PREVALENCE AND ASSOCIATED FACTORS OF POSTOPERATIVE SHIVERING IN ELECTIVE PATIENTS RECEIVING GENERAL ANAESTHESIA AND SPINAL ANAESTHESIA AT TASH MAJOR OR

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A RESEARCH THESIS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY SCHOOL OF MEDICINE, DEPARTMENT OF ACCPM IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR SPECIALTY CERTIFICATE IN ACCPM

Prevalence and associated factors of postoperative shivering in elective patients receiving general anaesthesia and spinal anaesthesia at TASH major OR

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STATEMENT OF DECLARATION

I hereby declare and affirm that this research is my own original work as a partial fulfillment of the requirements for the specialty certificate training in Anesthesiology. I have followed all the ethical considerations in the preparation, data collection, data analysis and completion of this research. All the sources of the materials used for this research and all people and institutions who gave support for this work are fully acknowledged. I affirm that I have cited and referenced all the sources used in this document.

There is no conflict of Interest.

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1. Contents

Abbreviations

TASH-Tikur Anbesa specialized hospital

ACCPM- Anesthesiology critical care and pain medicine

OR- Operating room

POS-Post operative shivering

AAU-Addis Abeba university

PACU- post anesthesia care unit

WBC-Whole blood count

PCT-Procalicitonin

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Abstract

Background: Transition out of the operating room is a very important period in terms of the occurrence of complications. And to promote the quality and safety advancements made in the operating room and better perioperative patient outcomes preventing these complications play a key role. Among these complications post operative shivering is the common one. So different studies were done to find out The size and elements linked to this complication showing that the impact of post operative shivering on post operative recovery.

Objective: To explore the prevalence and Factors related to postoperative shivering in elective patients receiving general and spinal anesthesia

Method: Institutional based Descriptive cross-sectional survey will be used.

Result: in the study period a total of 326 patient who underwent elective surgery both under general and regional anesthesia in TASH major operating room were included and the prevalence of post operative shivering was 41.1%. And multivariate logistic analysis showed statistically significant correlation with hypothermia (AOR= 36.629, 95%CI :(17.837-75.218) in PACU and duration of surgery more than 2 hours (AOR=4.332, 95%CI (1.332-14.083).

Conclusion: due to its high prevalence of post operative shivering in this study in-cooperating both passive and active warming mechanisms as part of intraoperative management should be considered.

1. Chapter 1: Introduction

1.1 Background

One significant potential for anaesthesiologists to promote the quality and safety advancements made in the operating room and better perioperative patient outcomes is the transition out of the operating room. Although the prevalence of intraoperative complications has been dramatically reduced complication rates after surgery remain high. As a result of these findings, anaesthesiologists have a responsibility and an opportunity to understand the causes for these and other complications. Among these complications post operative shivering is common with the prevalence reaching up to 66% (1).

Emergence from even brief general anaesthesia is sometimes associated with shivering (2).

Shivering is described as an uncontrollable trembling of the body brought on by muscular contraction or oscillatory muscular activity that increases metabolic heat generation by up to 600% above basal metabolic level and is clinically linked to clonic or tonic hyperactivity of skeletal muscles at various frequency. This results in increased oxygen demand and carbon dioxide production, which causes hypoxaemia, hypercarbia, and lactic acidosis, all of which are uncomfortable and exacerbate the pain experience. Post operative Shivering can be avoided by preserving intraoperative normothermia, providing warm fluids, covering wounds with warm clothes, or using pharmacological therapies (3, 4).

1.2 Statement of the problem

Many patients experience post-anesthesia shivering (PAS), which results in more metabolic alterations than are immediately noticeable, including discomfort, increased surgical pain, and abnormalities in the electrocardiogram (ECG).After elective heart surgery, it was found in a prior comparative clinical investigation that shivering decreased mixed venous oxygen saturation but increased cardiac output, suggesting that there may be an imbalance between the body's oxygen supply and demand. Shivering also causes significant carbon dioxide generation and oxygen consumption, which results in respiratory acidosis, hemodynamic instability, and significant inotropic support(5,6).

In prior studies, prevalences of 5% to 65% after general anesthesia and 30% to 33% after epidural treatments were noted. A recent meta-analysis found that 34% of people experienced shivering overall showing the significance of this complication (7, 8)

So, this study is aimed at searching the prevalence of post operative shivering in TASH elective surgical patients the associated factors so as to provide a strategic plan to tackle this complication.

1.3 Significance of the study

Post operative shivering is associated with multiple complications which put the post-surgical patients at risk of developing discomfort, increased surgical pain, and abnormalities in ECG, decreased mixed venous oxygen saturation and increased cardiac output, suggesting that there may be an imbalance between the body's oxygen supply and demand. And all these factors add up to jeopardize patients' ability to recover from surgery on a time.

This study is aimed at finding the magnitude of post operative shivering and associated factors in elective surgical patients at TASH there by contributing for good patient outcomes and providing information on factors which cause POS so that prevention strategies can be applied.

2. Chapter 2: Literature review

2.1 Definition

Postoperative shivering (PS) is an uncontrollable, rhythmic muscle movement that occurs in the initial stages after anesthesia recovery. Shivering occurs when there is hyperactivity in the muscles or fasciculation of the face, jaw, or head that lasts longer than 15 seconds.

In the PACU, this condition is frequently seen. An prevalence of 5% to 65% following general anesthesia and 30% to 33% after epidural treatments has been observed in earlier investigations. In a recent meta-analysis, the total shivering prevalence was 34% (7, 8).

