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Assessment on Magnitude and Associated Factors of Post Anesthesia Shivering at Zewditu Memorial Hospital from February 01 – March 31, 2016.

By: ZEMENU MULUKEN (MSc student in Anesthesia)

A RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR MASTER OF ANESTHESIA IN SCHOOL OF MEDICIN, COLLEGE OF HEALTH SCIENCE, ADDIS ABABA UNIVERSITY .

June, 2016

Addis Ababa, Ethiopia

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SCHOOL OF MEDICINE/DEPARTMENT OF ANESTHESIA

ASSESSMENT ON MAGNITUDE AND ASSOCIATED FACTORS OF POST ANESTHESIA SHIVERING AT ZEWDITU MEMORIAL HOSPITAL FROM FEBRUARY 01 – MARCH 31, 2016.

Investigator: Zemenu Muluken (MSc student in Anesthesia)

Advisor: Wosonyeleh Admasu (MSc, Lecturer)

June, 2016

Addis Ababa, Ethiopia

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Assessment on Magnitude and Associated Factors of Post Anesthesia Shivering at Zewditu Memorial Hospital from February 01 – March 31, 2016.

By: ZEMENU MULUKEN

Name and signature of Members of the Examining Board

Name Title Signature Date

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Name of Advisor(s)	Wosonyeleh Admasu
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ABSTRACT

Background: Now on these days as quality of patient care has being given big concern in developing countries, which was not yet, it is necessary to conduct a study to know some procedural and treatment complication. Post anesthesia shivering is one of these complications, which has many deleterious effects on the patient outcome. The cause of shivering is incompletely 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 in Zewditu Memorial Hospital, Addis Ababa, Ethiopia from February 01 – March 31, 2016.

Methods: Institutional based cross-sectional study design was conducted from Feb 01- Mar 31, 2016. A systematic random sampling method was employed to select 179 study subjects. A pre-tested structured questionnaire was used to collect data. Perioperative tympanic temperature was recorded every 15 minutes interval.

Results: The overall incidence of post-anesthesia shivering was 29.1%. From this majority of patients (60.8%) had grade 3 shivering. In multiple logistic regression analysis, being male patient (AOR= 3.273, 95% CI: 1.495, 7.165; p=0.003), older age (AOR= 0.123, 95% CI: 0.032, 0.469; P=0.002) and tympanic temperature less than 36^{0}C (AOR= 2.747, 95% CI: 1.248, 6.049; p=0.012) were considered associated factors of PAS.

Conclusion and Recommendation: The incidence of shivering was (29.1%); we also conclude that prophylaxis for shivering is necessary in those high risk patients. Age of the patient was the variable with the most predictive power by far. 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 the normal range post operatively. For pain management alternative, it may be better to use opioids which have known protective effect for shivering.

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Expanded Features
Unlimited Pages
PDF Complete

Table of contents

Contents **page**

Abstract……………………………………………………………………………….……….I

Acknowledgement……………………………………………………………………………..II

Table of contents……………………………………………………………………………....III

List of acronym…………………………………………………………………………….... V

List of tables and figures …..……………………………………………………………….VI

CHAPTER ONE: INTRODUCTION

1.1 Back ground……………………………………………………………………………....1

1.2 Statement of the problem……………………………………………………………....3

1.3 Significance of study……………………………………………………….……….…...4

CHAPTER TWO: LITERATURE REVIEW

2.1 Definitions ....…...5

2.2 magnitude and associated factors…………………………………………………..….5

CHAPTER THREE: OBJECTIVES

3.1 General objective……………………………………………………………………......12

3.1 Specific objectives..…...12

CHAPTER FOUR: METHODOLOGY

4.1 Study area and period ……………………………………………………………...13

4.2 Study design………………………………………………………………………..13

4.3 Population…………………………………………………………..………….13

4.3.1 Source population……………………………………………………………...13

4.3.2 Study population………………………………………………………………13

4.3.3 Study unit ………………………………………………………………………13

4.4 Eligibility criteria………………………………………………………………......13

4.4.1 Inclusion criteria…………………………………………………………………13

4.4.2 Exclusion criteria……………………………………………………..………….13

4.5 Sample size and Sampling technique …………………………………………………...14

4.5.1 Sample size determination……………………………………………..…….... 14

4.5.2 Sampling technique………………………………………………………..……. 15

4.6 Study variables……………………………………………………….…………….....15

Click Here & Upgrade
Expanded Features
Unlimited Pages
PDF Complete

4.6.2 Independent variables……………………………………………….……………………...15

4.6.1 Dependent variables……………………………………………………………………..15

4.7 Data Collection……………………………….……..……………………………16

4.8 Data quality control and assurance……………………….………….…………………...17

4.9 Data processing and analysis…………………………………..……………………17

4.10 Operational definition…………………………………………….……….……….…...17

4.11 Ethical consideration……………………………………………………………..…..17

4.12 Dissemination plan ……………………………………………..……………….18

CHAPTER FIVE

5. Result ………..……………………………………………………….………………19

CHAPTER SIX

6.1 Discussion …...…….……………………………………………………………….28

6.2 Limitation……………………………………………………………...………28

CHAPTER SEVEN

7.1 Conclusion …………………………………………………………………….33

7.2 Recommendation ………………………………………………………………...33

References……………………………………………………………………….…34

Annex I………………………………………………………………………….37

Annex II………………………………………………………………………….38

Annex III…………………………………………………………………..….39

Click Here & Upgrade
Expanded Features
Unlimited Pages
PDF Complete

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
ZMH	Zewditu Memorial Hospital

PDF Complete
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Expanded Features
Unlimited Pages

List of Dummy Tables

Table **page**

Table 1: Demographics and clinical parameters of shivering patients in ZMH from February Feb 01 – Mar 31, 2016……………………………………………………………………….…..20

Table 2: Association b/n individual factors and post anesthesia shivering among patients underwent surgery in ZMH, from Feb 01- Mar 31, 2016………………………………………23

Table 3: Variables which affect and do not affect the occurrence of post anesthesia shivering significantly among patients who underwent surgery at ZMH from Feb 01-Mar 31, 2016……..26

List of Figures

Figure **page**

Fig 1: Body temperature in the PACU among patients underwent surgery in ZMH from Feb 01- Mar 31, 2016…………………………………………………………………………..…21

Fig 2: Percentage distribution of grade of post anesthesia shivering who were done by SA and GA in ZMH from Feb 01-Mar 31, 2016……………………………………………………….….22

Fig 3: Distribution of post anesthesia shivering among patients who took GA and SA in ZMH from Feb 01-Mar 31, 2016…………………………………………………………………..…..24

Fig 4: Distribution of PAS among different types of surgery in ZMH from Feb 01-Mar 31, 2016…………………………………………………………………………………………..…25

Fig 5: Percentage distribution of sex and PAS among patients underwent surgery in ZMH from Feb 01- Mar 31, 2016………………………………………………………………….….25

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Expanded Features
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PDF Complete

CHAPTER ONE: INTRODUCTION

1.1 Back ground

Now on these days as quality of patient care has being given big concern in developing countries, which was not yet, it is necessary to conduct a study to know some procedural and treatment complication in the context of different setups and population in which the health care system is different. Post anesthesia shivering is one of these complications, which has many deleterious effects on the patient outcome [1, 6].

