PROPOSAL ON RESEARCH TOPIC ON PREVALENCE AND ASSOCIATED FACTOR OF POSTOPERATIVE SHIVERING IN PATIENT RECEIVING GA AND SA IN TASH.

TO BE SUBMITTED TO THE DEPARTMENT OF ANESTHSIOLOGY AAU, SCHOOL OF MEDICINE

ABSTRACT

Background:On the current era great emphasis is being given on improving quality of patient care. This motive includes conducting clinical study to know procedure and treatment associated outcome and complication. One of this complication is post anesthesia shivering which has deleterious effect several aspects of patient outcomes. The cause of shivering isincompletely understood. So, it is important to know the overall magnitude and major contributing factors for post anesthesia shivering for better health care.

Objective: To assess the magnitude and associated factors of post anesthesia shivering inTikur anbesa specialized hospital, Addis Ababa, Ethiopia from October 01 – November 1, 2019.

Methods: Institutional based cross-sectional study design was conducted from Oct 01- Nov1, 2019. A systematic random sampling method was employed to select 160 study subjects. Apre-tested structured questionnaire was used to collect data. Postoperative axillarytemperature was recorded every 5min for total of 20mintes.

Result: The overall incidence of post-anesthesia shivering was 46.9%. From this majority ofpatients (52.2%) had grade 3 shivering. In multiple logistic regression analysis, being femalepatient (AOR= 2.003, 95% CI: 1.038, 3.940; p=0.03), spinal anesthesia (AOR= 2.885, 95% CI: 1.433, 5.810; P=0.0031) and body temperature less than 360C (AOR= 36.293, 95% CI: 11.808, 111.554;p=0.001) were considered associated factors of PAS.

Conclusion and recommendation:In conclusion therewas overall high incidence of PAS, (46.9) which, necessitate close intraoperative temperature monitoring and institution of active warming. The relative high incidence of PAS on those patients operated under SA (62.9)

requires further inquiry. This study doesn't reveal strong positive predictive factors which can be used for recommendation regarding PAS prophylaxis.

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LISTS OF ACRONMYS

AAU Addis Ababa University

ASA American Society of Anesthesiologists

BMI Body Mass Index

ECG Electro Cardiogram

GA General Anesthesia

PACU Post Anesthesia Care Unit

SA Spinal Anesthesia

PAS post anesthesia shivering

Pt patient

RA Regional Anesthesia

TASH Tikur anbesa specialized hospital

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Key Words; shivering, general anesthesia and spinal anesthesia

Chapter 1

1. Introduction

1.1Background

On the current era great emphasis is being given on improving quality of patient care. This motive includes conducting clinical study to know procedure and treatment associated outcome and complication. One of this complication is post anesthesia shivering which has deleterious effect several aspects of patient outcomes. The cause of shivering isincompletely understood. So, it is important to know the overall magnitude and major contributing factors for post anesthesia shivering for better health care.

Postanesthetic shivering is a common complication that occurs in up to 60% of patients recovering from general anesthesia. Besides causing discomfort and increased surgical pain to the patient, severe shivering may be associated with a marked rise in oxygen consumption leading to an increased stress on the circulatory and respiratory systems, increase in intra-ocular and intracranial pressures, problems with monitoring and interference with surgical care in cases requiring postoperative immobilization such as nerve and vascular anastomoses.

We do know the negative effects of painexperiences, for instance during routine vaccination in children, on subsequent anticipation with respect to medical care. Therefore, itmight be speculated that a ‘bad shivering experience’ similarlycontributes to a negative anticipation as far as further anesthesiaprocedures are concerned. The potential to cause morbidity mayexplain why anesthetists considered shivering as a relevant, albeitminor, problem in a recent survey.A Medline search performed inMay 2002 using the search terms ‘shivering or shaking’, yielded 9292 reports. 462 were classified as randomized controlled

trials. These numbers suggest that shivering cannot be considered marginal problem in the anesthesia setting.

So, the aim of this study was to know the overall magnitude and major contributingfactors of post anesthesia shivering in a different set up to have appropriate intervention for thebetter health care.

1.2 Statement of the problem

Post anesthesia shivering is an unpleasant, thoroughly discomforting and frequent complication after surgery with many grades i.e. from a mild form of having skin eruptions to a severe form with generalized continuous skeletal muscle contractions with prevalence of up to 50–80 %. It is an involuntary, oscillatory muscular activity that augments metabolic heat production up to 600 % above basal metabolic level and clinically is associated with clonic or tonic skeletal muscle hyperactivity of different frequencies. This increased muscular activity leads to increased oxygen consumption and carbon dioxide production that results in hypoxemia, hypercarbia and lactic acidosis which are not only discomforting but also worsens pain sensation . Shivering can be prevented by maintaining intraoperative normothermia, giving warm fluids, using warm clothing covers sites or by administering pharmacologic treatments like tramadol, clonidine and pethidine (meperidine)]. In tikuranebesaspecialized Teaching Hospital (TASH) is faced with inadequate staffing and overwhelming patient numbers with a nurse: coupled with essential drug shortages and many drugs are not available for perioperative patient management . We thus sought to determine the prevalence and associated factors of post operative

shivering among patient receiving GA and SA for varioussurgical procedure in TASH.

1.3 significance of the study

Shivering is one of deleterious post anesthetic complication. It can be either thermoregulatory or non-thermoregulatory shivering. The adverse effects followed by shivering can be post-operative pain which increases analgesic demand, wound dehiscence, graft failure, doubling or tripling of oxygen demand and become potential to hypoxia, increases postoperative protein catabolism, increases intraocular and intracranial pressures. This study was conducted by considering the population of study area is different from others where previous studies cried out regarding to different drugs used, susceptibility to hypothermia and average body weight related to dietary habit and economic status. In addition to this, most of recent studies done on shivering address specific factors rather than general risk factors in one study and carried out in a room in which temperature is controlled. This study was done on patients who was operated in a room where temperature is not controlled which is the same in most of government hospitals in Ethiopia.

Chapter 2 Literature review

2.1 Definition:Post-anesthetic Shivering is spontaneous, involuntary, rhythmic, oscillating, tremor- like muscle hyperreactivity

2.2 general background

The autonomic nervous system, by a combination of physiologic and behavioral changes, maintains core temperature between 36.5 and 37.5 °C despite external environmental temperature changes while anesthesia causes a phase like decline of core temperature with phase I- the greatest- occurring at 30mins, phase 2 after 1 h and then phase 3 after 3–5 h with reduced heat loss till equilibrium is reached. Surgery causes heat loss due to exposure to cold environments, evaporation from exposed sites and administration of unwarmed fluids leading to Core

hypothermia that causes shivering as a compensation mechanism. Hypothermia leads to postoperative shivering, prolonged hospital stay, surgical wound infection, decreased immunity and coagulopathy, and increased incidence of cardiac morbidity.

Post-anaesthetic Shivering is spontaneous, involuntary, rhythmic, oscillating, tremor- like muscle hyperreactivity that increase metabolic heat production and it may cause discomfort to the patients, aggravate wound pain by stretching incision in the postoperative period ,increase intraocular pressure and intracranial pressure. It may also increase oxygen demand by the tissue up to 500%, which is accompanied by increase minute ventilation and cardiac output and this may deleterious to patient with limited cardio respiratory reserve. Shivering also may interfere with monitoring like ECG, blood pressure cuff, Pulse oximetry and it causes artifacts(2).