2.2 Pathophysiology aspects

Shivering after surgery is extremely uncomfortable and physically taxing. The concomitant increases in oxygen consumption (by 100–600%), cardiac output, carbon dioxide generation, and circulating catecholamines as well as a notable decline in mixed venous oxygen saturation may potentially result in problems, especially in individuals with coronary artery disease. Additionally, shivering patients have been reported to experience an increase in intracranial and intraocular pressure, difficulty with monitoring of ECG and blood pressure, an accelerated metabolic rate, and lactic acidosis (9, 10).

As a result of intraoperative hypothermia, as a side effect of volatile anesthetics during general anesthesia, or as a reasonably frequent finding during the postpartum period, postoperative shivering can happen in the immediate postoperative period. Nearly all anesthetic substances, especially inhalational agents, spinal, and epidural anesthesia, reduce sympathetic tone, hence reducing the typical response to hypothermia. Shivering that is frequently noticed during or after recovery from general anesthesia sometimes represents the body's attempt to enhance heat production and raise body core temperature, and it may be linked to strong vasoconstriction. Anesthetic drugs also lower the threshold for shivering. Whatever the cause, shivering appears to be linked to both the length of the procedure and the use of volatile agents. Sometimes, shivering might be so severe that it results in hyperthermia (2, 11).

Shivering in normothermic individuals has been attributed to a variety of processes, despite the fact that thermoregulatory systems can account for it in hypothermic patients. One theory is based on the finding that the brain and spinal cord do not recover from general anesthesia at the same time. It is believed that the quicker restoration of spinal cord function leads to unrestricted spinal reflexes that manifest as clonic activity. Doxapram, a central nervous

system stimulant, has some success in reducing postoperative shivering, which lends weight to this notion. The actions of kappa opioid, N-methyl-d-aspartate (NMDA), and 5-

hydroxytryptamine receptors are some more hypothesized processes. It is believed that the same mechanism that results in hyperalgesia in patients who receive high doses of remifentanil also causes the increased prevalence of postanaesthetic shivering in these patients(1).

A randomized controlled trial which compared the efficacy between alfentanil, pethidine and placebo for POS on 90 patients of both sexes aged between 18 and 70 years with ASA class 1or 2 and had undergone routine general orthopedic ,ENT, and gynaecologic surgery at Royal Hallamshire Hospital, Sheffield in 1997 used a grading mechanism for the severity of shivering based on a five point scale according to this grading system 0=no shivering; 1=one or more of the following: piloerection, peripheral vasoconstriction, peripheral cyanosis without other cause, but without visible muscular activity; 2=visible muscular activity confined to one muscle group; 3=visible muscular activity in more than one muscle group; and 4=gross muscular activity involving the entire body(12).

Patients say that shaking is incredibly uncomfortable, and some even say that the following cold feeling hurts more than the pain of the operation. Furthermore, the act of shaking itself may make postoperative discomfort worse by merely stretching surgical wounds. Additionally, shivering can occasionally interfere with monitoring procedures, elevate intraocular and intracranial pressures, and be particularly upsetting to women during labor and delivery. Shivering can increase oxygen use and carbon dioxide production by a factor of two or even three. These significant increases in metabolic demand could make individuals who already have intrapulmonary shunts, fixed cardiac output, or low respiratory reserves more susceptible to problems. Shivering, however, is uncommon in older individuals due to age's inherent impairment of normal thermoregulatory control. It is doubtful that shivering itself causes major negative effects in elderly and fragile patients because shivering intensity is markedly reduced in these patients(13).

On an electromyogram, the basic tremor frequency in people is usually in the range of 200 Hz. This basal frequency is regulated by a steady waxing and waning pattern that occurs at 4–8 cycles per minute. There are two distinct shivering patterns: a tonic pattern resembling typical shivering and a phasic wave pattern resembling a pathological clone. In volunteers, tonic and clonic patterns were thermoregulatory. In response to the intraoperative hypothermia, the tonic pattern revealed a persistent sinusoidal form of typical shivering that

appears to represent a thermoregulatory response. The clonic pattern, on the other hand, is not a typical aspect of thermoregulatory shivering and appears to be unique to those who are recovering from

Volatile anesthesia. This shivering pattern may be caused by the loss of inhibition that general anesthesia causes in the regulation of spinal reflexes (14).

2.3 Aetiology and prevalence

Shivering after surgery is typically, but not always, linked to hypothermia and young age, endo-prosthetic surgery, and core hypothermia are identified risk factors (1). Although there is not enough knowledge regarding the cause of shivering. A combination of thermoregulatory failure brought on by anesthesia and exposure to cold environments causes hypothermia in the majority of surgery patients who are not yet sedated. Furthermore, shivering during the perioperative period is a common symptom of hypothermia, although it can also affect normothermic people. (15).

Research done on 75 female patients with an ASA score of 1 or 2 to identify the primary causes of postoperative shivering and its thermal implications. Every ten minutes, the temperatures of the skin and the oesophagus were taken. The intraoperative energy balance as well as the average skin and body temperatures was calculated. There was no additional heat source. From 0 to 2, shivering received a rating. In contrast to mean skin temperatures, age, and opioid doses, statistical analysis revealed that the starting mean core and body temperatures were the only variables that were connected with shivering and its intensity. There was a linear connection between the oesophageal temperature after the conclusion of anesthesia and the frequency of shivering between 33.5 and 36.5 °C. Post operative shivering is commonly observed in women undergoing caesarean delivery, with a reported prevalence of 85%, (7).