Postoperative shivering-like tremor is a relatively frequent complication of anesthesia and surgery. Apart from the obvious discomfort, post anesthesia shivering is associated with a number of potentially deleterious sequelae. This includes increased oxygen consumption and carbon dioxide production, catecholamine release, increased cardiac output, tachycardia and hypertension, may decrease arterial oxygen saturation, and may be associated with an increased risk of myocardial ischemia, intraocular and intracranial pressure. Furthermore, shivering occasionally impedes monitoring techniques such as pulse oximetry and ECG. It is often preceded by core hypothermia and vasoconstriction but not necessarily true [1].

In one study 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. On this study it is concluded as they found a low overall incidence of shivering (3.5%) so, prophylaxis is not necessary in children and shivering can be treated only when it occurs [2].

Most PAS is simply normal thermoregulatory shivering that is triggered by hypothermia and preceded by arteriovenous shunts vasoconstriction. Shivering can also occur in normothermic patients, and hyperthermic patients who are developing fever. However, some shivering-like tremor during labor and after general anesthesia is not thermoregulatory. Although the etiology of this tremor remains incompletely understood, it is aggravated by inadequate pain control. Furthermore, some patients who are distinctly hypothermic do not shiver [3, 1].

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Post Anesthesia Shivering (PAS) occurs in 40% of patients recovering from general anesthesia and usually preceded by central hypothermia and peripheral vasoconstriction indicating that most of the time it is thermoregulatory mechanism, which even today is ill understood. Some shivering may not be thermoregulatory, thus making the management of PAS complex. Shivering is an important complication of hypothermia; it is a complicated response of the body. It occurs frequently i.e. 40 to 60 % after volatile anesthetics, but still it remains poorly understood. Shivering occurs 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 38 ^{0}C and 50% of them reach 38.4 ^{0}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. Also this article suggests that more research is required to understand about the Pathophysiology post anesthesia shivering [4].

Not only hypothalamic thermoregulation, behavioral thermoregulation is also obtunded during general and regional anesthesia usually end up in shivering which can double or even triple oxygen consumption and carbon dioxide production. Prospective randomized data suggest that high risk patients assigned to only 1.3 degree Celsius core hypothermia were three times more likely to experience adverse myocardial outcomes. Marked increase in plasma catecholamine level is perhaps associated with high-risk cardiac complications [4, 5].

The incidence of post anesthesia shivering varies between 6.3 and 66%. Young ages, male gender, the use of halogen-containing anesthetic agents, and prolonged anesthesia or surgery have been implicated [6, 7].

So, the aim of this study it is important to know the overall magnitude and major contributing factors of post anesthesia shivering in a different set up to have appropriate intervention for the better health care.

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1.2 Statement of the problem

Post anesthesia shivering is a common complication of modern anesthesia, affecting 5-65% of patients after general anesthesia and 33% of patients during epidural and regional anesthesia which was done in countries where health care system is developed [5].

In our country the government concern on health was for coverage but now on these days in addition to coverage, big attention is given for quality. So, to give quality care, it is important to know the magnitude and associated factors of unwanted effects of procedures and managements.

In some studies the incidence of post anesthesia shivering is as low as 3.5% which doesn't require prophylaxis rather than treating as it is happened since it is low incident. On the other side some studies say its incidence is up to 60% that needs prophylaxis routinely. There is only one research done in University of Gondar, which shows the overall incidence of post anesthesia shivering was 25.6% and older age, patients who didn't get opioids analgesics and low axillary temperature were considered associated factors of PAS [22].

Almost all review articles or researches done on shivering out of Ethiopia, did their study on patients take halothane alone on humans. Even though, other volatile anesthetics were addressed well, previous studies conducted on the effect of halothane in conjunction with nitrous oxide or on nonhuman subjects. So, this study is going to indicate whether there is a difference in the magnitude of shivering in the set up where halothane is routinely used for intraoperative maintenance for all patients taking general anesthesia unless there is a contraindication.

So, the aim of this study is to indicate the burden of the problem and major associated factors so that timely and rational prevention and intervention can be implemented in the context of our health care setups.

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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. A research done in University of Gondar tried to put a base line on this issue, but it has gaps which need to be addressed. These include the representativeness of the study population is not known and cases who took opioids that are known therapeutics included in the study population. The other gap is axillary temperature was used instead of core temperature and the effect of type procedure assessed by specific procedures instead regional, which is difficult to address all specific surgeries in non specialized hospital. This study was done by addressing all those gaps and on patients who was operated in a room where temperature is not controlled which is the same in most of government hospitals in Ethiopia.

This study can be additional input and give new finding for further study in different population in a different environment and conducted where halothane is used solely without mixing with nitrous oxide. For those who are going to conduct a research on this issue, it can be used as an input to the literatures and indicator for those who are going to implement the result of the project.

The result of this study may serve for tool development to perioperative health care providers to prevent and rationally intervene on post anesthesia shivering.

Also it will be helpful for program planners and policy makers to devise different strategies in a way that modify the organization of operation theatres to control room temperature, and take action on resource utilization for prevention and intervention of post anesthesia shivering.

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CHAPTER TWO: LITERATURE REVIEW

2.1 Definition

Shivering, according to review article done at Leicester General Hospital, UK in 2000, can be defined as readily detectable fasciculation or tremor of the face, jaw, head, trunk or extremities lasting longer than 15 seconds. As early as 1972, post-anesthetic shivering was been a well-documented phenomenon [1, 5, 8].

2.2 Magnitude and Associated Factors

Post anesthesia shivering is a common complication in modern anesthesia, globally affecting 5-65% of patients after general anesthesia and 33% of patients during epidural regional anesthesia and concerning to risk factors different studies result in different conclusions [1, 5,].

Volatile anesthetics can cause shivering due to hypothermia and peripheral vasoconstriction after redistribution of heat from core to peripheral. Morgan and Mikhail's Clinical Anesthesiology 5th edition justify this by taking isoflurane only. So, isoflurane produces a dose-dependent decrease in the threshold temperature that triggers vasoconstriction (3°C decrease for each percent of inhaled isoflurane) [1].

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].

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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 38^0 C and 50% of them reach 38.4^0 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 and

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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 O_2 shows 54 (25 %) shivered upon emergence from anesthesia. The mean rectal temperature of the shiverers was 36.17^{0}C., 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].

