

Magnitude and Associated Factors of Postanaesthesia Shivering Among Patients Who Operated Under General and Regional Anesthesia, Northwest Ethiopia: A Cross Sectional Study

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Abstract

Background: Post-anesthesia shivering is well-documented event which, can be distressing to patients and occasionally associated with numerous adverse effects. This study investigated the magnitude and the possible risk factors of post-anesthesia shivering.

Methods: A total of 203 patients undergoing general anesthesia or spinal anesthesia were reviewed. Axillary temperature was recorded preoperatively and postoperatively every 15 minutes in the recovery. Also grade of shivering, anesthetic and surgical data, and methods used to treat shivering were recorded. Both bivariate and multivariate logistic regressions were used to identify associated factors.

Results: The overall incidence of post-anesthesia shivering was 26%. Twenty-five patients had grade two shivering and six patient's grade three. In multiple logistic regression analysis, older age (AOR=0.067, CI; 0.01, 0.441; P=0.005), patients who didn't get opioid analgesics (OR=3.531; CI, 1.445, 8.73; P=0.011), and low axillary temperature (AOR=2.357, P ≤ 0.001) were considered associated factors of PAS.

Conclusion and recommendation: The incidence of PAS was very high. Low axillary temperature, and patients who didn't take opioids for postoperative analgesia was factors which increase the incidence of PAS. Being older age was protective to PAS. Interventions on prevention and treatment of PAS better if focus on patients less than sixty five years old, long duration of anesthesia, and low axillary temperature to reduce the incidence. Administration of opioids for postoperative analgesia is highly recommended.

Keywords: Post-anesthetic shivering; Incidence; Risk factors

Introduction

It is widely accepted that complications related to surgery and delivery of anesthesia care are inevitable. Post anesthesia shivering is one of the potential complications of anesthesia which may increase patient's morbidity.

Shivering is defined as a spontaneous and involuntary muscular activity which increases metabolic heat production. Shivering may develop as a physiological response to hypothermia manifested as tonic muscular activity secondary to non-thermoregulatory heat preservation mechanism [1-6].

There is a wide variety of PAS incidence reports due to PAS definition following anesthesia variations, population, sample size and study design difference. According to studies, the incidence of PAS ranges from 5% to 65% following general anaesthesia and 55% after neuraxial anaesthesia. The incidence may determined by other factors like type of anaesthesia used, age and gender of the patient, duration of anaesthesia and surgery, and type of surgery [1,7].

Postanaesthesia shivering may results the patient to various adverse effects. Patient discomfort, due to stressful sensation of coldness and/or increased pain caused by surgical site muscular contraction, are the first clinical consequence of PAS [1,6]. The mechanism responsible

for the increased oxygen consumption is prolonged shivering of several muscular groups, which triggers an increase in metabolic demands. According to literatures, postanaesthesia shivering may increase oxygen consumption ranging from 7% to 700% [1]. PAS also associated with poor patient outcomes, it increase carbon dioxide production, and bleeding, poor wound healing and it interferes monitoring [4,5].

Although initially believed to be developed as physiological response to hypothermia, PAS may occur in patients with normal body temperature which is not a thermoregulatory response. The exact causes responsible for the occurrence of postanaesthesia shivering in normothermic patients are still not fully understood. [1,2,7].

A recent meta-analysis of the independent risk factors for postanaesthesia shivering concluded that, postanaesthesia shivering can be associated with age, low core temperature, prolonged surgery, and orthopaedic surgery [8].

An audit done in paediatric patients, the overall incidence of shivering in children greater than six years old was 14%. Administration of atropine and intraoperative hypothermia were factors associated with shivering [9]. Hence, the purpose of this study was to assess the incidence and associated factors of postanaesthesia shivering.

Methodology

After institutional and ethical committee approval from University of Gondar Hospital, Collage of Medicine and Health Sciences, a cross sectional study design was conducted from the end of February to May 23, 2013. A valid informed consent was taken from all patients.

Inclusion criteria's are all patients operated either under general or regional anaesthesia. Patients operated under peripheral nerve block alone, Mental retardation, and Children below one year old are excluded from the study.

