

Relationship between the patient's time in bed and the onset of surgery with postoperative shivering in patients undergoing abdominal surgery

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ABSTRACT

Background: Shivering is an unpleasant complication in the postoperative period. It has been demonstrated that postoperative shivering is potentially risky, however the origin of postoperative shivering is unclear. The aim of this study was to determine the association between the patient's time in bed and the onset of surgery with postoperative shivering in patients undergoing abdominal surgery.

Methods: This cross-sectional study was performed from August to September 2018. The participants were all patients referred to Imam Reza hospital in Mashhad who were a candidate for any abdominal surgeries. Patients were selected according to the inclusion criteria and then divided into two groups of less than 20 minutes (N = 20) and more than 20 minutes (N = 14) based on the duration of bed rest until surgery. Postoperative shivering checklist was used to evaluate the severity of postoperative shivering. This checklist for post-operative shiver check is standardized in the anesthesia reference books (Miller Anesthesia Page 2319) and used in the study of Manouchehri et al. in 2007. Data were analyzed using SPSS-20 software which the significance level was considered to be less than 0.05.

Results: There was a significant positive correlation (P=0.024) between the duration of bedtime and shivering intensity after surgery. Also data analysis shows a positive relationship between intensity of shivering with investigated variables such as age, difficulty of induction (P=0.012) and duration of bed rest until surgery. There was no relationship between shivering severity, gender, patient age and difficulty of induction with duration of bed rest until surgery. Also results showed that there was no significant correlation between education level and gender of patients with intensity of shivering.

Conclusion: Our findings indicate a significant positive association between age and surgery duration with postoperative shivering. It seems that decreasing surgery duration can reduce the risk and incidence of postoperative shivering in patients undergoing abdominal surgery.

Keywords: Postoperative shivering, Patient's time in bed, Abdominal surgery.

INTRODUCTION

Shivering is a frequent and unpleasant complication in the postoperative period^(1,2). Although various mechanisms have been proposed, however the origin of postoperative shivering is unclear⁽²⁾. Shivering can be defined as spontaneous, rhythmic, oscillatory, tremor-like muscular hyperactivity which happens as a physiological stressful response to core hypothermia in an attempt to raise the metabolic heat production⁽³⁾. It may also occur as a thermoregulatory response to hypothermia or muscle hyperactivity with tonic patterns⁽²⁾. However, in the postoperative period muscle activity may be increased even with normothermia, suggesting that mechanisms other than heat loss may contribute to the development of shivering. These include uninhibited spinal reflexes, postoperative pain, decreased sympathetic activity, pyrogenic release, adrenal suppression and respiratory alkalosis⁽⁴⁾. Shivering also increases postoperative complications, which consequently increases the cost of treatment⁽⁵⁾. Shivering has detrimental effects like interference in monitoring of pulse rate, intra-ocular pressure (IOP), intra-cranial pressure (ICP), and lactic acid

production^(3,6). Increase in heart rate, cardiac output may cause problem in patient with low cardiac and pulmonary reserve. Shivering also contribute to increased wound pain, delayed healing, and delay discharge from post-anesthetic care unit⁽³⁾. which can consequently prolong the recovery from anesthesia and delay discharge after surgery⁽⁷⁾. Therefore, it is necessary to treat and prevent shivering.

According to the literature shivering is thermoregulatory mechanism that is required to increase core body temperature in patients with core hypothermia, however others reported that postoperative shivering can occur, even in patients without hypothermia^(8, 9). Frank et al. (2000) reported that the core body temperature set point increased after surgery⁽¹⁰⁾. Postoperative shivering (PAS) as a common phenomenon with an incidence of 20%–80%, is ranked as 6th most important problem of current anesthesiology practice^(2,8). It is a common complication occurring in 5-65% of patients recovering from general anesthesia (GA) and 33% after regional anesthesia^(4,11). Postoperative shivering can be describe as a heat-producing reaction to the postoperative increase in the core body temperature set point^(12,13). PAS can also increase

apatient's oxygen consumption by 200% to 500%, catecholamine release, carbon dioxide production, risk of cardiovascular complications, postoperative pain, blood pressure and stroke volume^(14,15). Thus, patients with already limited myocardial oxygen supply may develop further compromised myocardial function⁽¹⁶⁾. Previous studies reported that preventing postoperative shivering can decrease the risk of these adverse events and therefore can shorten the duration of a patient's stay in the hospital⁽⁸⁾.