We do know the negative effects of painexperiences, for instance during routine vaccination in children, on subsequent anticipation with respect to medical care. Therefore, itmight be speculated that a ‘bad shivering experience’ similarlycontributes to a negative anticipation as far as further anesthesiaprocedures are concerned. The potential to cause morbidity mayexplain why anesthetists considered shivering as a relevant, albeitminor, problem in a recent survey.A Medline search performed inMay 2002 using the search terms ‘shivering or shaking’ , yielded 9292 reports. 462 were classified as randomized controlled trials. These numbers suggest that shivering cannot be considered marginal problem in the anesthesia setting.

Thermoregulation

The processing of thermoregulatory response has three components: Afferent thermal sensing, Central regulation and Efferent responses. Together they work to maintain normal core body temperature.

Afferent thermal sensing

Signals from cold receptors travel along a delta fibres and Signals from warmth receptors are conveyed by C fibres. Thermal inputs get integrated at the level of spinal cord, its ability to sense and modulate thermal signals was pivotal for development of currently accepted multiple multilevel concept of thermoregulation.4 Infact all thermoregulatory effector mechanisms are modulated by spinal cord, eventually it arrives at the hypothalamus, the primary thermoregulatory control center in mammals. Two anatomically separate groups of neurons are involved in thermal responsiveness and control the thermoregulatory muscle tone and shivering in the reticular formation of rat.5 A comparative study in vertebrates also concludes that peripheral thermal input to the hypothalamic areas is via the polysynaptic nonspecific reticular areas in the brain stem. The nucleus raphe magnus and the subcoeruleus area of the brainstem are important relay stations in the transmission of thermal information from skin to hypothalamus.

Central regulation

Preoptic region of the anterior hypothalamus is the dominant autonomic thermoregulatory controller in mammals. Much of the excitatory input to warm sensitive neurons comes from hippocampus, which links the limbicsystem (emotion, memory, and behavior) tothermoregulatory responses. Warm sensitive neurons in the preoptic anterior hypothalamus along with sensing of core temperature also compare local information with thermal and nonthermal synaptic afferents arriving from ascending pathways.

Electrophysiological studies suggest that some anterior hypothalamic neurons act as “Sensors” as well as “integrators”. These interactions are inevitable because the thermoregulatory system has few specific effector

organs, and must be understood as a part of adaptive response of the organism as a whole.

Efferent responses

Multiple inputs are integrated into a common efferent signal to the effector systems. In both animals and humans,7 effector mechanisms are called upon in an orderly fashion, ensuring optimal regulation. The principle defense against hypothermia in humans includes skin vasomotor activity, nonshiveringthermogenesis, shivering and sweating. Heat loss is normally regulated by cutaneous vasodilatation or vasoconstriction, sweating and shivering are major response of the body to heat regulation.7 Thermoregulatory shivering is thus a “last resort” defense that is activated only when behavioral compensations and maximal arterio-venous shunt vasoconstriction are insufficient to maintain core temperature. Nonshiveringthermogenesis is the result of cellular metabolic process that does not produce mechanical work; it has been demonstrated in human neonate8and in rodents.

Heatbalanceandshivering

The processes that lead to core hypothermia in regional and general anaesthesia are similar.11 As in general anaesthesia, the initial hypothermia in regional anaesthesia results from redistribution of body heat from the core to the periphery.12 Patients given spinal or epidural anaesthetics cannot reestablish core temperature equilibrium, because peripheral vasoconstriction remains impaired. Shivering in these patients produces relatively little amount of heat, because it is restricted to the small muscle mass cephalad to the block. Shivering occurs in approximately 40% ofunwarmed patients who are recovering from general anaesthesia and in about 50% of patients with a core temperature of 35.5 degree centigrade and in 90% of patients with a core temperature of 34.5 degree centigrade It is associated with substantial adrenergic

activation and discomfort. Some patients find accompanying cold sensation worse than surgical pain.

Tremorpatterns

Three patterns of muscular activity were observed in hypothermic volunteers during emergence from isoflurane anaesthesia.1 The first was a tonic “stiffening” and appeared to be largely a direct non-temperature dependant effect of isoflurane anaesthesia. A second pattern was overt synchronous tonic waxing and waning at near 0.3% end tidal isoflurane concentration. This was the commonest pattern and resembled that produced by cold induced shivering “true” thermoregulatory shivering.19 The third pattern was spontaneous electromyographic clonus that required both hypothermia and residual isoflurane end tidal concentration between 0.4 and 0.2%. During epidural anaesthesia, synchronous waxing and waning patterns were present, however no abnormal EMG patterns were detected.20 Dissipation of anaesthetic induced thermoregulatory inhibition, with the increase in shivering threshold towards normal is the conventional explanation for the post anaesthetic tremor. Tremor frequency is not observed in markedly hypothermic patients, it occurs commonly in normothermic patients.2 Contradictory to this, one study1suggested that special factors related to surgery such a stress or pain might contribute to the genesis of postoperative tremor, since it failed to identify any shivering- like activity in normothermic volunteers. Pain might facilitate shivering like tremor in both postoperative patients7 and in women having spontaneous term labour.25% of postoperative patients reach a core temperature of380C and 50% of them reach 38.40C7and this eventually leads to an increase in thermoregulatory set point, which may be associated with normal thermoregulatory shivering. Normal thermoregulatory shivering remains by far the most common cause of postoperative shivering.

Prevention of post anaesthesia shivering

If we restrict ourselves to combat shivering solelywith pharmaceuticals, than heat recovery will be still slower and the patient will be deprived of an important defense mechanism against reduction of core temperature, shivering therefore should first of all be prevented, thereby offsetting hypothermia. If it does occur, it should be treated, mainly by warming the patient and thanadministering medication to inhibit it. The benefits of cutaneous warming in the postoperative patients have been controversial, with some studies identifying benefits 24 and others failing to confirm faster rewarming.25 Two factors contribute to rapid intraoperative transfer of heat from peripheral tissues to the core, the first is vasodilatation induced by central inhibition of thermoregulatory control26,27 the second is that general anaesthesia itself induces peripherally mediated vasodilatation, which facilitates intracompartmental heat transfer. Taken together, these studies suggest that intraoperative cutaneous warming is faster than comparable postoperative warming. It seems clear that patients should be warmed during surgery rather than allowed to cool and then rescued postoperatively for prevention of post anesthesia shivering. Cutaneous heat loss can be decreased by covering the skin (e.g. with surgical drapes, blankets or plastic bags). A single layer of an insulator reduces the heat loss by approximately 30%; unfortunately adding additional layers does not proportionately increase the benefit.28 In most cases some form of active warming is required to prevent hypothermia. Forced air warming is generally themost effective available method,29 but any method or combination of methods that maintain the core temperature above 360C is adequate. Forced air warming or a combination of forced air warming along with fluid warming is required to maintain normal intraoperative postoperative core temperature.