A prospective, randomized, double-blind, placebo-controlled trial done in Turkey to evaluate if Dexmedetomidine infusion prevents postoperative shivering in patients undergoing gynacologic laparoscopic surgery on 60 patients undergoing elective gynaecologic laparoscopy who had ASA physical status I or II and were between the ages of 20 and 50. Postoperative shivering was observed in 17 patients (16)

A study done in the PACU of the general university of Patrace in Greece to assess the effect of hypothermia and shivering on PACU monitoring from August 1 to November 30 2003 on 170 post orthopedic surgical patients' hypothermia was recorded in 124 patients (73.5%) and shivering was occurred in 42 patients (24.7%). There was no significance

finding between patients who had shivering and those who did not have for sex, ASA classification, type of anesthesia, total time in the operating room or operating room temperature (17)

In one study which was done on 2595 patients admitted to a recovery room in Derbyshire Royal Infirmary over a 6-month period from 1 July to 31 December 1990. 693 had undergone emergency surgery out of the total. The remaining procedures were elective, and 80 of them were day cases. A total of 124 surgeries were carried out under regional anesthesia. The 2471 patients received general anesthesia. Shivering followed surgery in 164 cases (6.3%). Only 58 of 1225 females (4.7%) exhibited shivering, compared to 106 of 1370 males (7.7%). When compared to emergences (3.8%), elective patients had a greater percentage of shivering (7.2%). 2398 of the 2471 patients who had general anesthesia and were administered volatile substances. 73 patients who underwent general anesthesia without the use of volatile medications did not shiver thereafter. 1121 patients in total received no premedication; of these, 59 (5.3%) shivered thereafter. 1474 patients received premedication; of these, 105 (7.1%) shivered afterward. The anesthetic method used in 1I78 individuals involved spontaneous breathing. In comparison, 56 of 1293 patients (4.3%) who had intermittent positive pressure ventilation (IPPV) as part of their anesthesia experienced postoperative shivering, while 108 (9.1%) of those patients did. The frequency of shivering was unaffected by the use of muscle relaxant (7).

Between January 2017 and July 2019, 120 patients who underwent flexible ureteroscopy holmium laser lithotripsy at the Urology Department of Suining Central Hospital in Sichuan, China, were enrolled in a randomized controlled experiment. There were 108 patients who had flexible ureteroscopic holmium laser lithotripsy and analysis (17 °C group: 36; 27 °C group: 35; 37 °C group: 37). Age, gender ratio, BMI, ASA grade, stone burden, preoperative creatinine, preoperative core temperature, and irrigation fluid volume did not substantially differ between groups.The occurrences of postoperative fever (38.9% vs. 17.1% vs. 13.5%) and shivering (22.2% vs. 5.7% vs. 2.7%) were significantly different between the 17 °C, 27 °C, and 37 °C groups (p 0.05 for all pairwise comparisons). In comparison to the 17 °C group, there was no discernible difference in WBC, PCT, or the frequency of suspected infections in the 37 °C or 27 °C groups. In the 37 °C group, there was one instance of both flash pulmonary edema and hemorrhage(18)

A prospective study which evaluated the effect of propofol on POS at Alexandra hospital, Singapore in 1994 on 60 ASA 1 adult patients in the age range of 18-55 and who did not receive any premedication after they scheduled for elective surgeries for knee arthroplasty, hemiorrhaphy, removal of simple orthopedic implant and excision of breast lump showed that 21 of 60 patients develop POS the anaesthetic technique they received was

General anaesthesia consisting of either propofol-nitrous oxide in oxygen or a conventional technique of thiopentone-isoflurane-nitrous oxide-oxygen (19).

By evaluating the anesthetic records of normothermic patients at a post-anesthesia care unit who received general anesthesia, a retrospective case control study was carried out between January 2017 and August 2018. The surgical location and age (±5 years) of 201 cases and 201 control patients were matched at random. The following information was taken from medical records: patient demographics, length of operation, kind of anesthesia, type of fluid, core temperature at the conclusion of surgery, and incidence of shivering afterward. The association between putative risk variables and postoperative shivering was examined using conditional logistic regression analysis. Higher body mass index (BMI) [odds ratio (OR) 0.91, 95% confidence interval (CI) 0.87-0.96] and higher core temperature at end of surgery (OR 0.33 95% CI 0.18-0.63) are associated with reduced risk of postoperative shivering. Whereas emergency case compared with elective case (OR 3.06 95% CI 1.63-5.72) and longer duration every 10 minutes (OR 1.05 95% CI 1.03-1.08) are associated with an increased risk of postoperative shivering. (24)

A cross sectional study which was done to assess the magnitude and associated factors of intraoperative shivering after cesarean section delivery under Spinal anesthesia by staffs of department of anesthesia at the university of Gondar on a total of 365 patients showed that the prevalence was 51.8% (95% CI: 46.3, 57.1).with the main associated factors being body temperature, mean arterial pressure of the patient, and duration of surgery and the majority of the patients develop POS after 20 minutes of spinal anesthesia(20).