Patients often comment on subsequent shivering upon awakening from anesthesia as one of the most uncomfortable immediate postoperative experiences⁽¹⁷⁾. As mentioned the exact mechanism of postoperative shivering is not well elucidated but perioperative hypothermia has been considered as one of the possible mechanisms of postoperative shivering⁽⁷⁾. One of the cases that seem to affect shivering in patients after surgery is delay in initiation of operation after induction of anesthesia⁽¹⁸⁾. Operating room (OR) time is expensive, costing an estimated \$15 per minute, and is a big contributor to the total cost of surgical services, which constitute approximately 40% of hospital revenue⁽¹⁹⁾. Knowing the interval between the beginning of anesthesia and the beginning of the surgery also helps the therapist to minimize the time to avoid post-operative complications such as shivering, which ultimately reduces hospitalization time and increases the satisfaction of patients undergoing abdominal surgery. In this study, we hypothesized that reduced the interval between the beginning of anesthesia and the beginning of the surgery, in other words, reduce the patient bed time has a prophylactic effect on postoperative shivering in patients undergoing abdominal surgery. To test this hypothesis, we performed a cross-sectional study, to investigate the relationship between the patient's time in bed and the onset of surgery with postoperative shivering

METHODOLOGY

Participants: The present study, in the form of a cross-sectional study, examined the relationship between the patient's time in bed and the onset of surgery with postoperative shivering. The statistical population of this study was all patients referred to Imam Reza hospital in Mashhad who were a candidate for any abdominal surgeries. The present study was done from August 2018 to September 2018, in an operating room unit of a teaching hospital. Inclusion criteria were the desire to participate in the study, candidate for abdominal surgery, over 18 years of age, acceptable listening, spoken and alert ability to answer questions, not having epilepsy, lack of cancer, especially lymphoma and nerve damage caused by diabetes, no alcohol or drug addiction, not prescribing a specific sedative drug as a precursor, non-pregnancy in the female. Exclusion criteria were duration of surgery lasted more than 5 hours, patients are candidates for emergency surgery, if the patient is undergoing major surgery or surgery that may result in significant body heat loss during surgery or requiring blood or blood transfusions. The Ethics Committee of Sabzevar University of Medical Sciences approved this study as well as informed consents from patients, was obtained. In this study, patients were selected according to the inclusion criteria and then divided into two

groups of less than 20 minutes (n=20) and more than 20 minutes (n=14) based on the duration of bed rest until surgery.

Data collection tools: Patient's demographic characteristics were recorded using a demographic information questionnaire. Postoperative shivering checklist was used to evaluate the severity of postoperative shivering which was used in the study of Manouchehri et al. in 2007 to evaluate the prevalence of shivering after limb surgery. This checklist for post-operative shiver check is standardized in the anesthesia reference books (Miller Anesthesia Page 2319). Checklist consists of two parts, the first part was about demographic characteristics of patients, which includes demographic data (age, gender, marital status, education, employment status), all of which can be accessed using patient records or questions from patients and family members completed. The second part includes the form of anesthesia start time, surgery start time, and post-operative shiver checklist.

Measurements: The measurement of the relationship between delayed onset of operation and postoperative shivering was examined by a checklist filled by the researcher during and after surgery. Time of entry into the operating room, time of anesthesia and time of surgery, type of surgery, type of anesthesia induction, difficulty of anesthesia induction according to anesthesiologist's opinion, patient ASA class, patient temperature, the drugs used and the anesthesia protocol were recorded by the researcher. Postoperative recovery room nurses who are responsible for disease control, were not aware of the post-operative shivering symptoms record in accordance with the checklist available in the section provided by the researcher, as well as the type and amount of medication used during recovery, and this study will thus be blinded.