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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 ± 0.3^0c) than in the younger group (36.2 ± 0.2^0c) (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 36.9^0c. The average Axillary temperature during the first 30 minutes in the post operative period was measured to be 36.2^0c. 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 34.4^0c to 39.9^0c. Patient and operation characteristics between hypothermic and non hypothermic patients did not yield significant differences for age, sex, ASA classification,

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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 ± 1.8^{0}c and 36.26^{0}c 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 anesthesia

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or 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, $P \leq 0.001$) 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 groups-shivering and nonshivering, no significant difference was found between them in respect of mean

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skin, 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 *($P>0.1$).* 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 ($0.63 \pm 0.14^{0}C$) than in the warm group ($0.32 \pm 0.10^{0}C$) ($p<0.01$), 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].

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CHAPTER THREE: OBJECTIVE

3.1 General Objective

To assess the magnitude and associated factors of post anesthesia shivering at Zewditu Memorial Hospital, Addis Ababa, Ethiopia from Feb 01 – Mar 31, 2016.

3.2 Specific objectives

- To assess the magnitude of post anesthesia shivering at ZMH
- To assess the associated factors that contributes for post anesthesia shivering at ZMH

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CHAPTER FOUR: METHODOLOGY

4.1 STUDY AREA AND PERIOD

This study was conducted at Zewditu Memorial Hospital which is located in the capital city Addis Ababa, Ethiopia. The hospital is one of the governmental hospitals which are more than 10 in Addis Ababa, and gives service for specialty of gynecology and obstetrics, neurosurgery, general surgery, internal medicine and pediatrics. It has 4 operation theaters, 2 Post Anesthesia Care Units which have 7 beds and run by 5 nurses. The study was carried out from Feb 01 – Mar 31, 2016.

4.2 STUDY DESIGN

Institutional based cross sectional study design was employed.

4.3 POPULATION

4.3.1 Source of population

All patients undergoing elective operation in Zewditu Memorial Hospital

4.3.2 Study population

All patients underwent elective operation in Zewditu Memorial Hospital from Feb 01 – Mar 31, 2016 G.C.

4.3.3 Study Unit

A patient undergoing elective operation

4.4 Eligibility criteria

4.4.1 Inclusion criteria

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

4.4.2 Exclusion criteria

- Pts who have been given Petidine and/or Clonidine
- Age <1 year
- Pts with history of head injury and epilepsy.
- Patients who undergo craniotomy procedure

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4.5 Sample size and sampling technique

4.5.1 Sample size determination

The sample size was calculated using the single population proportion formula;

$$n = (Z_{a/2})^2 \times p \times q / d^2$$

$$= \frac{(1.96)^2 \times (0.65)(0.35)}{(0.05)^2} = 350$$

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%)

Sample size was calculated from different proportions which were done from previous researches and yield different sample size. Then the largest sample size which was 350 is taken from 65% magnitude of PAS [7]. By using correction formula for finite population since source population are less than 10,000.

$$n_f = \frac{n}{1 + \frac{n}{N}}$$

where: n= the sample size = 350

N = No of pts who underwent elective operation = 364

n_f = Final sample size

$$= \frac{350}{1 + \frac{350}{364}}$$

$$= 179$$

Mean of midyear population was used to get total number of elective patients who underwent operation in 2 months duration. The midyear population from situational analysis is 1090. So, the size of population in 2 months is 1090 divided by 3 gives 364. So, the final sample size is **179**.

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4.5.2 Sampling Technique

Systematic random sampling technique was used to select study participants. Since, the population was homogeneous and daily operation list was available as sampling frame, this technique was employed.

The total population size was 364 that could be undergone elective surgery within 2 months duration and the calculated sample size was 179. So, sampling interval (**k**) was calculated as follows.

K=N/n where, n = total sample size

364/179= 2 k=sampling interval

N = Total study population

Therefore, 2 was the sampling interval and the first study participant (random start) was selected from the first two cases of the list by lottery method.

The first study participant was the second case from the list the list of surgery and the consequent cases were 4, 6, and 8, up to 364.

4.6 Study variables

4.6.1 Independent Variables

- Age
- Sex
- ASA physical status
- Type of surgery
- Duration of surgery
- Type of anesthesia
- Body Mass Index
- Body temperature
- Anesthesia maintenance agents

4.6.2. Dependent Variable

Post anesthesia shivering

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4.7 Data Collection

A structured questionnaire which was prepared in English was used. Both observation and chart review were used to collect the appropriate data. Patients' chart was reviewed to get demographic data and body mass index after they gave verbal consent to be part of the study and written consent to be operated before anesthesia was administered. Chart review continued post operatively for the type and duration of surgery, type of anesthesia and maintenance agent if general anesthesia was used. The observation including recording of tympanic temperature started intraoperatively up to the time that patient discharged from the PACU. In this study the infrared type tympanic membrane thermometer was used to record core body temperature with a claimed accuracy of $\pm 0.1\ ^0C$.

Temperature was taken intraoperatively and immediately the patient arrive the PACU after spinal or general anesthesia. Body temperature might be ideally monitored continuously; however, 15 minute intervals are sufficient [24, 25]. 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 was not actively warmed. Patients were continuously observed for the occurrence of tremor-like muscle-hyperactivity for the first 15 minutes and then at 3-min intervals for the following hour until the pt discharged from the PACU. For patients who were done under spinal anesthesia, data was collected at 15 minute interval after onset of action of LA and in the PACU data was collected in the same manner as pts who took GA.

The intensity of PAS was graded by using a four-point scale described by Crossley and Mahjan **(Annex II).** 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 were judged to have PAS when they displayed grade 2, 3 and 4 shivering activity for at least 15 seconds [8]. Data was collected by 3 PACU Nurses after training was given about the study and data collection.

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4.8 Data Quality Control and Assurance

Pre-test was done on 5% of estimated general population at ZMH after training was given for those data collectors about the study and data collection. After the pretest only the sequence of the questionnaire was modified.

The principal investigator made regular follow up and supervision during data collection process and checked for missing information and inconsistencies. All materials used for data collection were arranged sequentially and data was stored in safe and secure place.

4.9 Data Processing and Analysis

After data collection, it was checked manually for completeness and then coded and entered in to Epi info version7 computer software by investigator and transported to SPSS version 20 computer program for cleaning and analysis.

The result was presented using tables, graphics and chart, and it was analyzed, compared and discussed.

Bivariate and multivariate analysis was used to identify associated factors of PAS and the strength of association was measured by 95% confidence .Variable which was associated on bivariate analysis at p-value less than 0.2 was taken to multivariate analysis and then P- value of less than 0.05 was used as a cutoff point.

4.10 Operational definitions

Shivering - a spontaneous, involuntary, tremor-like muscle-hyperactivity which lasts at least 15 min and greater than grade 1 by Crossley and Mahjan intensity scale.

Post operative hypothermia – core temperature of the patient less than 36^0C in the PACU.

4.11 Ethical Consideration

Prior to data collection, permission to conduct this research obtained from Department of Anesthesia, AAU. Then after, official letter was given to Zewditu Memorial Hospital and permission obtained from the hospital to conduct the study. Moreover, the objective of the study was explained to both hospital administration and the patients who were included in the study. Informed verbal consent from the patients preoperatively was asked before reviewing their chart

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and ongoing observation by informing their confidentiality and anonymity will be kept. For study participants below 18yrs of age, parental consent was taken.