Another study which was done at zewditu hospital in 2016 with title of ‘’Assessment on Magnitude and Associated Factors of Post Anesthesia Shivering’’ on 179 patients after tympanic temperature was recorded every 15 minute the prevalence was 29.5% and 60.8% had grade 3 shivering and 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 360C (AOR= 2.747, 95% CI: 1.248, 6.049; p=0.012) were considered associated factors of POS(21).a study which was done at TASH with the same title with the done at zewiditu hospital showed an prevalence reaching 46.9%and 52.2% patients had grade 3 shivering. And

being female (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 POS. and it was done on non-obstetric patients(22).

3. Chapter 3: Objective

3.1 General objective

To assess the presence of postoperative shivering and associated factors

3.2 Specific objective

To determine the prevalence of post operative shivering in elective post operative patients

To determine the factors associated with post operative shivering.

4. Chapter 4:Method

4.1 Study design

Prospective Cross-sectional study

4.2 Study area and period

The study will be conducted at Addis Ababa university school of health science major operating room. It will be conducted from July to November 2023. TASH is located in Addis Ababa the capital city of Ethiopia. TASH is the largest referral hospital in Ethiopia with 700 beds. It has 13 operating rooms for elective surgeries and 4 operating rooms for emergency surgeries. It is also the main teaching hospital under Addis Ababa University for both undergraduate and postgraduate programs of many disciplines including subspecialties

4.3 Population

4.3.1 Source population

All patient whom undergo elective surgery in TASH

4.3.2 Study population

All patient whom undergo elective surgery during the study period and fulfil the inclusion criteria

4.4 Inclusion and exclusion criteria

4.4.1 Inclusion criteria

All patients scheduled for elective surgery under general and spinal anesthesia and give consent

4.4.2 Exclusion criteria

Patients who don't give consent

Emergency surgery

Sample size

The sample size (n) for this study is calculated by using single proportion population formula

n= (Z a/2)2×p×q / d2= (1.96)2×.461(1-.461)/(.05)2 = 380

Where: n= sample size. *d* = is the margin of sampling error tolerated (5%)

Z= desired 95% confidence,

Z=1.96.

p = proportion POS from previous studies (0.461)(1)

q =1-p = *1-0.461=0.539*

Since the sample size is <10,000 which is 315 the correction formula will be used to get the final sample size taking the annual number of elective cases done at BLH 2050(23)

nf=ni/(1+ni/N) Where nf – final sample size

ni– initial sample size

N – Sampled population

$$nf = \frac{380}{1 + 380/2050} = 315$$

Adding 10% non respondent final sample size becomes 347.

4.4.3. Sampling procedure

Convenience sampling method were used to select study participants by taking every consecutive patients undergoing elective surgery who fulfil the inclusion criteria

4.5 Study variables

4.5.1 Dependent variables

Post operative shivering

4.5.2 Independent variables

-Age

- Sex

- ASA physical status

- Duration of surgery

- Type of anaesthesia

- Body temperature

4.6 Operation definition

Post operative shivering: is an uncontrollable, rhythmic muscle movement that occurs in the initial stages after anaesthesia recovery

Grading of POS: 0=no shivering;

1=one or more of the following: piloerection, peripheral vasoconstriction, peripheral cyanosis without other cause, but without visible muscular activity;

2=visible muscular activity confined to one muscle group;

3=visible muscular activity in more than one muscle group;

4=gross muscular activity involving the entire body

Hypothermia: axillary temperature of less than 36.

4.7 Data collection procedure

We used an organized survey constructed in English. The right information was gathered through a combination of observation and chart analysis. After giving verbal consent to participate in the study and written consent to undergo surgery, patients' charts was reviewed to obtain demographic information and body mass index before anaesthesia was provided. Following surgery, the length of the surgery, the type of anaesthesia, type of surgery and the maintenance medication were all reviewed in the patient's chart.

4.8 Data analysis procedure

After completion of data collection, the data was checked for errors and coded. The coded data was entered to SPSS version 27.0 statistical package and analysis was performed. Cross tabulations and frequencies were utilized to characterize the research population in respect to pertinent factors and to look for missing values of variables.

To characterize the percentages and number of distributions of the respondents by socio-demographic traits and other pertinent study factors, descriptive analysis was employed. The logistic regressions were fitted as both bivariate and multivariate. In order to account for potential co-founders and find important characteristics connected to the outcome variable, independent variables with a p-value of less than 0.25 in the bivariate analysis were added to

the final multivariate logistic regression model. Ultimately, the strength of the link was evaluated by estimating the adjusted odds ratio (AOR) and 95% confidence interval, and a P value <0.05 was deemed significant. Bivariate and multivariate analysis were used to identify associated factors of POS and the strength of correlation was measured by 95% confidence.

4.9 Data quality assurance

The data collectors will receive training prior to data collection, and there will be daily meetings to address any ambiguities that may arise

4.10 Ethical consideration

Before the start of data collection ethical clearance was obtained from the institutional ethical review board of college of medicine and health sciences, the data collector explained the goals and expected advantages of the research project to each study participant during the data gathering procedure. They were ensured that their treatment and other hospital benefits won't be affected by their involvement in the research, and they were told of their full right to refuse, withdraw, or entirely reject part or all of their participation in it. Finally, patients were prompted to provide both verbal and written informed consent. confidentiality will be guaranteed by keeping the secrecy of personal identification, keeping completed questionnaires and results in secured area.