2.3 post anesthesia associated factor:

In one study conducted in Erciyes University School of Medicine, Turkey on Postoperative shivering in children and causative factors, in 2005, age is a major contributing factor for post anesthesia shivering and this study puts its finding as the overall incidence of shivering in the 0–16 age group was 3.5%. The use of intravenous induction, age over 6 years and prolonged operation time were identified as risk factors in logistic regression analysis. In addition to this it also says children with and without shivering differed significantly with respect to operation time, body temperature, and age ($P < 0.05$) [2]. In a study conducted in Taiwan, in 2012 done on Effect of Electro acupuncture in Post Anesthesia Shivering during Regional Anesthesia on 80 patients under spinal anesthesia. There was a finding that shows 23 of 40 (57.5%) patients in control group experienced shivering 15 minutes after spinal anesthesia is given. From this controlled group 10 (25%) patients experienced shivering at grade 4 [3].

In another study conducted on Independent Risk Factors for Postoperative Shivering, in Germany in 2005, and was done on 1340 consecutive adult patients, they found 11.6% incidence of post anesthesia shivering. This study did not restrict active perioperative warming. The overall shivering including grade 2 was 14.4%. They conclude that there were three major risk factors: young age, endoprosthetic surgery, core hypothermia, with age being the most important accounting for more than 70% of the predictive power of their entire model. Also this study discusses about risk factors that several risk factors for PAS identified in previous studies were rejected by their analysis, including pain, male sex, and type of anesthesia. Also in their observation core temperature has only a slight influence on PAS development compared with age as the most important determinant [4]. An article review done in India on Post Anesthesia Shivering in 2003, shows shivering occur in approximately 40% of unwarmed patients who are recovering from general anesthesia and in about 50% of patients with

a core temperature of 35.5 degree centigrade and in 90% of patients with a core temperature of 34.5 degree centigrade. 25% of postoperative patients reach a core temperature of 380 C and 50% of them reach 38.40 C and this eventually leads to an increase in thermoregulatory set point, which may be associated with normal thermoregulatory shivering. Normal thermoregulatory shivering remains by far the most common cause of postoperative shivering. This article suggests that more research is required to understand about the Pathophysiology post anesthesia shivering [6]. Of 2595 patients admitted to a recovery room in Derbyshire Royal Infirmary, UK in 1992, over a 6-month period, 164 (6.3%) shivered postoperatively. Data regarding the anesthetic techniques to which these patients had been subjected were gathered from the Derby Anesthetic Audit System. Subsequent analysis demonstrated the importance of a number of factors that led to shivering, including male gender, anesthetic techniques involving spontaneous ventilation, and anticholinergic premedication. The administration of Petidine, Alfentanil or morphine intra operatively reduced the incidence of shivering postoperatively [7]. In a study done in Hamburg, Germany in 1998, on Non-thermoregulatory shivering in patients recovering from isoflurane or desflurane anesthesia on 120 patients did not apply warming and7 allowed hypothermia in one group and applied active warming and maintained postoperative body temperature above preoperative levels in the other group. The incidence of shivering was 50% in the group in which hypothermia was allowed and 22% in the group that received active warming. Although active warming decreased the frequency of shivering, it did not abolish it completely. This suggests that temperature change is not the only factor in shivering [9]. In a study done in University Hospital of Cleveland, Ohio**,** America in 1963 on halothane and post anesthesia shivering on 225 patients by using 0.5 to 2% halothane with 50% nitrous oxide in O2 shows 54 (25 %) shivered upon emergence from anesthesia. The mean rectal temperature of the shiverers was 36.170C., while that of the nonshiverers was 36.66 0*C***.** There is a highly significant difference between these 2 mean temperatures, and it is concluded that there is a relationship between a lowered body temperature and shivering after halothane anesthesia,

although the relationship is not necessarily one of cause and effect [11]. Core temperature monitoring (*e.g.* tympanic membrane, pulmonary artery, distal esophagus, and nasopharynx) is used to monitor intraoperative hypothermia, prevent overheating, and facilitate detection of malignant hyperthermia. No reliably core temperature monitoring sites are completely non invasive and easily to use in awake patients. Because these sites are not necessarily available or convenient, a variety of "near-core" sites are also used clinically. These include the mouth, axilla, bladder, rectum, and skin surface. Each has distinct limitations but can be used clinically in appropriate circumstances. What level of accuracy is clinically necessary has yet to be established. But a good rule of thumb, one that has been used in many studies, is that the combined inaccuracy of a site–thermometer combination should not exceed 0.5°C. One basis for this choice is that 0.5°C is the smallest difference that has been shown to be associated with hypothermia-induced complications [12]. In a review article done in Inje University School of Medicine, Seoul, Korea, which was published in 2010 shows from 26 patients under controlled group with no prophylaxis for shivering, age between 18 and 62 years old done under spinal anesthesia, shivering was observed in 9 patients (34.6%) with p value of 0.038% and with no significant correlation between height of block and core temperature [13]. In a prospective randomized study done in Inonu University, Malatya, Turkey in 2007, on control of shivering during regional anesthesia: shows from 40 ASA physical status I and II pts done under spinal anesthesia and receiving saline only, 22 (55%) pts experienced PAS at P=0.025. In a study conducted in Seoul National University Bundang Hospital, Seoul, South Korea, in 2005, on Intrathecal clonidine does not reduce post-spinal shivering which is controlled trial type shows on the controlled group consisting of 50 pts who did not take any prophylactic, the incidence of shivering was 40%. During the first 90 min after spinal anesthesia, the maximal intensity of shivering, which was graded as mild, moderate, and severe, showed 16%, 14%, 10%, respectively [14,10]. In a study conducted in The Johns Hopkins Medical Institutions, Maryland, USA, in 2000, on Age- related Thermoregulatory Differences during Core Cooling in Humans on eight

younger (age 18-23) and eight older (age 55-71) male subjects shows the mean core temperature threshold for vasoconstriction was lower in the older groups (35.5+ 0.30c) than in the younger group (36.2+0.20c) (p=0.03). The mean maximum shivering score was also lower in the older group (2+0) than in the younger group (3+0) (p=0.01) [15]. In an article review conducted in 2012, on reduction in the incidence of shivering with perioperative dexmedetomidine which is institutional base prospective randomized study shows from 40 ASA I and II patients who were in the controlled group, preoperative Axillary temperature was 36.90c. The average Axillary temperature during the first 30 minutes in the post operative period was measured to be 36.20c. There were 17 patients who had to be treated with rescue injection of tramadol for control of shivering in the PACU. The demographic composition of patients who had suffered from an episode of shivering consisted of 7 females and 10 males with an average age of 36.84+ 9.28yrs and an average weight of 66.8 kg. Out of these 17 patients, 11 suffered grade 2 shivering, 4 reached grade3 shivering, and only 2 had vigorous shivering of grade 4 in the first one hour of post operative period [16]. In a study done at General Hospital of Patras, Greece, from August 1 to November 30, 2003 on effects of hypothermia and shivering on standard PACU monitoring of patients shows from the total of 170 patients, hypothermia was present in 125 (73.5%) patients, with core temperature ranging from 34.40c to 39.90c. Patient and operation characteristics between hypothermic and non hypothermic patients did not yield significant differences for age, sex, ASA classification,anesthetic technique, or operating room temperature. The only parameter found to be significantly different was the total time in the operating room (p=0.02) [17]. Shivering was present in 42 (24.7%) patients and operation characteristics between shivering and non shivering patients did not yield differences for sex, ASA classification, anesthetic technique, total time in the operating room, or operating room temperature. The only parameter found to be significantly different was age (p= 0.01). At the PACU arrival, 38 (30.4%) hypothermic and 4 (9%) normothermic patients developed shivering. A significant correlation between hypothermia and shivering was noted in post operative patients ($p<0.01$)

