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Post-operative Hypothermia in Surgical Patients at University of Gondar Hospital, Ethiopia

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Abstract

Background: Hypothermia (i.e., temperature <36°C) is a common incident in the immediate postoperative period. However, it is usually diagnosed and treated infrequently. Maintaining normal body temperature will reduce hospital stay, surgical site infection, postoperative blood transfusions, pressure ulcers, subjective discomfort and mortality. The aim of this study was to identify magnitude and factors associated with postoperative hypothermia.

Methods: Hospital based cross sectional study was conducted at University of Gondar Hospital. All consecutive postoperative (N= 384) patients that underwent scheduled or emergency surgery were included. Tympanic membrane temperature was measured before surgery and on arrival at recovery room via clinical nurses. Analysis was done using version 20 SPSS and binary logistic regression was utilized to identify associated factors.

Result: The incidence of postoperative hypothermia at Recovery Room was 30.72%. Of these, 30 (27.96%) and 43 (34.44%) were mild and moderate respectively, with no severe hypothermia. Surgical patient operated under general anesthesia was more likely to develop postoperative hypothermia than spinal anesthesia (AOR, 1.84; 95% CI, 1.17; 3.24). Additionally, those with higher ASA physical status were at higher risk of postoperative hypothermia (AOR, 1.99; 95% CI, 1.16; 3.44). Temperature was not routinely taken by health care providers in the preoperative and intraoperative period.

Conclusion and recommendation: Incidence of postoperative hypothermia at Recovery Room was high. Patient with high ASA physical status and operated under general anesthesia were significant factors for the development of postoperative hypothermia. Anesthesia providers along with perioperative surgical team should participate to reduce the occurrence of postoperative hypothermia with early prediction and diagnosis, especially in high risk groups.

Keywords: Postoperative hypothermia; Recovery room; Surgical patients

Introduction

Hypothermia is defined as a body temperature of <36°C (96.8F) and may be classified as mild (35.0°C-35.9°C), moderate (34.0°C-34.9°C) and severe (≤ 33.9°C) [1-3]. Despite, overlooked as an inevitable consequence, it is usually a typical incident of surgical patients [4,5]. It is a frequent occurrence that affects more than 70% of patients undergoing surgery and anesthesia. Moreover, it is the most cause of recovery room admission in the immediate postoperative period [6]. A body temperature change of 1-3°C leads multiple physiological derangements [7,8], such as, change in protein metabolism [9] that compromise healing and platelet dysfunction [10] which leads to bleeding and postoperative transfusions [11], arrhythmia [12], prolonged hospital stay [13], surgical site infection and pressure ulcers [14,15]. It also lowers patient satisfaction with the services [16,17] and causes subjective discomfort due to cold and shivering [18].

In the postoperative period, patients might be hypothermic due to different reasons. This may cause prolonged hospital stay, surgical site infection, postoperative blood transfusions, pressure ulcers, subjective discomfort and mortality [13-16]. The occurrence of postoperative hypothermia is associated with older age [16], female, emergency surgery [19], higher American Society of Anesthesiology physical status, major surgical procedure, amount of intravenous or blood replaced, longer duration of anesthesia or surgery, operating room temperature [20,21], preoperative body temperature and anesthetic technique [22].

Temperature monitoring provides an early detection of postoperative hypothermia. As Dubois described, there are two (core and periphery) thermal compartments for temperatures of the human body [23]. The pulmonary artery, nasopharyngeal, esophageal and tympanic temperatures measurements are the best temperature monitoring sites [24], but temperature from bladder, axilla, skin and rectal are slowest to change and underestimate the magnitude of alteration in body temperature [25,26]. Although ear thermometer is easy and fast, its accuracy has always been controversial. It has been noticed that an ear thermometer reading varies from 1 to 2°C below and above the temperature than rectal and oral thermometers [27]. Conversely, tympanic temperature measurements seem to be the best alternative to rectal and infrared skin measurements with appropriate use. The reading can be affected by place of insertion, size of ears (intended for people older than 1 year of age), fluid and exudate [28]. The device was designed for patients suffering from accidental hypothermia [29].

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In our hospital, surgical patients are transferred to recovery room almost naked with a simple cover of surgical drapes and gowns postoperatively. This will expose the patient to the cold environment that causes heat loss and adverse effects. Anesthesia providers along with postoperative surgical team remain diligent in implementing a variety of interventions to minimize postoperative hypothermia. In an effort to decrease the occurrence of postoperative hypothermia, it would be helpful to identify and correct significant associated factors. Therefore, the aim this study was to assess magnitude and associated factors of postoperative hypothermia at Recovery Room of University of Gondar Hospital, Northwest Ethiopia.

Methods

Hospital based cross sectional study was conducted from January to March 2014 at University of Gondar Hospital. According to review of surgical registry book, 14082 patients were operated in 2012/13. Postoperatively, patients are admitted in the Recovery Room until their vital signs are stabilized before transferred to wards.