4.12 Dissemination plan

The copies of this result will be disseminated to college of health science, school of medicine/department of anesthesia, Zewditu Memorial Hospital and Addis Ababa University student research office. In addition the copy will be submitted to Ethiopian Ministry of Health. It will be published in international language and presented on workshop and different seminar.

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CHAPTER FIVE: RESULT

During a two month data collection period a sample of 179 patients operated under general anesthesia or spinal anesthesia were included in the study. Out of these 4 (2.2%) cases were excluded from analysis because 2 cases data was not complete by missing important variables and 2 cases who had to be excluded by exclusion criteria were part of the study. Therefore the result of this study is out of 175(97.8%) cases.

The overall incidence of post anesthesia shivering was 29.1%. From 123 patients who took GA, 26.0% developed PAS and from 52 patients who took SA, 36.5% of patients had post anesthesia shivering. Almost for all patients, maintenance agent for general anesthesia was halothane except 3 cases (1.7%) to whom ketamine used as a maintenance drug for GA. Only 8(4.6%) patients developed post anesthesia shivering in the operation room after spinal anesthesia and their shivering was continued in the PACU. The rest of patients 29.3% shivered in the PACU after SA. From all patients operated under spinal anesthesia bupivacaine used for 60.7% and lidocaine for 39.3% patients. There was no difference in the incidence of shivering in both groups.

Grade of shivering according to the scale described by Crossley and Mahjan, was used in this study to record shivering score. From all patients who had PAS, grade 2 shivering accounted 15.7%, grade 3 and grade 4 shivering were 60.8% and 23.5% respectively (figure 2).

Premedication was given for patients operated only under general anesthesia. 55(31.4%) patients from the total cases premeditated with atropine before the induction of general anesthesia. From all patients who were followed in the PACU less number of patients 103(58.9%) became hypothermic with tympanic temperature $<36^0$C compared to patients whose tympanic temperature was 36^0C and above.

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Table 1: Demographics and clinical parameters of shivering patients in ZMH from February Feb 01 – Mar 31, 2016

Variables	Frequency	Percent
sex of the patient		
Female	99	56.6
Male	76	43.4
age (year)		
<=64	143	81.7
>=65	32	18.3
BMI(kg/m^2)		
<18.5	13	7.4
>=18.5	162	92.6
ASA physical status		
I	106	60.6
II	69	39.4
type of anesthesia given		
GA	123	70.3
SA	52	29.7
type of surgery		
Abdominal	120	68.6
Extremity	10	5.7
head & neck	10	5.7
Perennial	22	12.6
Spine and thorax	13	7.4
duration of procedure		
<=1	52	29.7
1.1-2	92	52.6
>=2.1	31	17.7
body temperature in PACU		
<=36	103	58.9
>36	72	41.1
shivering in the PACU		
no shivering	124	70.9
Shivering	51	29.1

The median age of patients was 42(82), where as the mean of body temperature in PACU 35.907 ± 0.5772, (34.0, 37.8), Volume of intraoperative fluid administered 2199.43 ± 762.143, (800, 4500), duration of surgery 1.621±0.686, (0.6, 3.6) in hour, body temperature after SA in the OR 35.880±0.7186, (33.9, 37) and body mass index of the patient was 21.615±2.4342, (16.4, 29.4).

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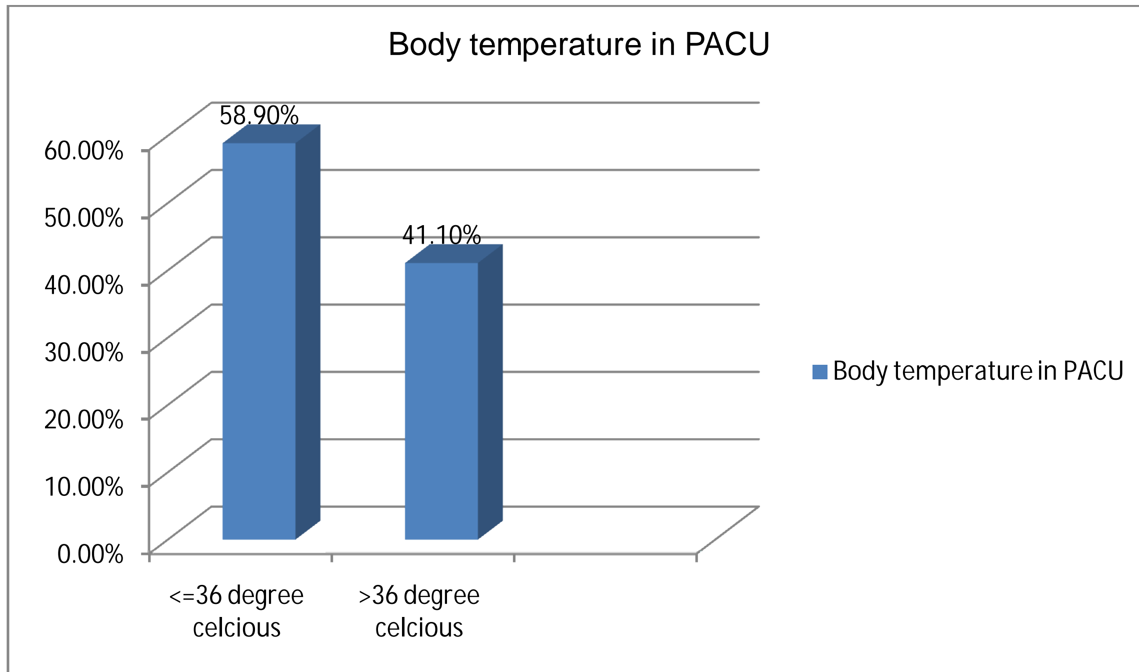

Fig.1: Body temperature in the PACU among patients underwent surgery in ZMH from Feb 01-Mar 31, 2016.

From all patients in the study, more than half of patients (58.90%) were hypothermic that was bellow 36^{0}C.