[17]. In many researches which were about incidence of shivering, they excluded patients who took meperidine and Clonidine because these drugs abolish shivering and can the affect the study. In Miller's anesthesia 7th edition and Morgan and Mikhail's Clinical Anesthesia books, it has mentioned Clonidine, and meperidine 0.35 to 04 mg/kg effectively abolish shivering. Also in a study done at hospital of the city Ludwigshafen, Germany, in 2000, on Comparison of Urapidil, Clonidine, Meperidine and placebo in preventing post anesthesia shivering reveals the incidence of post anesthesia shivering was significantly less frequent in Clonidine (20%) and meperidine (16.6%) treated patients than in the placebo group (35.3%). In addition to this the shivering score was significantly lower in the two drugs compared to the placebo group [18, 1, 5]. A review article done in UK, 2000 and Southern African, 2014 says in human adults, the amount of brown adipose tissue is small and nonshivering thermogenesis increases the rate of heat production by less than 10-15%, in contrast to infants, where it can double heat production. Nonshivering thermogenesis increases metabolic heat production without producing mechanical work via brown fat oxidation. It increases heat production by about 100% in infants, but only slightly in adults [19]. A research conducted at Logos University Teaching Hospital, Indi-Araba, Nigeria, in 2012, on Pattern of Post Anesthetic Shivering, 400 consecutive patients aged 16-79 years with a male to female ratio of 1:3.3 were studied. Mean ambient theatre temperature and body temperature at onset of shivering was 28+1.80c and 36.260c respectively. Shivering occurred in 79(19.8%) cases and was significantly associated with female gender 65(82.3%), obstetric surgery 46(58.2%), regional anesthesia 55(69.6%), grade 2 shivering 42(53.2%) but not with duration of anesthesiaor degree of blood loss. Finally this research concluded that PAS was associated with the female gender, obstetric surgery and regional anesthesia [20]. One research done in University of Gondar, Ethiopia, on March to April, 2015 on Perioperative Hypothermia and Predictors of Intra-Operative Hypothermia, shows the overall incidence of post-operative hypothermia during this study was 50.6%, of this, mild hypothermia constituted 57.7%. Moderate and severe hypothermia were seen among 36.9 and

5.4% of patients respectively [21]. In another study conducted in this university, from end of February to May 23, 2013 on Magnitude and Associated Factors of Post anesthesia Shivering among Patients Who Operated under General and Regional Anesthesia shows 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 [22]. A review article on new temperature monitoring and thermal management guideline, in 1998, body temperature might be ideally monitored continuously; however, 15 minute intervals are sufficient. Tympanic temperature was measured upon arrival at the recovery room at 15 minutes interval until discharge from the recovery room [24, 25]. A research done on post anesthesia shivering in children in 1992, on 166 children between the ages of 1 month and 14 years showed the incidence of shivering 54 (14.4%). By using univariate analysis they identified six factors influencing the frequency of postanaesthetic shivering with p values <0.05 includin age, inhalational induction, administration of atropine, maintenance with isoflurane, narcotic analgesics (Fentanyl or morphine), duration of anaesthesia and peri-operative temperature decrease. With the logistic regression model, three significant factors were found: age, perioperative temperature change and the administration of atropine [26]. A study done on Heat loss during anesthesia, in England 1978, shows the relation between body temperature and the occurrence of shivering. All the patients were divided into two groupsshivering and nonshivering, no significant difference was found between them in respect of meanskin, tympanic or body temperature at the beginning of recovery (P>0.1), the temperature gradient (mean skin minus aural temperature) (P>0.05), or the previous heat loss during anesthesia *(P>0.l)*. Shivering was unrelated to the actual temperature of the patient (P>0.1), that is, a mean skin temperature of less than 33 °C or an aural temperature less than 35 °C. During the recovery period there were no significant differences between the two groups in respect of mean skin,

mean body or aural temperature, and heat gained (P>0.1) [27]. A research done in the Derbyshire Royal Infirmary, England, 1994,on the intensity of post anesthesia shivering is unrelated to axillary temperature; in 302 patients over one month period. As the report said no relationship was found between body temperature and the occurrence of post anesthesia shivering [28]. A study done in Tanta University, Egypt, 2012, on Prevention of shivering during regional anesthesia has showed Comparison of patients' demographic data showed that the differences among the five groups were not statistically significant as regard age, weight, BMI, ASA status and duration of surgery [29]. A research report by International Anesthesia Research society, in 1980, on effect of operating room temperature on patient's temperature at recovery room, has showed despite significantly greater heat loss in the cold room group (0.63+0.140C) than in the warm group (0.32+0.100C) ($p<0.01$), there were no difference in temperature in the recovery room, shivering, myocardial renal, CNS, pulmonary or graft morbidity in the two groups [30]. One research done on effect of meperidine on oxygen consumption, carbon dioxide production, and respiratory gas exchange in post anesthesia shivering in 1987 has reported that shivering is a frequent complication in the postoperative period. Shivering may occur as an adverse effect of surgery and anesthesia. It may be associated with an increase in oxygen consumption, intraocular or intracranial pressures, and wound pain [31].

Chapter 3: objective

3.1: GeneralObjectives

TO ASSESS THE PREVALENCE OF POST OPERATIVE SHIVERINGIN TASH.

3.2:Specific objective

To assess the prevalence of post operative shivering in TASH

To assess associated factors affecting postoperative shivering In TASH.

Chapter four: Methodology

. 4.1Study designs and period

A prospective descriptive cross sectional study among patient undergoing GA and SA for various surgical procedure from 1st Oct to 1st Nov1st, 2019 TASH.

4.2: Study area

The study will be conducted in TASH operation theatre ward and recovery room. The TASH is one of the referral and teaching hospital in the Addis Abeba region and serving around 1 million people.

4.3: Source and Study population

4.3.1 :Source population

All patient whom undergo elective surgical operation under in TASH major operation theatre.

4.3.2: Study population

All patient whom undergo elective surgical operation under general anesthesia in TASH major operation theatre from Oct 1st till NOV 1st.

4.3.3: study unit

A patient undergoing elective surgery.

4.4: Eligibility criteria

4.4.1: Inclusion criteria

All patients scheduled for elective operation under general anesthesia and spinal anesthesia give consent to be part of the study.

Exclusion criteria

Age <1 year
Pts with history of head injury and epilepsy.

4.5: Sample size and sampling procedure

4.5.1: Sample size Determination

The sample size will be calculated using the single population proportion formula;
n= (Z a/2)2×p×q / d2
= (1.96)2× (0.3) (0.35) = 160
(0.05)2 Where: n= sample size.