General anesthesia was done for different procedures. The airway management, drugs used for induction and maintenance during general anaesthesia was not the same. Different intravenous anesthetic induction agents like ketamine, propofol and thiopentone were used based on the type of procedure, patient's condition, and the preference and experience of the anaesthetist. Muscle relaxants administered for patients are either by Suxamethonium, Vecronium or Pancronium for intubation and maintenance during the procedure.

The drug used for regional anaesthesia was 0.5% plain bupivacian, which is the only drug used for regional anaesthetic in our department.

A pre-tested and structured questionnaire containing the shivering grade was prepared to be taken in PACU and OR from the patient chart and by observation.

Upon transfer to PACU following general anaesthesia, the occurrence and severity of shivering was assessed for the first 1 hour at 15 minutes intervals. For patients who had spinal anaesthesia, data was collected following local anesthetics are injected during intraoperative period and postoperatively in the first 1 hour at 15 minutes interval.

Data was checked, coded, entered and analysed with SPSS version 20 statistical package. Frequencies, proportion and summary statistics was used to describe the study population in relation to relevant variables. Both bivariate and multivariate logistic regression was used to identify associated factors. The degree of association between independent and dependent variables was assessed by using odds ratio with 95% confidence interval. Those variables with p-value of less than 0.05 in the multivariate analysis were considered as significant.

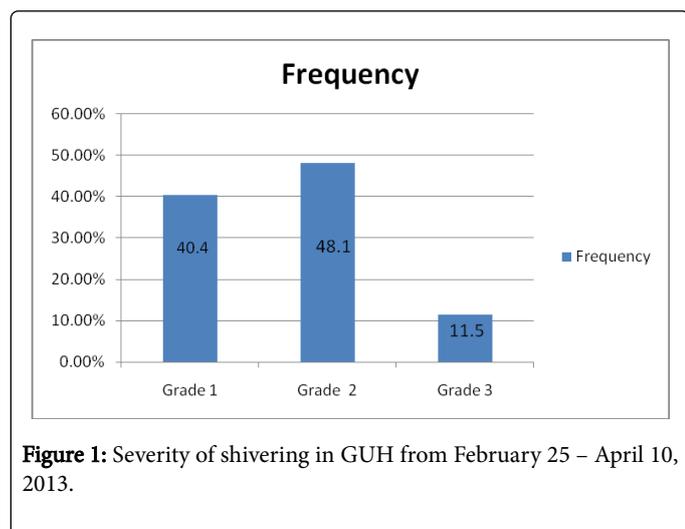


Figure 1: Severity of shivering in GUH from February 25 – April 10, 2013.

Shivering scoring grade as described by Javaher foroosh and his colleagues used in this study with the following shivering score grading system; Grade 0-None (no shivering), Grade 1-mild fasciculation of

face or neck (mild), Grade 2-visible tremors involving the face, head, and upper extremity (moderate), Grade 3- gross muscular activity involving the entire body (severe), which is more objectively expressed and statically quantifiable.

Results

During a two month data collection period a total of 203 patients operated under general anaesthesia, or regional anaesthesia or both were included to the final analysis

The overall incidence of postanaesthesia shivering was 25.6%. From 52 (25.6%) patients who had PAS, 21 (40.4%) of patients were develop grade 1 (mild) shivering. The incidence of moderate and severe (grade 2&3) shivering was 25 (48.1%), and 6 (11.5%) respectively (Figure 1).

Among 52 patients who was experienced shivering in this study 40 (77%) of them were patients less than 65years. Majority of patients shivered in this study were following spinal anesthesia 28 (53.8%) (Table1).

Variable	Patients with shivering (n=52)
Age (year)	
<65	40 (77%)
>65	12 (23%)
Sex	
Male	29 (55.8)
Female	23 (44.2)
ASA status	
ASA I&II	35 (67.3%)
ASA III&IV	17 (32.7%)
Type of surgery	
General & urology	17 (32.7)
Obs & Gyn	21 (40.4)
Orthopedics	8 (15.4)
Others	6 (11.5)
Type of anesthesia	
General anesthesia	24 (46.2)
Spinal anesthesia	28 (53.8)
Duration of anesthesia (min)	105.3 ± 70.8
Duration of surgery (min)	91.8 ± 68.7
Axillary temperature (degree centigrade)	34.9 ± 1.4

Table 1: Demographics and clinical parameters of shivering patients in GUH from February 25 – April 10, 2013. Data was presented as mean/SD, and frequency (percentage).