All consecutive patient that underwent scheduled or emergency non-cardiac surgery were included while patient with fever, sepsis and procedure performed under local anaesthesia were excluded from the study. A single population proportion formula was used to estimate the sample size with the following assumptions: P as 50%, considering 95% confidence interval and 5% margin of error (d=0.05). The total sample size then, was 384 patients.

Individual tympanic membrane temperature was measured before surgery and on arrival at RR. It was measured using reusable infrared thermometer (Thermos Scan^{R} Type 6014 Pro 3000 WelchAllyn with an accuracy of ±0.03°C in the range of 20°C-42.2°C). This thermometer is considered ideal because the tympanic membrane and hypothalamus share an arterial blood supply originating from the carotid artery; therefore, the tympanic membrane is considered to directly reflect core temperature [30]. All patients were examined to exclude ear infection and occluding ear wax was cleared. The probe of the thermometer was inserted into the external auditory meatus (either the left or right ear) by pulling the pinna backward, and directing the probe towards the eye. The instrument was calibrated in accordance with the manufacturer's manual of instruction before each reading. The ambient OR temperature was also measured using the thermocouple room thermometer. Postoperatively patients were classified as hypothermic (<36°C) or normothermic (≥ 36°C) [1,31]. All other data were collected from patient medical record.

All responses to the questionnaires were coded, entered and analyzed using SPSS Version 20. Bivariate logistic regression was employed to determine associated factors between variables. P-value and 95% confidence interval was used to check statistical significance. The distribution normality of each variable was analyzed in the Kolmogorov-Smirnov test.

Ethical clearance was taken from Gondar College of Medicine and Health Sciences Research Ethical Review committee. Official permission was also obtained from University of Gondar Hospital. Preoperatively, participants were told individually about the purpose of the study and verbal informed consent was taken. The right of participants to withdraw from the study at any time, without any pre-condition was kept, and disclosed to respondents. Confidentiality of the information was assured. All hypothermic patients were managed with external rewarming measures that include more synthetic blanket covers and electrical heater.

Results

Sociodemographic characteristics of postoperative hypothermia

A total of 384 patients with age range from 1 to 83 years (median, 28.0) were included in the study. Among these, 52.1% were females and 68.5% operated with general anesthesia. The median Operation Room ambient temperature was 20.0°C with a range of 8.8°C. Duration of surgery was ranged from 30-210 minutes (median, 85 minutes); (Table 1).

Magnitude of postoperative hypothermia

The incidence of postoperative hypothermia immediately at recovery room was 30.72%. Of these, 30 (27.96%) and 43 (34.44%) were mild and moderate respectively with no severe hypothermia noticed. The median (Range) temperature was 36.80 (0.96)°C in preoperative patient but 36.10(0.83)°C in the postoperative cases. The paired t-test showed significant difference in pre and post operative temperature measurements. Patients with hypothermia were more frequently in age of 25-50 years (52.5%), male gender (50.8%), with ASA I (79.7%), having a normal preoperative temperature (81.4%) and underwent schedule operation (62.7%). Temperature was not monitored preoperatively and intraoperatively in the operation room by nurses and anesthesia providers respectively. All crystalloid fluids were administered without warming but blood and abdominal irrigation fluids were utilized after warming, though the temperature was not adjusted in the recommended range of body temperature. Occurrence of hypothermia was prevented using passive warming measures such as cotton sheets, drapes, gowns or blankets covering in the intraoperative period and during patient transfer to recovery room.

Characteristics		Frequency (%)
Age (years)	<25	107 (27.9%)
	25-50	205 (53.4%)
	>50 years	72 (18.8%)
ASA physical status	I	280 (72.9%)
	II	104 (27.1%)
Sex	Male	184 (47.9%)
	Female	200 (52.1%)
Preoperative temperature (˚C)	<36.0°C	76 (19.8%)
	≥ 36.0°C	308 (80.2%)
Magnitude of procedure	Moderate	84 (28.1%)
	Major	276 (71.9%)
Type of anesthesia	General	263 (68.5%)
	Spinal	121 (31.5%)
Condition of surgery	Elective	214 (55.7%)
	Emergency	170 (44.3%)
Amount of crystalloid fluids replaced intraoperatively (litre)		
	≤ 2	303 (78.9%)
	>2	81 (21.1%)
Duration of Anesthesia (min) (Range 35-230 min)		
	≤ 1 hr	57 (14.8%)
	>1 hr	327 (85.2%)
Duration of Surgery (min) (Range 30-210 min)		
	≤ 1 hr	121 (31.5%)
	>1 hr	263 (68.5%)
Operation room temperature	≤ 23°C	309 (80.5)
	>23°C	75 (19.5)

Table 1: Characteristics of patients by postoperative temperature status in Gondar town, Northwest Ethiopia, 2014 (n=384).