5. Chapter 5: RESULT

5.1 Socio-demographic characteristics

During a three month period of data collection 345 patients, who were operated at TASH main operating room, included in the study. Among this 19(5.5%) data was excluded due to incomplete registration. So the study undertook on 326 patients. Demographic distribution showed 271(83.1%) of the participants was between the age of 18 to 59 and the rest 55(16.9%) were above the age of 59. And Gender wise female participants accounted for 172 (52.8%) and male participants accounted for 154(47.2%). The weigh distribution the participants showed that 19 (5.8%) of the patients had a BMI of <18.5kg/m2, around 267 patients had a BMI of 18.5-24.9kg/m2, a total of 39(12%) patients had a BMI of 25-29. 9kg/m2 and only 1 patient had a BMI of 1(3%) >30kg/m2.

Table 1 socio-demographic parameters of patients who underwent elective surgery from the month of December to February 2024

Variable	frequency	Percent
Sex		
Female	172	52.8
Male	154	47.2
Age		
18-59	271	83.1
>59	55	16.9
BMI		
<18.5kg/m2	19	5.8
18.5-24.9kg/m2	267	81.9
25-29. 9kg/m2	39	12
>30kg/m2	1	3

5.2 Clinical parameter

The prevalence of POS in this study is 40.4%. From the study group of 326 patients 191(58.6%) patients took GA, 131(40.2%) patients took Regional and 4(1.2%) patients took combined and Reginal GA. Among the patients who received GA 162(84.8%) patients received isoflurane as the maintenance of anesthesia, 17(8.9%) patients received halothane and 16(8.3%) patients received combined propofol and isoflurane. All those patients who

underwent the surgery under regional anesthesia received bupivacaine. Based on the definition devised by Crossley and Mahjan the Grade of shivering in this study was 28(8.6%) for grade 2, 88(27%) for grade 3 and 16(4.9%) for grade 4.

Table 2 Clinical parameter

Variable	Frequency	Percent
ASA Status		
ASA 1	177	54.3
ASA 2	142	43.6
ASA 3	6	1.8
Type of anaesthesia		
GA	191	58.6
Regional	131	40.2
GA +Regional	4	1.2
Duration of surgery		
<1 hour	43	13.2
1-2 hours	117	35.9
>2 hours	166	50.9
Post op Hypothermia		
Yes	153	46.9
No	173	53.1
Post operative shivering		
Yes	135	41.4
No	191	58.6

Graph 1 prevalence of post operative shivering

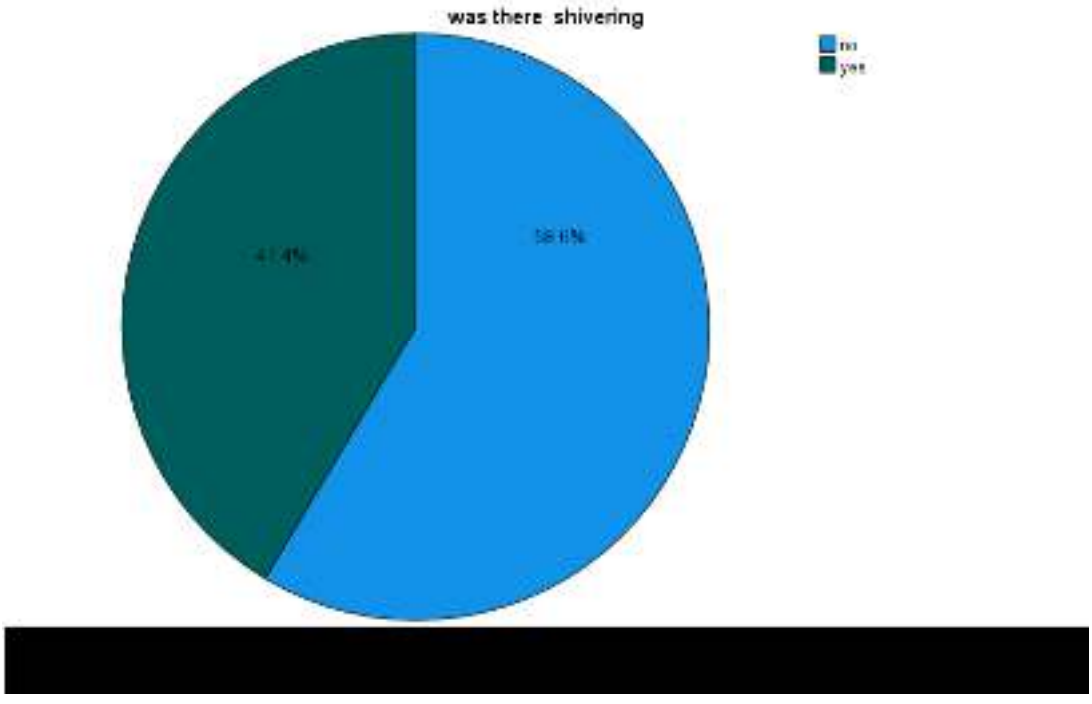

Table 3 Types of surgery done

Variable	Frequency	Percent
Abdominal	80	24.5
Cardiovascular	28	8.6
Gynaecology	27	8.3
Head and neck	34	10.4
Neurology	19	5.8
Obstetrics	38	11.7
Orthopaedics	43	13.2
Urology	57	17.5

5.3 Factors associated with post anaesthesia shivering.

In this study age, Sex, type of procedure, duration of surgery and hypothermia in the PACU were the selected variables for the multivariate binary logistic regression analysis, with P-value less than 0.25 in bi-variate binary logistic regression. In multivariate analysis two variables duration of anesthesia and hypothermia in the PACU were statistically significantly associated with post operative shivering..