Z= desired 95% confidence,

Z=1.96.
p = proportion PAS from previous studies (0.65)
q =1-*p* = *1-0.65=0.35*
d = is the margin of sampling error tolerated (5%)

4.5.2: Sampling procedures

Systematic random sampling technique will be used to select study participants.

4.6:Study variables

4.6.2: Independent Variables

- Age

- Sex

- ASA physical status

- Type of surgery

- Duration of surgery

- Type of anesthesia

- Body temperature

- Anesthesia maintenance agents

4.6.2. Dependent Variable

Post anesthesia shivering

4.7: Data collection procedures

A structured questionnaire which was prepared in English will be used. Both observation and chart review will be used to collect the appropriate data. Patients' chart will be reviewed to get demographic data and body mass index after they give verbal consent to be part of the study and written consent to be operated before anesthesia is administered. Chart review will continue post operatively for the type and duration of surgery, type of anesthesia and maintenance agent. The observation including recording of tympanic temperature start intraoperatively up to the time that patient discharged from the PACU.

Temperature will be taken intraoperatively and immediately the patient arrive at PACU after general anesthesia. Tympanic temperature was measured upon arrival at the recovery room at 15 minutes interval until discharge from the recovery room. The average body temperature was

recorded to put the study units in the category of hypothermic or normothermic until the time of shivering was happened or until discharged from PACU for none shivering patients. Both intraoperatively and in the PACU, patients might be covered with a blanket but will be not actively warmed. Patients will be continuously observed for the occurrence of tremor-like musclehyperactivity for the first 15 minutes and then at 3-min intervals for the following hour until the pt discharged from the PACU. The intensity of PAS will be graded by using a four-point scale described by Crossley and Mahjan **.** Shivering usually defined as readily detectable fasciculation or tremor of the face, jaw, head, and trunk or extremities lasting longer than 15 seconds. So, patients will be judged to have PAS when they displayed grade 2, 3 and 4 shivering activity for at least 15 seconds.

Data will be collected by PACU Nurses after training is given about the study and data collection.

4.8: Data quality management

To ensure quality of data, pre-testing of the data collection tool (the questionnaire) will be conducted on 20 patients who will not be included in the main study and the collected data will be checked for the completeness, accuracy and clarity. Then necessary corrections will be made accordingly to the questionnaire for the main study.

4.9: Data processing and analysis procedure

After completion of data collection, the data will be checked for errors and coded. The coded data will be entered to SPSS version 20.0 statistical package and analysis will be performed.

Bivariate and multivariate analysis will be used to identify associated factors of PAS and the strength of association was measured by 95% confidence.

4.10: Ethical consideration

Before the start of data collection ethical clearance will be obtained from the institutional ethical review board of college of medicine and health sciences, AAU. During data collection process the data collector will be informed for each study participant regarding the purpose and anticipated benefits of the research project .they will also informed on their full right to refuse, withdraw or completely reject part or all of their part in the study and they will be assured of that their treatment and other benefits they gain from the hospital and/or other organizations will not be influenced by their participation in the study. Finally, patients will be asked for oral and written informed consent .confidentiality will be guaranteed by keeping the secrecy of personal identification, keeping completed questionnaires and results in secured area.

4.11 : Operational définitions

Shivering :is an involuntary muscular activity that augments heat production.

Post anesthesia shivering: is an involuntary or uncoordinated muscular activity following general anesthesia.

Grade of shivering: it will be graded using a scale validated by Tsai and Chu (13)

Grade 0 = No shivering
Grade 1 = Piloerection but not visible shivering.

Grade 2 = muscular activity involving one muscle group,
Grade 3 = Muscular activity in more than one muscle group but not generalized.
Grade 4 = gross muscular activity involving the entire body or Shivering all over the body.

4.12: Dissemination of results

The result of this study will be presented to the department of ANESTHSIOLOGY as partial fulfillment of certificate in post graduate course in anesthesiology, annual research conference of the AAU and on annual conference of Ethiopian Society of anesthesiology (ESA) and it will be sent for publication.

CHAPTER FIVE: RESULT

During a one-month data collection period a sample of 150 patients operated under generalanesthesia or spinal anesthesia were included in the study. Out of these 6 (4.8%) cases wereexcluded from analysis because 4 cases data were not complete by missing important variablesand 3 cases whom had to be excluded by exclusion criteria were part of the study. Therefore, theresult of this study is out of 143(95.3%) cases.
The overall incidence of post anesthesia shivering was 46.9%. From 89 patients who took GA,33(39.7%) developed PAS and from 54 patients who took SA, 34(62.9%) of patients had PAS. For most patient maintenance agent for general anesthesia was halothane. for 15(10%) patient isoflurane and 10(6%) patient halothane and ketamine in combination were used for maintenance of anesthesia. Bupivacaine is used for all patient operated under SA.

. Grade of shivering according to the scale described by Crossley and Mahjan, was used in thisstudy to record shivering score. From all patients who had PAS, grade 2 shivering accounted19.4%, grade 3 and grade 1 shivering were 52.2% and 26.5% respectively. Grade 4 accounted for 1.5%.

Premedication in the form atropine was given for 15(11%) patient. All these patients were under 5years and operated under GA. From all patient followed in the PACU 61% of patient become hypothermic with body temperature less than 36^0C.

Demographics and clinical parameter of patient included in the study.

variables	frequencies	percent's
Sex		
male	73	51
female	70	49
age		
1-5year	19	13.3
6-59year	107	74.8
>60	17	11.9
ASA physical status		
1	85	59.4
2	54	33.6
3	10	7
Type of surgery		
Head and neck	29	20.3
abdominal	70	49.0
extremity	3	2.1
genitourinary	33	23.1

thorax	8	5.6
Duration of surgery		
<1hour	74	51.7
1-2hours	42	29.4
>2hours	27	18.9
Body temperature in PACU		
<36	86	60.1
>36	57	39.9
Shivering		
present	67	46.9
absent	76	53.1

Fig 1 body temperature of patients in the study while in PACU. 60.1% of patient were hypothermic.