Characteristics		Status of temperature		Crude Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P- value
		Hypothermic	Euthermic			
ASA physical status	I	94 (79.7%)	186 (69.9%)	1	1	0.01
	II	24 (20.3%)	80 (30.1%)	2.5 (1.5-4.0)	1.99 (1.16-3.44)	
Type of anesthesia	General	91 (77.1%)	172 (64.7%)	1.9 (1.3-3.1)	1.84 (1.17-3.24)	0.02
	Spinal	27 (22.9%)	94 (35.3%)	1	1	
Condition of surgery	Elective	74 (62.7%)	140 (52.6%)	1	1	0.03
	Emergency	44 (37.3%)	126 (47.4%)	0.7 (0.5-1.1)	0.56 (0.33-0.94)	

1: Reference group

Table 2: Factors associated with postoperative hypothermia in surgical patient of University of Gondar Hospital, North West Ethiopia, 2014 (n=384).

Factors associated with postoperative hypothermia

The multivariate logistic regression in Table 2 indicated that patients operated under general anesthesia were 1.8 times more likely develop postoperative hypothermia than operated under spinal anesthesia(AOR, 1.84; 95% CI, 1.17; 3.24). Among the preoperative factors, emergency surgery were significant protective factors against hypothermia (AOR, 0.52; 95% CI, 0.31; 0.84). Those patient with higher ASA physical status were at higher risk of postoperative hypothermia (AOR, 1.99; 95% CI, 1.16; 3.44) than lower ASA status. No statistically significant difference found between postoperative hypothermia and sex, age, preoperative temperature, magnitude of surgery; duration of anesthesia; duration of surgery, Operation Room temperature, Body Mass Index, fluid administration and blood transfusion.

Discussion

Hypothermia is the most common complications in the recovery room which is associated with anesthesia and surgical intervention [15,32]. Early articles listed the incidence of hypothermia as ranging from 50% to 90% [33]. The current study showed that 30.72% patients had body temperature of less than 36°C on admission to the recovery room. This finding is lower than study conducted by Karalapillai [34], Kongsayreepong, et al. [19], Slotman et al. [35] and Abelha [26] which was 48.1%, 57.1%, 51% and 57.8% respectively. But it was high compared with study conducted by Shari [36] which is 4 percent. The result was almost comparable (32%) with study conducted by Clara Luis [37]. These differences could be due to small sample size, case mix, definition, site of measurement and thermometer type used as compared to the reference.

Inadvertent hypothermia is a recognized side effect of general anesthesia [38] because the body's normal thermoregulatory mechanisms, in particular vasoconstriction and shivering, are inhibited. While the mechanisms may differ, hypothermia also is an unintended side effect of regional anesthesia (i.e., spinal or epidural) [39]. Most patients in the present study underwent general anesthesia (68.5%) with was no correlation found between duration of anesthesia and postoperative temperature. This is in contrary with evidences, i.e. the longer the anesthesia, the lower the patient's body temperature [21]. However a statistically significant difference was observed between types of anesthesia and postoperative temperature. Accordingly, those who took general anesthesia had lower temperatures than spinal anesthesia (AOR, 1.84; 95% CI, 1.17; 3.24). This finding corroborates with literature, indicating that general anesthesia poses higher risk of postoperative hypothermia [20,26,40,41]. Regardless of the type of anesthesia selected, derangement of pre and intra- operative body temperature may have an impact on postoperative temperature. In this case, monitoring and maintaining patient body temperature are paramount [42].

Evidence also showed that the higher the American Society of Anesthesiology (ASA) physical status, the greater the risk for hypothermia [20,26,43,44]. Similarly this study showed higher ASA physical status had a significant risk factor for the development of postoperative hypothermia (AOR, 1.99; 95% CI, 1.16; 3.44).

Urgency of the procedure, especially emergency surgery, was also important risk factors for the development of postoperative hypothermia [20,26] which was in contrast with the current study finding. This showed that hypothermia should be considered in elective surgery too.

One of the limitations of the present study was the use of tympanic membrane temperature as a measurement of core temperature rather than the rectal one in which ear thermometer reading varies from 1 to 2 degrees below and above the temperature calculated by rectal and oral thermometers. Furthermore, this study includes different case mixes and procedures for body temperature control which may confound the results of this study. The other major limitation of this study was lack of generalizability.

Conclusions and Recommendations

The incidence of postoperative hypothermia in recovery room was high. Patient with high ASA physical status, operated under general anesthesia and elective surgical patients were strongly associated with the development of postoperative hypothermia. Maintaining normothermia in these risky patients is important on patient safety as this reduces risk of complications, costs to the hospital and patients. All perioperative surgical team should participate to reduce the occurrence of postoperative hypothermia with early prediction and diagnosis for better outcome of patient.

Authors' Contribution

Tadesse Belayneh participated in the conception, design, acquisition of the data, statistical analysis, interpretation of the data, drafting of the paper, and critical revision of the manuscript. Abebaw Gebeyehu and Zewditu Abdissa participated in the design and critical revision of the manuscript. All authors read and approved the final manuscript.

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