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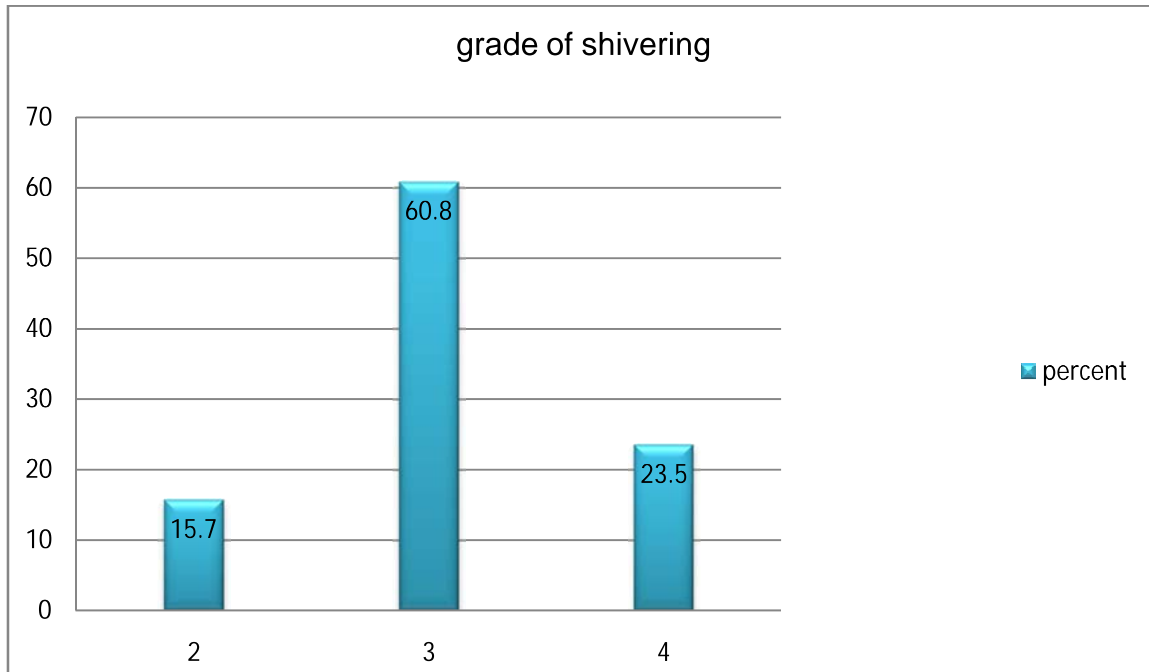

Fig 2: percentage distribution of grade of post anesthesia shivering who were done by SA and GA.

Among patients who developed post anesthesia shivering, majority of them 60.8% were under the category of grade 3 shivering.

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Table 2: Cross tabulation b/n factors and post anesthesia shivering among patients underwent elective surgery in ZMH, from Feb 01- Mar 31, 2016.

Variable	Shivering in the PACU (%)		COR	95% CI for COR	
	no shivering	Shivering		lower	Upper
sex of the patient					
female	78.8	21.2	2.422	1.244	4.716
male	60.5	39.5			
Age (year)					
<=64	66.4	33.6	.205	.059	.706
>=65	90.6	9.4			
ASA status					
I	74.5	25.5	1.560	.806	3.021
II	65.2	34.8			
Type of anesthesia					
GA	74.0	26.0	1.637	.818	3.276
SA	63.5	36.5			
BMI (kg/m^2)					
<18.5	44.4	55.6	.920	.270	3.133
>=18.5	73.9	26.1			
Body temperature in PACU					
<=36°C	65.0	35.0	.490	.244	.985
>36°C	79.2	20.8			

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

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With cross tabulation core body temperature in the PACU, age and sex were associated with post anesthesia shivering at p-value less than 0.05. Even though it was expected that variables could be associated with the outcome variable, there was only a difference in the incidence within the variable without significant association.

From type of surgeries done by regional classification, spine and thorax area procedures had the highest incidence of PAS 46.2% where as the list incidence was among extremity procedures was 10%.

On the duration of surgery, incidence of shivering was parallel to duration surgery and the higher incidence 35.5% was observed among procedures lasting longer than 2 hour.

With in patients with BMI less than 18.5 and greater than 18.5, the higher incidence of PAS 55.6% was among patient groups less than 18.5kg/m^2 compared to 26.1% incidence of PAS in the group of patients with greater than 18.5kg/m^2.

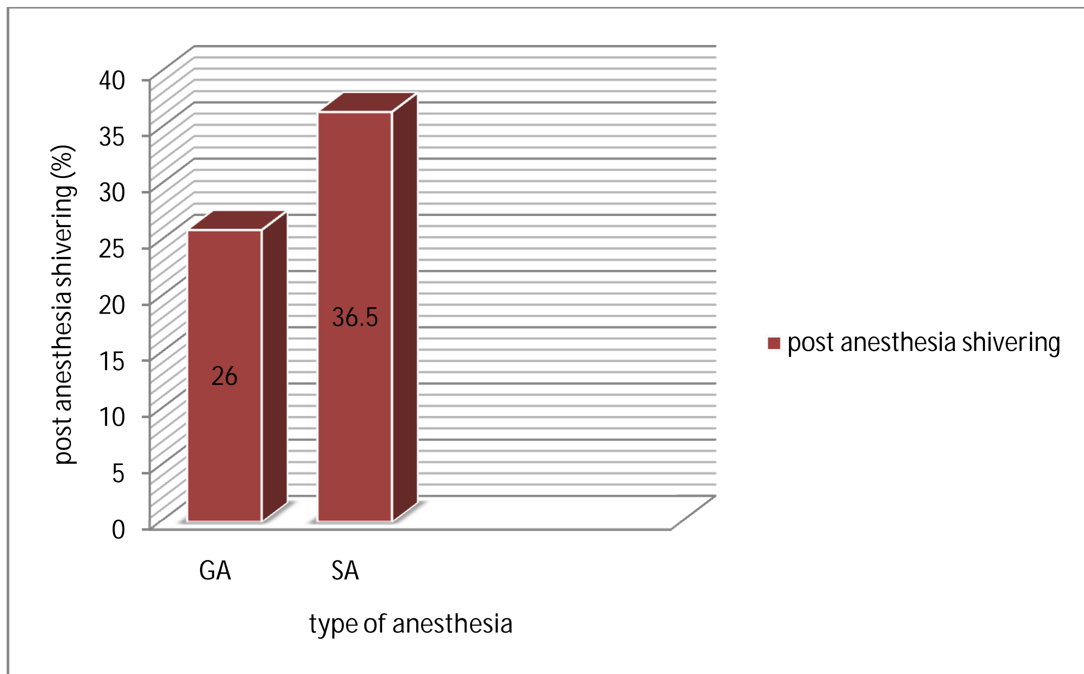

Fig 3: Distribution of post anesthesia shivering among patients who took GA and SA in ZMH from Feb 01-Mar 31, 2016.