Associated Factors of Postanaesthesia Shivering

All explanatory variables with p-value of ≤ 0.2 from bivariate analysis were fitted in to the multivariate logistic regression model to see the independent effect of each variable on PAS. Age, type of surgery, type of anaesthesia, induction agent, and duration of surgery, duration of anaesthesia, opioid analgesics, and skin temperature were found statistically significant in the bivariate analysis.

Among the 8 potentially relevant factors that were included in the backward-logistic regression analysis, five variables were removed because they proved to be no significant predictor at 5% level of significant. The remaining three variables: age, opioid for postoperative analgesia, and skin temperature were found to be statistically significant at p value <0.05 (Table2).

Variables		Post-anesthesia shivering		COR (95% CI)	AOR (95% CI)	p-value
		Yes	No			
Age(year)	<65	40 (76.9)	121 (80.1)	1	1	0.005
	>65	12 (23.1)	30 (19.9)	0.161 (0.037, 0.7)	0.067 (0.01, 0.441)	
Opioid for postoperative analgesia	Yes	14 (26.9)	99 (65.6)	1	1	0.011
	No	38 (73.1)	52 (34.4)	3.208 (1.649, 6.241)	3.531 (1.445, 8.73)	
Perioperative temperature (°C)	Skin >36 (°C)	17 (32.7)	62 (41)	1	1	<0.001
	<36 (°C)	35 (67.3)	89 (59)	2.113 (1.55, 2.88)	2.357 (1.58, 3.517)	

Table2: factors associated with postanaesthesia shivering in GUH, North West, Ethiopia, 2013 Data were presented as frequency (%). COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio.

In this study age was significantly associated with the occurrence of PAS. Older ages (>65yrs) was found only 0.067 times less likely to develop shivering than children and adults (AOR=0.067, CI: 0.01, 0.441). Patient who didn't take opioid for postoperative analgesia were about three times more likely to develop PAS than patients who had opioid (AOR=3.531, CI: 1.445, 8.73)

Another significant variable associated with PAS was skin temperature. Patients who were hypothermic (<36°C) was about two times more likely to develop PAS than patients who were eutermic (AOR=2.35, CI: 1.58, 3.517).

Discussion

The overall incidence of PAS was found to be 25.6%. Even though the overall incidence of postanaesthesia shivering in this study was found to be high, by considering other factors which affect the incidence of shivering, it is still consistent with the usual figure [2,3].

The incidence of PAS in adult patients following general anaesthesia done in Germany was 14.4% [8]. Another study done in Ireland on the incidence of PAS on children was 14.4 % [10,11]. The reason being higher in GUH may be due to the incorporation of all age group, and both anaesthetic techniques. The other explanation for this may be due to the difference of patient care like the use of passive warming could be inadequate, there is no active warming technique, and patients are waiting for a long time outside OR in GUH. The finding was also consistent with a systemic review done in India which was reported as PAS occurs around 40% of unwarmed patients following general anaesthesia [12]. A study done in Singapore shows that 25% of patients following thiopentone induction was developed shivering [3].

The incidence of PAS in GUH following spinal anaesthesia was 28(53.8%). The finding is still comparable with a study done in Republic of Ireland which were 55 % (interquartile rages of 40% -64%) following neuraxial anaesthesia develop PAS [10]. The incidence of PAS following spinal anaesthesia was also high in this study than one

prospective study done in Brazil which was 32.5% [13]. The reason for this may be in our hospital we didn't add opioids with local anaesthetics for spinal anaesthesia. As it is widely known opioids are effective for prevention and treatment. The other possible justification could be due to the difference of age of the study populations and the amount of local anaesthetics used. High amount of local anaesthetic, even though this variable was not included in this study, it may affect the incidence PAS due to high block [9]. Using the same grading system with study done in Iran on 90 patients following spinal anaesthesia to evaluate the effect of tramadol on prevention of shivering, the incidence of mild and moderate shivering grade was 13.3% and 73.3% respectively in the control group [11].

Previously several authors tried to identify factors which are associated with the occurrence of PAS, but it is still difficult to identify the exact risk factors which associated with PAS because several factors influence its occurrence during perioperative setting. In addition to this the situation is complicated by the co-linearities between factors affecting the occurrence of PAS [14-16].