Table 4 Factors associated with post operative shivering

Variables		Shivering		COR	P-Value	AOR	P-Value	95%CI	
		Yes	No					lower	Upper
Age	18-59	108(33.12%)	163(50%)	1		1			
	>59	27(8.28%)	28(8.5%)	1.455	0.206	1.021	0.966	0.403	2.584
Sex	Female	63(19.32%)	109(33.43%)	1		1			
	Male	72(22.1%)	82(25.15%)	0.578	0.064	1.423	0.359	0.670	3.026
Duration of surgery	<1hr	14(4.29%)	56(17.17%)	1		1			
	1 to 2hrs	26(7.97%)	63(19.32%)	0.606	0.186	2.861	0.141	0.706	11.593
	>2hrs	95(29.14%)	72(22.08%)	3.197	<0.01	4.342	0.015	1.328	14.198
temperature	<36	120(36.81%)	33(10.12%)	38.303	<0.01	36.945	<0.001	17.888	76.302
	>36	15(4.6%)	158(48.46%)	1		1			
Type of procedure	Abdominal	36(11.04%)	44(13.49%)	1		1			
	Cardiovascular	9(2.76%)	19(5.82%)	0.579	0.238	0.307	0.064	0.088	1.073
	Gynaecologic	9%(2.76%)	18(5.52%)	0.611	0.291	0.628	0.499	0.164	2.415
	Head and neck	10(3.06%)	24(7.36%)	0.509	0.124	0.417	0.168	0.120	1.447
	Neurology	7(2.14%)	12(3.68%)	0.713	0.520	0.300	0.079	0.078	1.148
	Obstetrics	27(8.28%)	11(3.37%)	0.498	0.099	1.763	0.482	0.363	8.567
	Orthopaedics	25(7.67%)	18(5.52%)	1.698	0.166	1.640	0.445	0.460	5.845
	Urology	28(8.58%)	29(8.89%)	1.180	0.634	2.900	0.124	0.747	11.261

Those who had a sugary duration of more than 2 hours had the likelihood of developing post operative hypothermia 4 times than of those who had surgery duration of less than 1 hour and 2 times than those who had surgery duration of 1 to 2 hours. The likelihood of developing postoperative shivering for those who had hypothermia in the PACU was 36 times more than those who didn't have.

ASA classification, BMI and type of anesthesia were found to have no statistically significant correlation on bivariate regression.

Variable		Shivering		COR	P-value
		Yes	No		
ASA	ASA 1	57(17.48%)	92(28.22%)	1	
	ASA 2 and ASA 3	78(23.92%)	99(30.36%)	0.786	0.289
Type of anesthesia	GA	78(23.92%)	113(34.66%)	1	
	RA and GA+RA	57(17.48%)	78(23.92%)	1.059	0.803
BMI	<18.5kg/m2	7(2.14%)	12(3.6%)	1	
	18.5-24.9kg/m2	112(34.35%)	155(47.54%)	1.239	0.663
	24.9kg/m2-29.9kg/m2 and >29.9kg/m2	16(4.90%)	24(7.36%)	1.143	0.816

6. Chapter 6: Discussion

The prevalence of post operative shivering in this study found to be 41.1% which is higher than a prospective, randomized, double-blind, placebo-controlled trial done in Turkey 28.8%. The difference may be due to one the sample size in their study was lower and it also done on single group of population.(16) Another study done in the PACU of the general university of Patrace in Greece to assess the Effect of hypothermia and shivering on PACU monitoring from August 1 to November 30 2003 on 170 post orthopedic surgical patients' and shivering was occurred in 42 patients (24.7%).(17). Another cross sectional study which was done to assess the magnitude and associated factors of intraoperative shivering after cesarean section delivery under Spinal anesthesia by staffs of department of anesthesia at the university of Gondar on a total of 365 patients showed that the prevalence was 51.8% the fact that the used a single population study and the participant received single form of anesthesia may have resulted in the discrepancy. (20) A cross sectional Study done at TASH to Assess the Magnitude and Associated Factors of Post Anesthesia Shivering on 143 elective cases the overall prevalence of post anesthesia shivering was 46.9%. Even though their study has similar study population, having small sample size on their study may be accounted for the difference.

This study also tried to assess factors which are associated with post operative shivering. Having hypotherma at the PACU found to have statistically significant correlation with postoperative shivering in this particular study. This is also evidenced by a study done at the Urology Department of Suining Central Hospital in Sichuan, China, a randomized controlled experiment which assessed the associated factors of post operative shivering I 108 patients who had flexible ureteroscopic holmium laser lithotripsy and the study showed that there was a significant correlation between hypothermia in the PACU and occurrence of post operative shivering (18). Another study done in the PACU of the general university of Patrace in Greece effect of hypothermia and shivering on PACU monitoring from August 1 to November 30 2003 on 170 post orthopedic surgical patients showed the occurrence post operative shivering is statistically associated with the occurrence of hypothermia the post anaesthesia care unit (17). A cross sectional study which was done to assess the magnitude and associated factors of intraoperative shivering after cesarean section delivery under Spinal anesthesia by staffs of department of anesthesia at the university of Gondar on a total of 365 patients showed their main associated factor was low temperature at the PACU(20). A study which was done at zewditu hospital in 2016 with title of ''Assessment on Magnitude and Associated Factors of Post Anesthesia Shivering'' on 179 patients and a study done at TASH

With the same title both studies showed there was a statistically significant correlation with hypothermia in the PACU and occurrence of post operative shivering(20,22).