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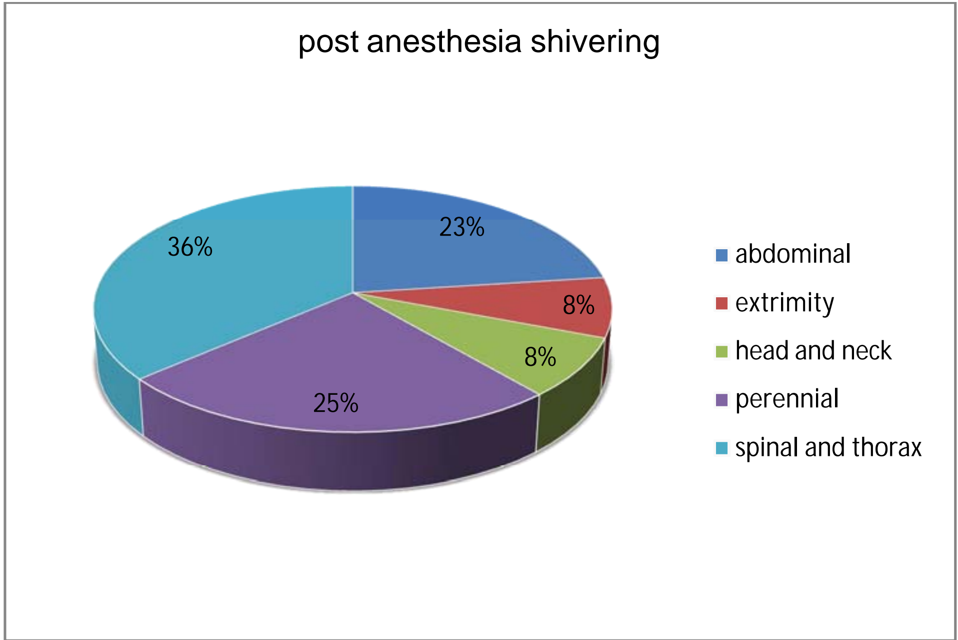

Fig. 4: Distribution of PAS among different types of surgery in ZMH from Feb 01-Mar 31, 2016.

The highest incidence of shivering was observed among spinal and thorax area surgeries.

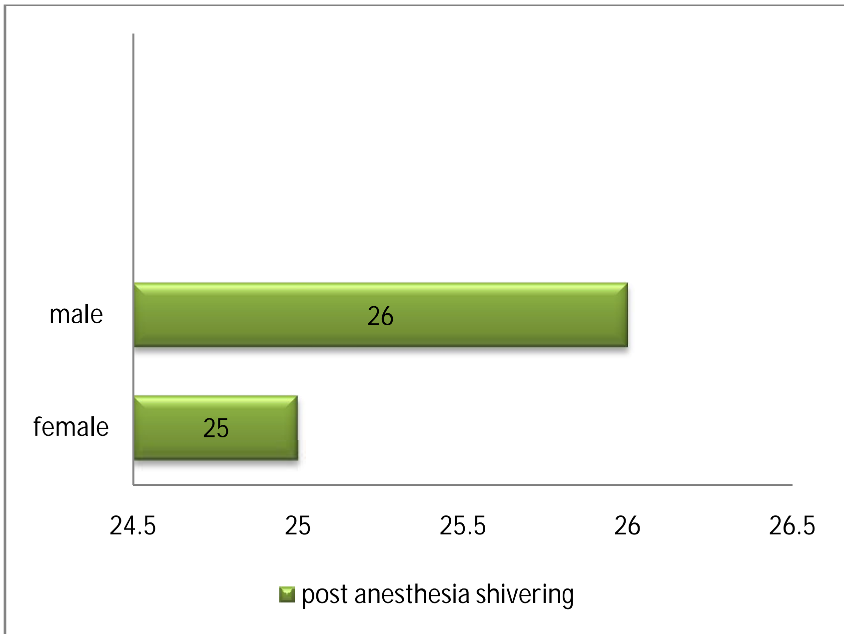

Fig5: Percentage distribution of sex and PAS among patients underwent surgery in ZMH from Feb 01- Mar 31, 2016.

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Factors associated to post anesthesia shivering

All exposure variables which had p-value of ≤ 0.2 from bivariate analysis were filtered to multivariate logistic regression to check whether these explanatory variables affect the outcome variable (PAS) independently. Sex, age, core body temperature in PACU, ASA status, type of anesthesia and room temperature were proved statistically significant in bivariate analysis and filtered to multivariate logistic regression model.

From 6 potentially proved relevant factors which were included in bivariate logistic regression analysis, 3 explanatory variables were removed because they were confirmed that no statistically significant association with post anesthesia shivering at 5 % level of significant on multivariate logistic regression analysis. The rest of 3 variables sex, age and core body temperature in the PACU were proved to be statistically significant at p-value <0.05 (Table3).

Table 3: Factors associated and did not associate with post anesthesia shivering among patients who underwent surgery at ZMH from Feb 01-Mar 31, 2016.

Variables		Exp(B)	95% C.I for AOR		P-value
			Lower	Upper	
Body temperature in the PACU5 (^{0}C)	≥36°C	1			.012
	<36^{0}C	2.747	1.248	6.049	
Sex	Female	1			.003
	Male	3.273	1.495	7.165	
Age (year)	<65	1			.002
	≥65	.123	.032	.469	
Room temperature	23 ^{o}C	1.958	.395	9.702	.410
	24 ^{o}C	1.508	.538	4.224	.435
	25 ^{o}C	1.249	.540	2.890	.603
	26 ^{o}C	1			.790
ASA status	I	1			.068
	II	1.996	.950	4.192	
Type of Anesthesia	GA	.750	.335	1.677	.483
	SA	1			

Data were presented as AOR, 95% CI for AOR and P-value.

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On the result of this study, sex was significantly associated with the development of post anesthesia shivering. Male patients were found to be 3 times more likely to had shivering than female patients (AOR= 3.273, 95% CI: 1.495, 7.165). Patients with age 65 years and above were found 0.123 times less likely to develop shivering than children and adults age group (AOR= 0.123, 95% CI: 0.032, 0.469).

The third exposure variable significantly associated with the outcome variable PAS was core body temperature in PACU. Patients who were hypothermic less than 36 ^{0}C were about 2 times more likely to develop PAS compared to patients who were not hypothermic (AOR= 2.747, 95% CI: 1.248, 6.049).

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CHAPTER SIX

6.1 DISCUSSION

The overall incidence of PAS was found to be 29.1%. Even though this figure was found to be high, by considering other factors which affect the incidence of shivering, it is still in line with previous study findings of post anesthesia shivering elsewhere. Previous reported incidence of shivering following general anesthesia varied between 5 and 65% whereas after spinal anesthesia was about 33% [5, 7]. 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 [17]. 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 [4]. In contrast to these studies, the finding at ZMH was higher. This could be due to active warming was not restricted in those studies, and they did on either types of anesthesia, and/or one 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-spinal shivering which is controlled trial type has shown on the controlled group consisting of 50 pts who did not take any prophylactic, the incidence of shivering was 40% [14]. And in a review article done in Inje University School of Medicine, Seoul, Korea, which was published in 2010, has shown from 26 patients under controlled group with no prophylaxis for shivering, age between 18 and 62 years old, shivering was observed in 9 patients (34.6%) ($p = 0.038$) [13].

Grade of shivering was mild, moderate and sever according to the scale described by Crossley and Mahjan, 1994, with percentage of 4.6%, 17.7% and 6.9% respectively. It was a little bit different compared to the previous reports. In a study conducted in Seoul National University Bundang Hospital, South Korea, in 2005, on post-spinal shivering, the maximal intensity of shivering during the first 90 min after spinal anesthesia, which was graded as mild, moderate, and severe was 16%, 14%, 10%, respectively [14]. This difference could be due to the inclusion of patients who either SA or GA in the study at ZMH. Even though grading shivering is objective, there may be observational error since it needs close and careful observation to

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differentiate between part, group and gross muscular tremor like activity and this could be another reason for the difference. Despite of the difference, the incidence of moderate and severe shivering together that needs usually intervention still comparable in both reports.