In this study age was significantly associated with the occurrence of PAS. Older ages (>65yrs) was found only 0.067 times less likely to develop shivering than children and adults. Being older age was a protective mechanism for PAS. One explanation is that the thermoregulatory response to the change in body temperature in elderly is attenuated [8] or it could be due to the atrophy of skeletal muscles. The other explanation may be due to the predominant role of non-shivering thermogenesis for heat production particularly in the first one year of life [9,17]. This finding was similar with other findings [8,10].

In this study administration of opioids for postoperative pain control is significantly associated with the occurrence PAS. Patients who didn't take opioid for postoperative analgesia were about three times more likely to develop PAS than patients who had opioid (AOR=3.531, CI: 1.445, 8.73). Several systemic review and journals reported that opioids especially pethidine and tramadol are effective in

the preventing and treating postanaesthesia shivering [11,18,19]. These two drugs in GUH were frequently given for patients to control pain rather than shivering. The possible justification could be the action of opioids on the modulation of thermoregulation at central nervous system. Even though the mechanism whereby opioids (pethidine or tramadol) arrest PAS has not been completely understood, but there is evidence which suggested that the anti-shivering effect of pethidine is on kappa opioid receptors whereas tramadol is its antagonist effect on 5-HT₃ receptors [19]. The finding of this study was similar with other findings [4,9,11,19].

The other factor which was significantly associated with PAS in this study was the change in axillary temperature following general anaesthesia and spinal anaesthesia. This study shows that patients who were hypothermic were about two times more likely to develop PAS than eutermic patients (AOR=2.35, CI: 1.58, 3.517). Several theories and evidences suggested that PAS occurs as a physiological response to hypothermia secondary to internal redistribution of heat from core to the periphery due to anaesthetic induced vasodilatation and as a result heat loss to the environment [5,6,20].

In contrast to the above, evidences also demonstrated that PAS is not observed in severely hypothermic patients and on the other hand it occurs commonly in normothermic patients following anaesthesia and surgery [21,22]. The finding of this study was consistent with other studies. The result of one study shows that patients with low body temperature following general anaesthesia shivered for prolonged period than who was warmer [21] Similarly other studies found that core hypothermia was an important risk factor for the development of PAS [8,9]. In contrast with the current study finding, studies also reported that the incidence of PAS is not associated with either core or skin body temperature [23-25]. Simply covering the patient with blanket was reported to decrease the incidence of PAS without changing core hypothermia [26,27].

One may expect that patients with long duration of anaesthesia and surgeries are colder than short procedure. However, according to a study done in Germany [8] there was no strong correlation between duration of surgery and core or skin temperature.

Although this study failed to detect the effect of type of anaesthesia on PAS, majority of patients who was shivered were following spinal anaesthesia. Although the mechanisms of shivering during general and spinal anaesthesia are the same, there are some differences. During general anaesthesia, shivering is impaired by muscle relaxants or anaesthetic agents, it usually occurs during recovery. During neuraxial anaesthesia, skeletal muscles above the level of the block contribute for high degree of compensatory shivering [10].

Induction agents were also thought to contribute to the incidence of PAS. One study suggests that thiopentone as induction agent was associated with high incidence of PAS than propofol [3], but this study didn't show any association between induction agent and the occurrence of PAS. The possible justification may be most of our patients are induced with Ketamine, or due to the complexity of perioperative setting.

Previous finding [8] identified that orthopaedic surgery was an independent risk factor for the occurrence of PAS, but this study didn't show any association. The reason for this may be only small number of orthopaedic cases were included during analysis.

One of the limitations of the present study was it cannot determine the causal relationships between the variables in the analysis since it is

cross-sectional study. Small sample size was included. The other limitation of this study was the use of axillary temperature to assess heat loss and not core temperature.

Conclusions and Recommendations

The incidence of PAS was very high. Low axillary temperature, and patients who didn't take opioids for postoperative analgesia was factors which increase the incidence of PAS. Being older age was protective to PAS. Interventions on prevention and treatment of PAS better if focus on children and adults, and low axillary temperature to reduce the incidence. Administration of opioids for postoperative analgesia is highly recommended.

Conflict of Interest

No conflict of interest exists.

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