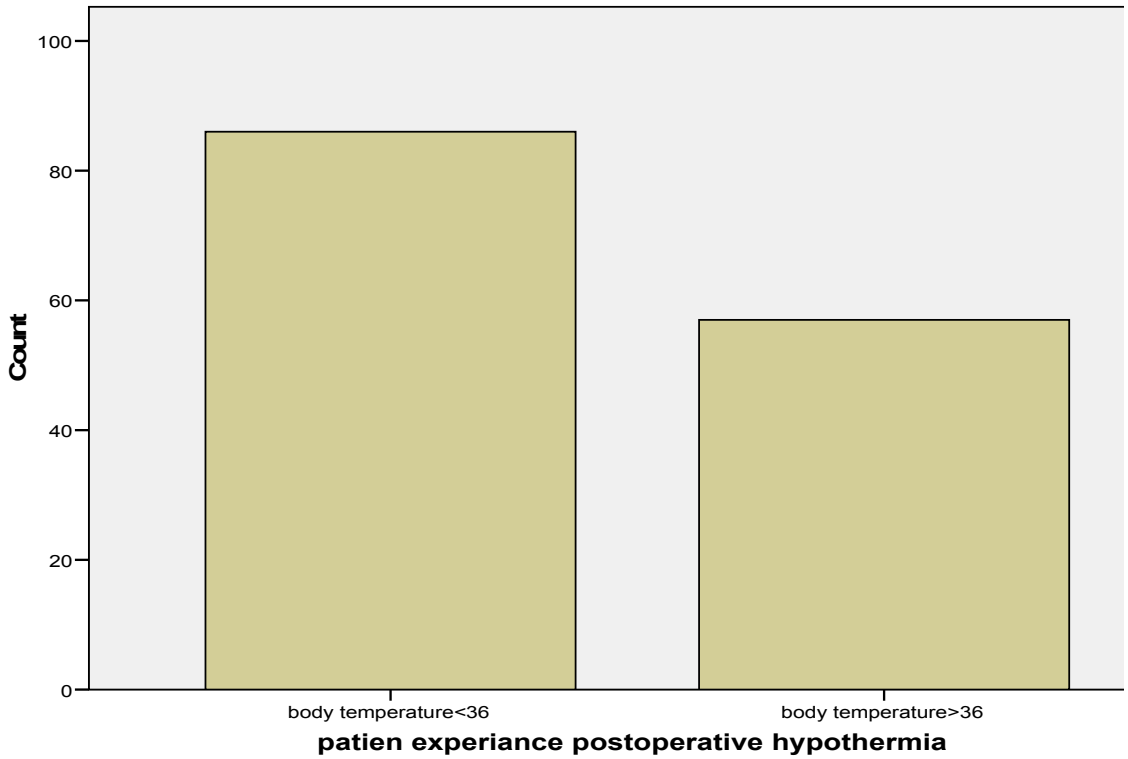
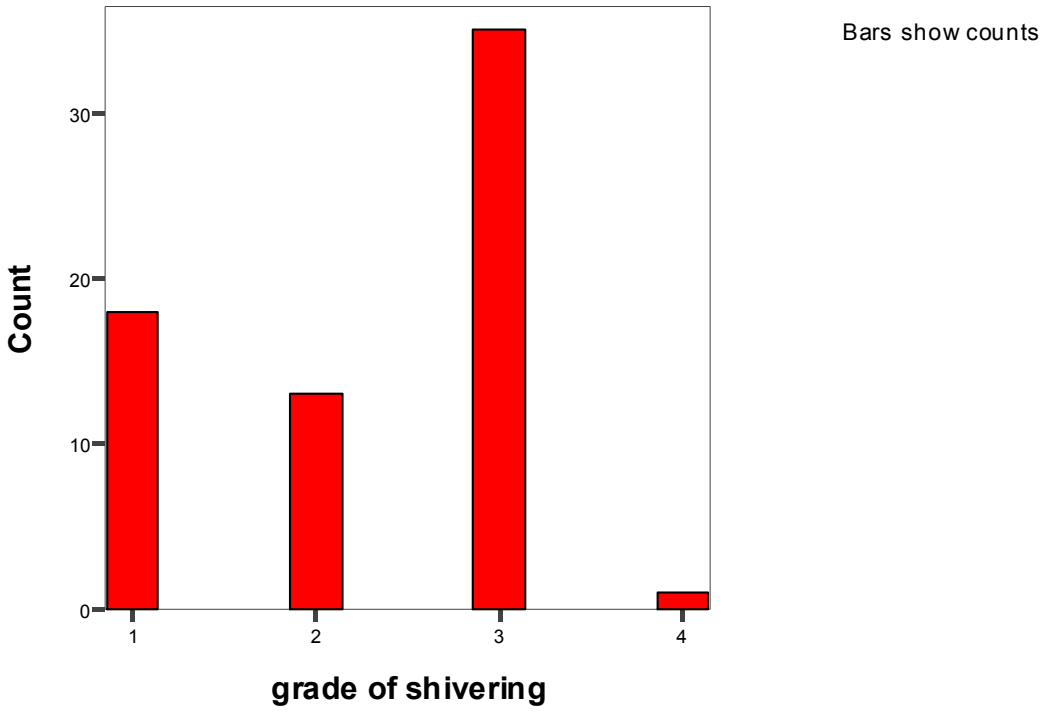


Fig 2 Percentage distribution Grade of shivering of study population.



Among the patient who had PAS, majority of them had grade 3 shivering

Cross tabulation between factors and post anesthesia shivering

variables	Shivering in PACU		COR	95% CI for COR	
	No shivering	shivering		lower	Upper
Sex					
male	45	28	1.427	1.017	2.002
female	31	39			
Age					
<60	68	58	1.276	.522	3.120
>60	8	9			
Type of anesthesia					
GA	56	33	.668	.506	.882

SA	20	34			
Body tempreature					
>36	53	4	.086	.033	.224
<36	23	63			

Data presented as percentage with in variable, Odds Ratio and 95%CI for OR.

Cross tabulation of PAS with gender of patients, type of anesthesia and body temperature at PACU with assessment of odd ratio, has showed association with CI of 95%. however, age of patients didn't reveal significant association.

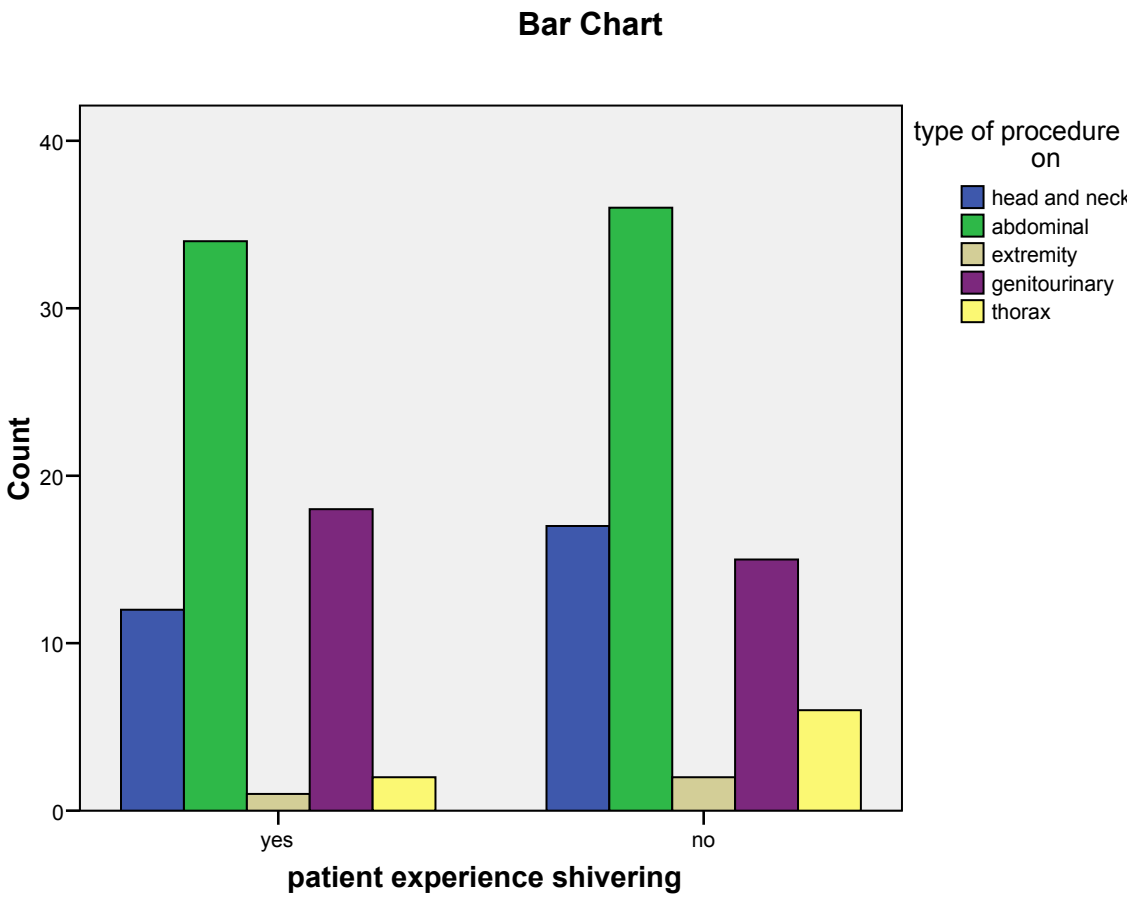
From the type of surgery higher incidence of PAS was found among genitourinary and abdominal surgery with 54.5% and 48.5% respectively.

