group 'B' was 94.0 ±0.08 MAP (mean arterial pressure) in Group 'A' was 94.51±0.92 and in Group 'B' was 102.42 ±0.98. There were no clinically relevant differences in measured results as regards to blood pressure and heart rate between the study groups (group B) throughout the study period.

Table-3: Comparison of changes produced in the mean values of the two groups (N=52)

Observation Time (Recovery minute)	Pulse rate		MAP		P Value
	Group A	Group B	Group A	Group B	
05 minute	92.00±0.83	93.02±0.99	98.23±0.96	101.81±1.62	>0.05
10 minute	88.87±0.92	91.01±1.03	91.72±1.02	95.32±0.91	<0.01
15 minute	85.70±1.05	89.34±0.97	89.61±0.97	89.12±0.98	>0.05
20 minute	83.27±0.91	82.92±1.01	88.86±0.81	88.32±0.79	
40 minute	81.78±0.21	85.92±0.91	88.23±0.74	90.02±1.26	
60 minute	85.25±1.21	87.01±0.99	93.66±1.02	95.26±1.22	

Values are expressed in mean SEM Unpaired student's "t-test' MAP = mean arterial pressure P-Value >0.05 not significant P – Value < 0.01 significant.

Table-3 show that after 5 minute recovery time Group A 92.00±0.83 and Group B 93.02±0.99 (pulse rate), MAP Group A 98.23±0.96 and Group B 101.81±1.62 p-value >0.05. But after 15 minutes and onwards of ketamine given, the blood pressure and the heart rate both came down to normal range and even to lower level than the initial pre-anesthetic states though it was not significant only two are significant.

Table-4: Incidence of shivering in two groups (N=52)

Observation time (recovery minutes)	Group-A		Group-B		P-Value
	Mean	SD	Mean	SD	
05 minutes	98.98	0.54	98.30	0.68	>0.05
10 minutes	99.95	0.50	99.84	0.09	„
15 minutes	99.72	0.58	98.06	0.71	„
20 minutes	99.81	0.64	98.00	0.64	„
30 minutes	99.66	0.64	99.02	0.09	„
40 minutes	99.71	0.98	98.42	0.84	„
60 minute	99.29	0.74	100.36	0.79	”

Analysis done by unpaired student's "t-test" Values are expressed in mean ± SEM P-Value > 0.05 not significant.

Table-4 shows that the observation time after 5 minute (Group A) 98.98+0.54 and Group B 98.30+0.68 and 30 minute Group A 99.66+0.66 and Group B 99.02+0.09 and 60 minute recovery time induction in group 'A' arterial oxygen saturation was 99.29 ± 0.74, and in group 'B' was 100.36 ± 0.79. But 20 minutes after the end of surgery SpO2 in group A 99.81 ± 0.64 and in group B 98.00 ± 0.64, P value >0.05, so pulse oximetry showed no such significant difference between the two groups.

Table-5: Shivering score in post-operative period in two groups (N=52)

Incidence of post-operative shivering	Group –A	Group –B	P-Value
Shivering score	21 (80.7%)	13 (50%)	<0.001 (Z>3)

Values are expressed in mean ± SEM Analysis done by (P<0.001) highly significant. The incidence of post-operative shivering was 80.7% in Group-A, 50% in Group-B. Analysis was done by "Z" test; p< 0.001. The difference between the two groups was highly significant (table-5). Shivering score 60 minutes after the end of surgery varies at the post-operative period for both the groups.

DISCUSSION

Ketamine was first synthesized in the early 1960s as a safe alternative to phencyclidine [13]. It is a non-competitive -NMDA receptor antagonist with an effect of thermoregulation. Other than being a competitive NMDA receptor antagonist, ketamine also acts as an opioid agonist [14]. In our study demographic data concerning the patient age, weight as well as duration of anaesthesia and type of surgery were comparable in two groups which are fairly matched. In preoperative situation in Group A mean pulse rate was 79 ±2.4, in Group B 82 ±1.5, mean anterial pressure 92.71±1.05 (Group A), 94.01±1.14 (Group B), SpO2 99±0.56 Group A, 98 ±0.26 (Group B) which showed no significant difference between the groups. Further, it can cause blockage of amine uptake in the descending inhibitory monoaminergic pain pathways, having a local anaesthetic action and interacting with the muscarinic receptors [15]. In contrast, even at sub-anaesthetic doses, ketamine might cause a dissociative state, characterised by a sense of detachment from one's physical body and the external world (depersonalization and derealization). Ketamine probably controls shivering by acting on non-shivering thermogenesis [16]. Ketamine is predominantly utilized as an anaesthetic agent that induces analgesia but for a long time it has been criticized for some of its side effects which include the induction of a psychedelic state causing agitation and hallucinations [17]. In our study the aetiology of post-operative shivering is multifactorial. Factors associated with an increased risk of post-operative shivering include age, sex, obesity, anxiety, pain, hypoxia, type of anesthetic, hypotension, type & duration of the surgical procedure. Patient undergoing gynecological surgery are at high risk for post-operative shivering. The average duration of anesthesia was 60 minutes. There was no significant difference between the groups respect to heart rate, MAP and SpO_2. In our study, incidence of post-operative shivering in group-P (those received placebo) were 80.07% and in group-k (those received ketamine) were 50% that means the data shows the incidence (p<0.01) of shivering is highly significant in placebo group. Heart rate differences between the groups at control states (p>0.05) and post-operative period (p>0.05) were not significant. Mean arterial pressure and arterial oxygen saturation between the two groups were not (p>0.05) significant. The difference in the results of asymptomatic patients in our study 19% compared with those S. N. Piper *et al*. [18] 15% may be explained by a small number of population and the meant duration of anesthesia was greater in our study. The frequency and severity has been reduced by identifying precipitating factors, improving surgical techniques, newer anaesthetic agents and technique and also by newer drugs. Despite these changes there is still an unacceptable frequency which needs to be reduced for betterment of future surgery and anaesthesia. Furthermore, we evaluated the side effects of the anaesthetic drugs and the role of ketamine in preventing or overcoming the effects. Moreover, the efficacy of ketamine was compared with a placebo. The side effects observed in the trials were nausea, vomiting, hypotension, bradycardia, and hallucinations. Ketamine showed a favourable outcome in reducing the incidence rate of hypotension and bradycardia as ketamine causes dose dependent direct stimulation of the CNS which leads to increased sympathetic nervous system stimulation followed by increased systemic blood pressure and heart rate. Besides various pharmacological interventions above, we noticed that active warming for elective caesarean delivery reduced the incidence of postoperative shivering and provided more stable perioperative temperature change [19]. Accumulating evidence has shown that the active warming method including electric heating, water-circulating garments, forced-air, and radiant heating are effective in preventing post-anaesthetic shivering. The current American Society of Anesthesiologists Task Force on Postanesthetic Care guidelines

recommend forced-air warming as a common method to reduce shivering in the perioperative setting [19]. Future research should focus on combinations of pharmacological interventions with non-pharmacological methods to better solve this problem.

CONCLUSION

In concluded that the post-operative shivering are the most common complaints. The aetiology of postoperative shivering is multifactorial including anesthetic, patients and surgical factors. All surgical patients should be kept normothermic unless hypothermia is specifically indicated for putative protection against cerebral ischaemia. Antishivering prophylaxis may be justified in patients who are at great risk of developing post-operative shivering after general anaesthesia. The incidence of major side effects is not significant in ketamine group and contributes to some extent to post-operative analgesia.

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