The incidence of PAS in ZMH among patients who took spinal anesthesia was 19(36.5%). This finding was comparable with the report of Leicester General Hospital, UK in 2000, PAS globally affecting 33% of patients after spinal anesthesia [8]. 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% [13]. The close similarity of this finding with the study finding at ZMH may be due to the absence of local anesthetic adjuncts like opioids in both studies as that of ZMH, which has protective effect from shivering. Also the absence of prophylaxis in both studies could be another reason for close similarity.

The finding of a research done at GUH following spinal anesthesia was 28(53.8%) [22]. Relative to this the finding at the ZMH was lower. The reason for this could be the type of surgery done here was shorter since long procedures like orthopedics were not done. As the surgery becomes longer more amount of cold fluid can be administered which results in decrease in core body temperature. Another explanation could be the use of local anesthetic used there was bupivacaine alone where as at ZMH both lidocaine and bupivacaine were used, which can make a difference.

Concerning to maintenance agent for GA, almost for all patients 97.6% under GA, the maintenance agent was halothane. The rest about 2.4% was done under GA with ketamine as a maintenance agent. This was because of halothane was the only inhalational anesthetic agent available as most government hospitals in the country. Related to this the incidence of shivering among patients who operated under GA was 26.0%. This figure found to be higher compared to previous study done in another study conducted on Independent Risk Factors for Postoperative Shivering, which is observational in Philips University, Germany in 2005, and was done on 1340 consecutive adult patients, they found 11.6% incidence of post anesthesia shivering [4]. This much amount difference could be due to mixing of volatile with nitrous oxide. And also this study did not restrict active perioperative warming resulting reduced incidence. So, an inhalational anesthetic produces a dose-dependent decrease in the threshold temperature that

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triggers vasoconstriction (3°C decrease for each percent of inhaled inhalational) and the initiation of shivering will be increased [1]. Besides that study in Germany did not include pediatrics.

ASA status was also thought to have high variation on the incidence of shivering as only 25.5% (27 of 106) patients shivered in ASA class I patients compared to 34.8% 9 (24 of 69) patients who develop shivering under ASA class II patients. However figures were not statistically significant at p-value 0.05 with multivariate logistic regression model. This finding can be strengthened by a study done in Tanta University, Egypt, 2012, Prevention of shivering during regional anesthesia**;** has shown ASA status with shivering incidence was not statistically significant[29].

Many studies done before tried hard to know the associated factors of post anesthesia shivering even though it remains poorly understood to predict the occurrence of PAS exactly in the presence of several factors in which most of them are co-linear [6, 9, 11].

The incidence of PAS in male patients following anesthesia with volatile anesthetic halothane done in Cleveland, Ohio was 29.2% whereas in females 20.2% [11]. Another study done in Turkey 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 anesthesia with sevoflorane or thiopentone [2]. The reason being higher in ZMH, which was males 39.5% and female 21.2%, may be due to the inclusion of adult patients who took a different volatile anesthetic (halothane) alone as intraoperative maintenance agent and spinal anesthesia. In addition to this in ZMH there was no active warming of patients where rooms' temperature was as low as 22^{0}C and not controlled.

The second factor in this study, which was associated with PAS, was age. The incidence of PAS in geriatric patients following general and spinal anesthesia done in Gondar, Ethiopia was 28.5% compare to the age group less than 65 years old, from whom the incidence of post anesthesia shivering was 24.8% [22]. The reason for reduced incidence (9.4%) in the geriatric age group in ZMH could be due to relatively short duration surgeries like benign prosthetic hypertrophy compared to orthopedic procedures which was not done in this hospital. Also it could be due to

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narrow variety and complexity of procedures done in ZMH. The reason for reduced incidence of PAS in geriatrics can be Age- related Thermoregulatory Differences as reported by a research done in The Johns Hopkins Medical Institutions; Maryland, USA. According to their report, the mean core temperature threshold for vasoconstriction was lower in the older groups (35.5 ± 0.3^0c) than in the younger group (36.2 ± 0.2^0c) ($p=0.03$) and 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]. One can understand from this lower incidence of PAS in older age as the threshold for vasoconstriction is low equivalent to initiation for shivering.

In this study age was significantly associated with the development of PAS. Geriatric age (≥65yrs) was found 0.125 times less likely to had shivering than other age group (<65yrs). According to this older age was found to be protective for PAS. The reason for this protectiveness could be due to decreased muscle mass as the one becomes older and the thermoregulatory responses to cold and heat are of attenuated in older patients [4]. The second explanation for this could be the rate heat loss in aged patients is reduced as the vasoconstriction and vasodilation capacity decreases in older age [26]. The finding of this study was consistent with other studies [22].

The influence of core body temperature on the occurrence of PAS was studied by several authors. A study done in Hamburg, Germany in 1998, on Non-thermoregulatory shivering in patients recovering from isoflurane or desflurane anesthesia on 120 patients allowed hypothermia deliberately and the incidence of shivering was 50% in those patients who were hypothermic [9]. Similar study done in India on Post Anesthesia Shivering in 2003, shows shivering occur in about 50% of patients with a core temperature of 35.5^0C that was hypothermia[6]. As one can see the finding at ZMH, there was a difference in the occurrence of PAS among hypothermic patients, which was 35.0% (36 of103). The explanation for this difference could be in those studies patients made to be hypothermic deliberately may be without passive warming. This could result a difference in intensity of hypothermia with the finding at ZMH where passive warming was not restricted.
In contrast to those reports, one study finding strengthens the finding at ZMH. A research done at

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General Hospital of Patras, Greece, in 2003 on effects of hypothermia and shivering on standard PACU monitoring showed 38 (30.4%) hypothermic patients developed shivering at the PACU arrival ($p<0.01$) [17]. Compared to the finding at ZMH which was 35.0% (36 of 103) hypothermic patients developed shivering in the PACU ($p<0.012$), it has little difference.

The room temperature of the operation theatre was ranging from22^0C to 26^0C while this study was conducted. By using bivariate logistic regression model it was significantly associated with outcome variable at p-value 0.05. But when it was filtered to multivariate logistic regression analysis model it has no statistical significance with p-value 0.410 at lowest temperature. In contrast to the report of previous researches this finding was acceptable. A research report by International Anesthesia Research society, on effect of operating room temperature on patient's temperature at recovery room, has showed that despite significantly greater heat loss in the cold room group (0.63 ± 0.14^0C) than in the warm group (0.32 ± 0.10^0C) ($p<0.01$), there were no difference in temperature in the recovery room and shivering in the two groups. Rather than this, the presence or absence of active warming and passive supportive measures like covering with blanket had greater effect and association with the outcome variable [30], which proved the finding at ZMH where passive supportive measures were routine care for patients.