patient experience shivering * type of procedure done on Crosstabulation

Count

		type of procedure done on					Total
		head and neck	abdominal	extremity	genitourinary	thorax	head and neck
patient experience shivering	yes	12	34	1	18	2	67
	no	17	36	2	15	6	76
Total		29	70	3	33	8	143

Fig 3 distribution PAS among the type of surgery in TASH.



In this study regarding the duration of surgery higher incidence of PAS is depicted with procedure lasting more than 2hours (66.6%). The incidence in procedure lasting less an hour and within one to two hours were 48,6% and 30.9% respectively.

patient experience shivering * duration of surgery in minutes Crosstabulation

Count

		duration of surgery in minutes			
		<60min	1-2hours	>2hours	Total
patient experience shivering	yes	36	13	18	67
	no	38	29	9	76
Total		74	42	27	143

Magnitude of factors associated with post anesthesia shivering.

In this study factory of inquiry gender of patient, type of anesthesia and body temperature in PACU were shown to have significant association. However, age, ASA classification and duration of surgery didn't have statistically significant association in this particular study. Analysis was done with binary logistic regression and factors with p value <.2 were taken to have statistically significant.

variables		Exp(B)	95%C.I for OR		p-value
Body temperature in PACU	>36oc	36.293	11.808	111.554	.000
	<36oc				
sex	male	2.002	1.038	3.940	.0392
	female				
Type of anesthesia	GA				
	SA	2.885	1.433	5.810	.0031.
ASA classification	1				
	2	1.012	.499	2.057	.972
	3	2.174	.527	8.976	.283
	4				
Duration of surgery	<1hour	2.113	.952	4.691	.066
	1-2hour	.472	.189	1.190	.112
	>2hour				
Age	<60	1.319	.478	3.639	.538
	>60	.889			

A logistic regression was performed to ascertain factors contributing for PAS. Gender, type of anesthesia and average temperature in PACU were found to be statically significant associated factors. Males were twice more likely to develop PAS. Patient operated under SA 3X more likely

to develop PAS. Finally, most of patient who develop PAS were hypothermic with body temperature less than 360c. This result are statistically significant with p-value <.05.

Chapter six
6.1: Discussion
The overall incidence of PAS was found to be 46.9%. Even though this number was high, it is still in line with previous reported incidence of shivering following general anesthesia varied between 5 and 65% whereas after spinal anesthesiawas about 33%. In a study done at General Hospital of Patras, Greece, in 2003 on effects of hypothermia and shivering on standard PACU monitoring of patients, has shown from the total of 170 patients, Shivering was present in 42 (24.7%) patients. In another study conducted on Independent Risk Factors for Postoperative Shivering, which was observational in Philips University, Germany in 2005, and was done on 1340 consecutive adult patients, they found 11.6% incidence of post anesthesia shivering. The incidence in this study was higher compared to above studies. This difference may be accounted for lack of consistent intraoperative temperature monitoring and institution of active warming. In addition, those studied were done on one specific type of anesthesia and age group.

The finding was also consistent with one study conducted in Seoul National University,Bundang Hospital, South Korea, in 2005; on Intrathecal clonidine does not reduce post-spinalshivering which is controlled trial type has shown on the controlled group consisting of 50 ptswho did not take any prophylactic, the incidence of shivering was 40%.

Grade of shivering as mild, moderate and sever according to the scale described by Crossleyand Mahjan, with percentage were12.4%, 9% and 25.1% respectively. There were little difference compared to previous study.In a study conducted in Seoul National University
Bundang Hospital, South Korea, in 2005, on post-spinal shivering, the maximal intensity ofshivering during the first 90 min after spinal anesthesia, which was graded as mild, moderate,and severe was 16%, 14%, 10%, respectively. This difference was due to inclusion of patient operated under both GA and SA. In addition, even though grading

ofshivering isobjective, there may be observational error since it needs close and careful observation to differentiate between part, group and gross muscular tremor like activity and this could beanother reason for the difference.

The incidence of PAS in this study among patients who took spinal anesthesia was 34(62.9%). This finding was higher compared to previous study done elsewherebut comparable to study done GUH which is 28(53.8) In the report of Leicester General Hospital, UK in 2000, PAS globally affecting 33% of patients after spinal anesthesia. In another study done in Inje University, Seoul, Korea, which was published in 2010 shows the incidence of shivering after spinal anesthesia was 34.6% with p value of 0.038%.This result may as result of high incidence perioperative hypothermia, which need further in query like intraoperative hypotension and dose of local anesthetics.

Many studies done before tried to reveal the associated factors of post anesthesia shiveringeven though it remains impossible to exactly predict the occurrence of PAS in thepresence of several factors in which most of them are co-linear.

The incidence of PAS in male patients following anesthesia with volatile anesthetic halothanedone in Cleveland, Ohio was 29.2% whereas in females 20.2%. Another study done inTurkey on post-operative shivering in children and causative factors reported male to female ratio of post-operative shivering was 35/18 among 1507 patients who took general anesthesiawith sevoflorane or thiopentone. There was dissimilar result in this study which is 38.3% male and 55.7%. This was due to most of female patient in the study undergo obstetric surgery under spinal anesthesia. Both obstetrics surgery and SA were found to have high incidence of PAS in this study.