The other variable that has significant correlation on this study was duration of anesthesia. Our finding the suggested that the longer the duration the more likely the probability of developing post operative hypothermia this is evidenced by a study done on 2595 patients admitted to a recovery room in Derbyshire Royal Infirmary over a 6-month period from 1 July to 31 December 1990 to asses the effect of different variables including male gender, anaesthetic techniques involving spontaneous ventilation. and anticholinergic premedication. On therir study theye were able to show that there was a significant correlation with hypothermia in the PACU and occurrence of postoperative shivering (7). Cross sectional study done in gonder university to assess the magnitude and associated factors of intraoperative shivering after cesarean section delivery under Spinal anesthesia didn't show significant correlation may be because all of their sample size underwent surgery which is less than 1 hour (20). The cross sectional studies in Zewditu memorial hospital and TASH also didn't show any correlation and this could be due to both studies small sample size compared ours (22).

Body mass index in this study found to have no statistical significant correlation with the occurrence of post operative shivering on bivariate regression but on descriptive statistics more patients in the group of 18.5 – 24.5kg/m2 developed post operative shivering ,unlike retrospective case control study which was conducted between January 2017 and August 2018 by evaluating the anesthetic records of normothermic patients the PACU of Songklanagarind Hospital located in Southern Thailand who underwent general anesthesia. According to this study Higher BMI (OR) 0.91 95% CI(0.87-0.96) has a protective effect for of post anesthesia shivering.(24)

7. Strength and limitation of the study

7.1 Strength of the study

- We used a relatively larger sample size compared to previous studies
- We included patients from eight surgical tables compared to the previous studies which included less than ours
- We tried to assess the correlation of BMI with postoperative shivering unlike the previously done studies

7.2 Limitation of the study:

- The fact that we used axillary temperature measurement
- Not including paediatrics patients
- Only including elective patients
- The study was conducted in a single hospital which makes the generalizability of this study finding specific to TASH

8. Conclusion and recommendations

We have found that the prevalence of post operatives shivering is higher which is 41.1% and statistically significantly associated with factors like hypothermia in the PACU and duration of anethesia. Therefore in-cooperating both passive and active warming mechanism as a means of prevention of hypothermia, for the prevention of post operative shivering should be considered as part of our intraoperative management.

9. Reference

1. Gropper MA, Miller RD. Miller's anesthesia. 2824 p.
2. Butterworth J, Mackey D, Wasnick J. Morgan and Mikhail's Clinical Anesthesiology, 7th Edition.
3. Luggya TS, Kabuye RN, Mijumbi C, Tindimwebwa JB, Kintu A. Prevalence, associated factors and treatment of post spinal shivering in a Sub-Saharan tertiary hospital: A prospective observational study. BMC Anesthesiol. 2016 Oct 18;16(1).
4. Amsalu H, Zemedkun A, Regasa T, Adamu Y. Evidence-Based Guideline on Prevention and Management of Shivering After Spinal Anesthesia in Resource-Limited Settings: Review Article. Vol. 15, International Journal of General Medicine. Dove Medical Press Ltd; 2022. p. 6985–98.
5. Ralley FE, Wynands JE, Ramsay JG, Mo C, Mo M. The effects of shivering on oxygen consumption and carbon dioxide production in patients rewarming from hypothermic cardio-pulmonary bypass.
6. Jo YY, Kim YB, Lee D, Chang YJ, Kwak HJ. Implications of palonosetron in elderly patients undergoing laparoscopic cholecystectomy with respect to its anti-shivering effect. Aging Clin Exp Res. 2016 Feb 1;28(1):83–8.
7. Crossley Summary AWA. Six months of shivering in a district general hospital. Vol. 47, Anaesthesia. 1992.
8. Buggy DJ, Crossley AWA. Thermoregulation, mild perioperative hypothermia and post-anaesthetic shivering. Vol. 84, British Journal of Anaesthesia. Oxford University Press; 2000. p. 615–28.
9. Dal D, Kose A, Honca M, Akinci SB, Basgul E, Aypar U. Efficacy of prophylactic ketamine in preventing postoperative shivering. Br J Anaesth. 2005;95(2 PAPER):189–92.
10. Singh Bajwa SJ, Gupta S, Kaur J, Singh A, Parmar SS. Reduction in the prevalence of shivering with perioperative dexmedetomidine: A randomized prospective study. J Anaesthesiol Clin Pharmacol. 2012 Jan;28(1):86–91.
11. Xu R, Hu X, Sun Z, Zhu X, Tang Y. Prevalence of postoperative hypothermia and shivering and risk factors in patients undergoing malignant tumor surgery: a retrospective study. BMC Anesthesiol. 2023 Dec 1;23(1).
12. Wrench IJ, Cavill G, Ward JEH, Crossley AWA. Comparison between alfentanil, pethidine and placebo in the treatment of post-anaesthetic shivering. Br J Anaesth. 1997;79(4):541–2.
13. De Witte J, Sessler DI. Perioperative Shivering Physiology and Pharmacology [Internet]. Vol. 96, Anesthesiology. 2002. Available from: http://pubs.asahq.org/anesthesiology/article-pdf/96/2/467/334558/0000542-200202000-00036.pdf
14. Lopez MB. Postanaesthetic shivering - from pathophysiology to prevention. Rom J Anaesth Intensive Care. 2018 Apr 1;25(1):73–81.
15. Eberhart LHJ, Döderlein F, Eisenhardt G, Kranke P, Sessler DI, Torossian A, et al. Independent risk factors for postoperative shivering. AnesthAnalg. 2005;101(6):1849–57.