The occurrence of shivering was higher in surgeries longer than 2 hour compared to other shorter procedures. However, by logistic regression analysis model duration of surgery had no significant association with PAS at p-value 0.05. 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 differences total time in the operating room [17].

6.2 Limitation

Time: time was a constraint take large sample size.

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CHAPTER SEVEN

7.1 Conclusion

In conclusion, I found high overall incidence of shivering (29.1%), I also conclude that prophylaxis for shivering is necessary in those high risk patients. PAS can be predicted with moderate discriminating power using three risk factors derived from a logistic regression analysis. According to this finding age of the patient was the variable with the most predictive power by far. Other risk factors included male sex and low core body temperatures in the PACU pose patients at high risk for post anesthesia shivering.

Even though they are potential risk factors, atropine premedication, BMI, ASA status, type of anesthesia, duration and type of surgery had no statistically significant association with post anesthesia shivering in this study.

7.2 Recommendation

This study provides baseline information for hospitals in Addis Ababa, which could help with possible prevention and interventions regarding PAS. Meticulous passive and active warming has 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 the normal range post operatively. For pain management alternative, it may be better to use opioids like meperidine which have known protective effect for shivering as prophylaxis.

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 and Mahjan, 1994.

Grade 1 = no visible muscle activity but piloerection, peripheral vasoconstriction or both are present (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 generalized shaking.

Grade 4 = violent muscular activity that involves the hole body

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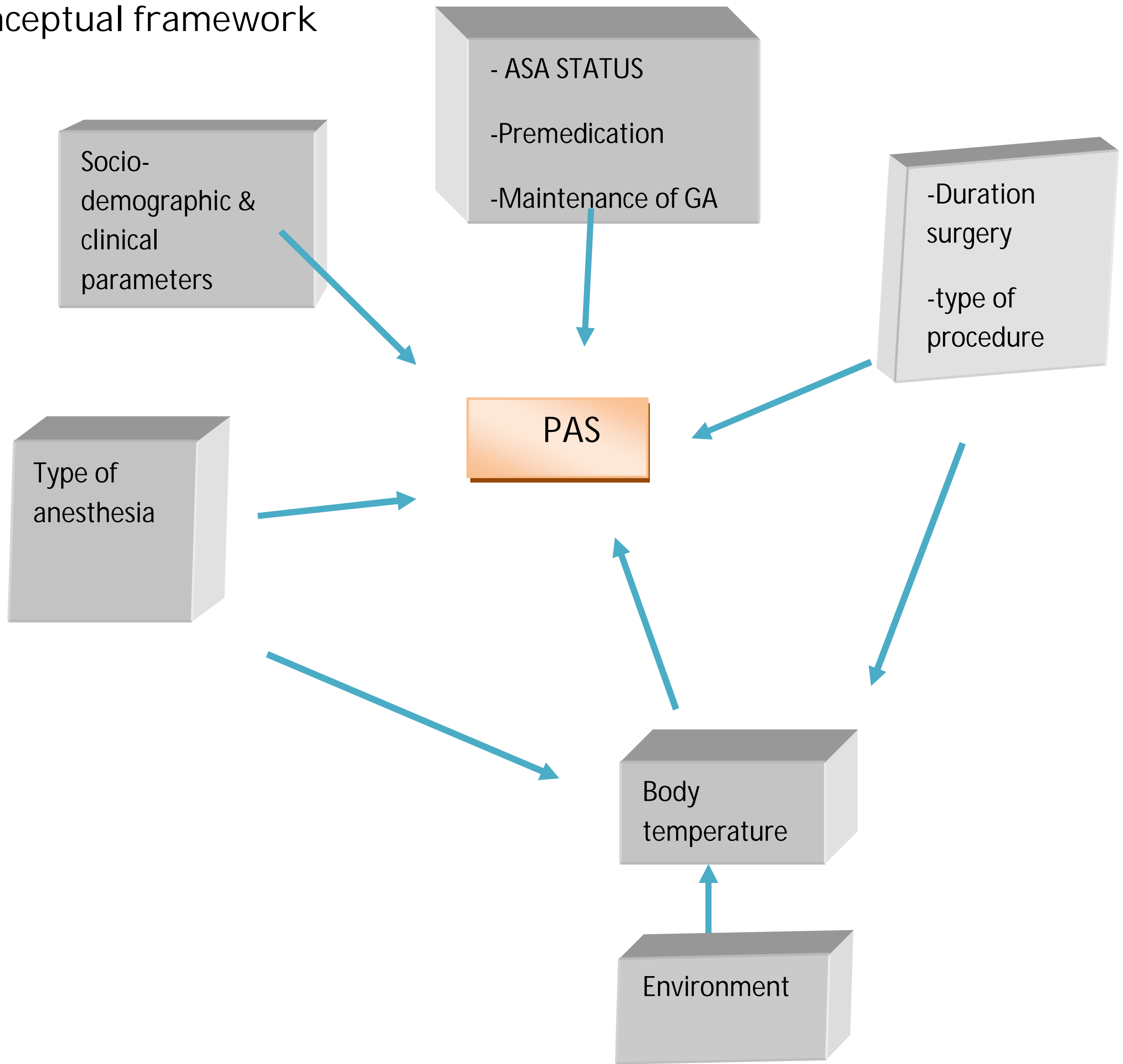
ANNEX II

Conceptual framework



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ANNEX III

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 in Zewditu Memorial Hospital, Addis Ababa, Ethiopia from Feb 01 – Mar 31, 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) _____
   b. Sex _____
   c. height (in meter) _______
   d. weight (in kilogram) _________
   e. BMI if calculated __________
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

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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. If the type of anesthesia administered is **spinal anesthesia**, how much is the body temperature of the patient 15 minute after spinal block is given in the **OR**?
   a. In the 1st 15 min_______ c. in the 3rd 15 min ______ e. in the 5th min________
   b. In the 2nd 15 min______ d. in the 4th 15 min ______ d. in the 6th min________
11. 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 ^{0}c? _______
15. Has the patient experienced shivering in the **PACU**?
   a. Yes b. No

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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) ________________

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22. Does the patient have any of the following problems?
    a. History of head injury
    b. History of epilepsy
    c. History of thyroid disorder
    d. History of neuromuscular disorder
    e. None of the above mentioned
23. Room temperature ________ ^{0}c
24. Was the patient given fluids intraoperatively?
    a. Yes   b. no
25. If the above question's answer is yes what type of fluid was given?
    a. Ringer lactate   b. normal saline   c. dextrose containing fluid
26. How much fluid was given ___________ml
27. Temperature of fluids given__________ ^{0}c

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The undersigned agrees to accept responsibility for the scientific ethical and technical Conduct of the research project and for provision of required progress reports as Per terms and conditions of the Research Publications Office in effect at the time of Grant is forwarded as the result of this application.

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