The second factor in this study, which was examined for association with PAS, was age. There was higher incidence in geriatric patient, age greater than sixty which was 9(52.9%) compared to those less than sixty

58(46%). Similar higher incidence of PAS in geriatric patients following general and spinal anesthesia was found in research done in Gondar, Ethiopia. Which was 28.5% for age group greater than 65 years old and 24.8% for those less than 65years. However, other previous research showed lower incidence in this age group. This include a research done in The Johns Hopkins Medical Institutions; Maryland, USA. According to their report, themean core temperature threshold for vasoconstriction was lower in the older groups (35.5+ 0.30c) than in the younger group (36.2+0.20c) (p=0.03) and the mean maximum shivering score wasalso lower in the older group (2+0) than in the younger group (3+0) (p=0.01). Lower threshold for vasoconstriction means equivalent lower threshold for shivering since the threshold gap is unaffected. This fact combined with low maximum shivering score explained the lower in incidence of PAS in geriatric population.

The reason for this different result was due to small number of geriatric populations included (17). The type of procedure and mode of anesthesia has also it's role. In addition, age was not found to have statistically significant association with PAS.

The influence of core body temperature on the occurrence of PAS was studied by severalauthors. A study done in Hamburg, Germany in 1998, on Non-thermoregulatory shivering inpatients recovering from isoflurane or desflurane anesthesia on 120 patients allowed hypothermia deliberately and the incidence of shivering was 50% in those patients who werehypothermic [9]. Similar study done in India on Post Anesthesia Shivering in 2003, showsshivering occur in about 50% of patients with a core temperature of 35.50C that washypothermia. In this study slightly higher incidence of PAS(73%) was found on those who were hypothermic in PACU.

Core body temperature in PACU had statistically significant association with PAS(P<.001). This association also showed in research done in General Hospital of Patras, Greece, in 2003 on effects of hypothermia

and shivering on standardPACU monitoring showed 38 (30.4%) hypothermic patients developed shivering at the PACU arrival ($p<0.01$) [17]. In research done ZMH which was 35.0% (36 of 103)hypothermic patients developed shivering in the PACU ($p<0.012$).

The occurrence of shivering was higher in surgeries lasting longer than 2 hours compared to shortprocedures. However, by logistic regression analysis model duration of surgery had no significant association with PAS. One study done in Greece, on effects of hypothermia and shivering on standard PACU monitoring of 170 patients, has shown shivering and non-shivering patients did not yield difference with total time in the operating room.

ASA status was found to have no relation on the incidence of shivering as 48.2%(41 of 85) patients shivered in ASA class I patients, 47.9.8% 9 (23 of 48) of ASA II patientsand 30% (3 of !0) develop shivering under ASA class II patients. In addition, figures were not statistically significant at p-value 0.05 with bivariate logistic regression model. This finding can be supported by a study done in Tanta University, Egypt, 2012, Prevention of shivering during regional anesthesia**;** has shown ASA status with shivering incidence was not statisticallysignificant.

6.2:Limitation

Factors presumed to have association like BMI, intraoperative temperature record and amount and temperature of infused fluids were not included.

Axillary temperature rather than core temperature was used in PACU.

Chapter seven

7.1: Conclusion

In conclusion there was overall high incidence of PAS, (46.9) which, necessitate close intraoperative temperature monitoring and institution of active warming. The relative high incidence of PAS on those patients operated under SA (62.9) which requires further inquiry. This study doesn't reveal strong positive predictive factors which can be used for recommendation regarding PAS prophylaxis.

7.2: Recommendation

This study provides baseline information for hospitals in Addis Ababa, which could help withpossible prevention and interventions regarding PAS. Meticulous passive and active warminghave to be part of routine care for the patients especially for those at high risk, and this has to be given concern by operation room and PACU staffs.If surgery is planned on patients who are Male, low core body temperature, children and adult age group every precautions and care should be considered to make core body temperature in thenormal range perioperatively.

Finally, for administrators and other stakeholders, I recommend to them to consider ways to make OR and PACU temperature-controlled rooms for better health care to our patients.

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ANNEX I

Intensity of post anesthesia shivering is graded by using the scale described by Crossley andMahjan, 1994.

Grade 1 = no visible muscle activity but piloerection, peripheral vasoconstriction or both arepresent (other causes exclude).

Grade 2 = muscular activity in only one muscle group.

Grade 3 = moderate muscular activity in more than one muscle group but no generalizedshaking.
Grade 4 = violent muscular activity that involves the whole body.

ANNEX II

Code No_____

Questionnaire

❖ Addis Ababa University College of Health science, school of medicine/department of anesthesia; format for assessment of the magnitude and associated factors of post anesthesia shivering inTASH, Addis Ababa, Ethiopia from oct 01 – nov 1, 2016.

❖ First of all I would like to acknowledge for your willingness to participate in this study and also I would like to assure as I will keep the confidentiality of this record in case that you may not want to be public. The purpose of this study is to provide important information on to what extent post anesthesia shivering is present and what factors contribute for post anesthesia shivering in our country hospitals. After having said this I will like to inform you that you have the right not be the part of the study.

1. Socio-demography and clinical parameters

a. Age (yrs) _____ d. weight (in kilogram) _____

b. Sex _____ e. BMI if calculated _____

c. height (in meter) _____

2. preoperative tympanic temperature _____^{0}c

3. American Society of Anesthesiologists physical status.

a. ASA I b. ASA II c. ASA III d. ASA IV

4. Type of anesthesia:

a. GA

b. SA

c. GA + RA

5. If the above question's answer is (a), what anesthetic agent used for intraoperative maintenance of anesthesia.

a. Halothane

b. Ketamine

c. Propofol

d. Thiopentone

6. If the type of anesthesia is SA or combined GA and RA, what local anesthetic is used?

a. Lidocaine b. bupivacaine

7. Type of procedure done on:

a. Head and neck

b. Abdominal

c. Extremity

d. Perennial

e. Pine and thorax

8. Duration of surgery in hrs_____

9. What premedication has been given for the patient?

a. Narcotics (specify) c. Benzodiazepine e. none

b. Atropine d. Clonidine

10. Depending on question **No 10**, has the patient shivered?

a. Yes b. no

12. Patient's body temperature in ^{0}c in the **PACU** :

a. In the 1st 15 min_____ c. in the 3rd 15 min _____

b. In the 2nd 15 min _____ d. in the 4th 15 min _____
13. Depending on question **No 12**, has the patient experienced post operative hypothermia?
a. Yes b. No
14. If the above question is yes, what is the least body temperature in 0c? _____
15. Has the patient experienced shivering in the **PACU**?
a. Yes b. No
41
16. If the answer for **either or both** question number **11 or 15 is yes**, what is the grade of shivering?
a. Grade 1 = no visible muscle activity but piloerection, peripheral vasoconstriction or both are present (other causes exclude).
b. Grade 2 = muscular activity in only one muscle group
c. Grade 3 = moderate muscular activity in more than one muscle group but no generalized shaking.
d. Grade 4 = violent muscular activity that involves the hole body
17. For how long this shivering persists?
A. <15 seconds B. >15 seconds
18. Is the patient actively warmed?
a. Yes b. No
19. What intervention has been done for shivering patients?
a. Supportive b. therapeutic c. none
20. If the above question's answer is supportive, what was done for the patient?
a. Warming the patient by heater
b. Covering by blanket
c. Warming of the fluid which has being given
d. Supplement with 100% oxygen
21. If the answer for question number 19 is therapeutic, what drug has been given?
a. Petidine
b. Clonidine
c. Other (specify) _____