16. Karaman S, Günüşen I, Ceylan MA, Karaman Y, Çetin EN, Derbent A, et al. Dexmedetomidine infusion prevents postoperative shivering in patients undergoing gynecologic laparoscopic surgery. Turk J Med Sci. 2013;43(2):232–7.

17. Complications of hypothermia [Internet]. Available from: www.aana.com/members/journal/

18. Yeh BY, Hsu YC, Huang JY, Shih IT, Zhuo WJ, Tsai YF, et al. Effect of electroacupuncture in postanesthetic shivering during regional anesthesia: A randomized controlled trial. BMC Complement Altern Med. 2012 Nov 27;12.

19. Cheong KF, Low TC. Propofol and postanaesthetic shivering. Vol. 50, Anaesthesia. 1995. p. 550–2.

20. Ferede YA, Aytolign HA, Mersha AT. "The magnitude and associated factors of intraoperative shivering after cesarean section delivery under Spinal anesthesia'': A cross sectional study. Annals of Medicine and Surgery. 2021 Dec 1;72.

21. Ababa A. Assessment on Magnitude and Associated Factors of Post Anesthesia Shivering at Zewditu Memorial Hospital from By: ZEMENU MULUKEN (MSc student in Anesthesia) A RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR MASTER OF ANESTHESIA IN SCHOOL OF MEDICIN, COLLEGE.

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

23. Wondimu S, Bekele S, Giorgis DG, Getachew F, Seyoum N. Pattern of surgical admissions to TikurAnbessa Specialized Hospital, Addis Ababa, Ethiopia: A five-year retrospective study. East Cent Afr J Surg. 2018 Sep 28;23(2):66–70.

24. Rattanapittayaporn, L., & Oofuvong, M. (2022). Risk factors of postoperative shivering at post anesthesia care unit in normothermic patients underwent general anesthesia. *Journal of Health Science and Medical Research*, *40*(1), 45–51. https://doi.org/10.31584/jhsmr.2021816

10. List of annex

10.1 Annex 1

Annex 1: subject information sheet

Addis Ababa University

School of medicine

Subject information sheet

Hello, my name is ----------,I'm here on Dr. Natnael Kinfe's behalf. He is a medical student at Addis Ababa University. He is doing researchon “Prevalence and associated factors of postoperative shivering in elective patient receiving general anaesthesia and spinal anaesthesia at Addis Ababa University, college of health sciences, 2023, Addis Ababa, Ethiopia”. He has been given approval to carry out the investigation by representatives of the TASH and the AAU School of Medicine. Because you are undergoing surgery at TASH right now, you have been chosen to take part in this study. Only your desire to take part will determine whether you take part in this study. You are free to decide not to participate in this study.If you don't want to, you have the option to quit at any moment or withdraw without providing a reason, and you won't be treated unfairly. Participating in this study won't directly benefit you, but the data it collects will help academics, programmers, and policy makers focus their attention on relevant concerns in the future and develop tailored treatment alternatives.By utilizing just code numbers and locking the data, we'll keep the information you submit private. Access to the non-coded data will be restricted to study team members only, and it will not be utilized for anything else. Your openness and engagement are crucial to the success of this study. This is the address to contact if you require any further details or an explanation of the study.

E-mail: kknatikk@gmail.com

Phone number:+251907254130

10.2 Annex 2

Consent Form

TITLE OF STUDY: Prevalence and associated factors of post operative shivering in elective patients at TASH major OR

PRIMARY RESEARCHER

Name - Dr Natnael kinfe 2nd year ACCPM resident

Primary Advisor: Dr semira

Department: ACCPM

Address: Addis Ababa

Phone: +251907254130

E-mail: kknatikk@gmail.com

PURPOSE OF STUDY

to understand the severity of post-operative shivering and the factors that contribute to it at TASH

PROCEDURES

Cross sectional study, post operative patients will be asked to participate in this research

RISKS

Your participation in this study is not expected to put you at risk

BENEFITS

You will be contributing to the development of anesthesia in Ethiopia

CONFIDENTIALITY

Please do not write any identifying information. Every effort will be made by the researcher to preserve your confidentiality including the following by assigning code names/numbers for participants that will be used on all research notes and documents

CONTACT INFORMATION

You may reach the researcher using the details above at any time if you have any concerns regarding this study.

VOLUNTARY PARTICIPATION

It is entirely up to you whether or not you take part in this study. You will be required to sign a permission form if you choose to participate in this study. You have the right to revoke your consent at any time after signing the consent form..

CONSENT

I got the chance to read, comprehend, and ask questions about the material offered. I agree to participate in the study examining "prevalence and associated factors of post operative shivering at major OR of Addis Ababa university college of health science, Ethiopia"

Participant's Signature _____ Date _____

Researcher's Signature _____ Date _____

10.3 Annex 3

Questionnaire

AAU College of Health science, school of medicine/department of ACCPM; format for assessment of the prevalence and associated factors of post operative shivering in TASH, Addis Ababa, Ethiopia from.

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 _____0c

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 GA

(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 0c in the **PACU:**

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

50

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

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