Statistical analysis: Data analysis was performed using SPSS software version 20. The significance level was considered to be less than 0.05.

RESULTS

Table 1: Frequency of patients and missing in each variable

Variable	Frequency	
Age	Less than 35 years	19
	More than 35 years	16
Gender	Male	19
	Female	14
Education	High school	12
	Diploma	12
	Bachelor	11
Difficulty induction	1-3	18
	4-7	16
Duration of bed rest until surgery	Less than 20 minutes	20
	More than 20 minute	14
Duration of bedtime	Less than 1 h	15
	Between 1 and 2 h	17
	More than 3 h	11
Intensity of shivering	Shivering	19
	Without Shivering	16

In the present study patients (n= 35) were divided into 2 groups of less than 20 minutes (n= 20) and more than 20 minutes (n=14) based on the duration of bed rest until surgery (Missing=1). The demographic characteristics

are presented in table 1. Of the 35 patients, 19(54.3%) were under 35 and 16(45.7%) were over 35 years old, 57.6% were men and 42.4% were women. Frequency of patients and missing in other variables such as education, difficulty induction, and duration of bed rest until surgery, duration of bedtime, and intensity of shivering are shown in table 1.

The mean and frequency of studied variables were compared in two groups based on Chi-square and t-test. As shown in table 2, there was no relationship between shivering severity and gender with duration of bed rest until surgery. Furthermore these results showed no relationship between patient age and difficulty of induction with duration

of bed rest until surgery (Table 2). The distribution of studied variables was the same between the groups.

Our results indicated that there was a significant positive relationship between intensity of shivering after operation with variables of age (P= 0.012), difficulty of induction (P= 0.012) and duration of bedtime (P=0.024); such that with increasing patient age, induction difficulty or duration of bedtime, the intensity of shivering also increases. In addition with increasing duration of bed rest until surgery, the shivering intensity of patients also increases (not significant, P= 0.69). There was no significant correlation between education level and gender of patients with intensity of shivering (Table 3).

Table 2: Evaluation of demographic information in studied patients

Variable	Class	Group 1*	Group 2*	Chi square	t-test	P-value
Gender	Male	13(68.4%)	6(46.2%)	1.587	-	0.208
	Female	6(31.5%)	7(53.8%)			
Intensity of shivering	Shivering	10(62.5%)	10(55.6%)	0.169	-	0.681
	Without Shivering	6(37.5%)	8(44.4%)			
Age (mean±SD)	-	34.75 ± 12.62	40.64 ± 19.10	-	-1.085	0.286
Difficulty induction (mean± SD)	-	3.85 ± 1.66	3.00 ± 1.61	-	1.483	0.148

* Duration of bed rest until surgery less than 20 minutes (Group 1) and more than 20 minutes (Group 2)

Table 3: The relationship between shivering intensity and studied variables

Variables	Intensity of shivering	
	Correlation coefficient	P-value
Age		
Gender	0.421	0.012
Education	-0.201	0.261
Difficulty induction	-0.241	0.163
Duration of bed rest until surgery	0.425	0.012
Duration of bedtime	0.07	0.692
	0.476	0.024

indicated a significant positive association between age with postoperative shivering in patients undergoing abdominal surgery, so that, increasing patient age resulted in significantly more postoperative shivering.

The effect of gender on postoperative shivering has been reported inconsistently in the literature. Probably because of the type of surgeries, some studies reported no relationship, some showed males, and others found that females are more prone to shivering²³⁻²⁶. These differences may be due to opiates use or to differences in pain thresholds between men and women. However, our results showed no relationship between shivering severity and gender with duration of bed rest until surgery. Although some research reported that male sex was contribute to the incidence of postoperative shivering²⁰, but we did not find that this to be an effective factor. It may be that shivering is not more common in males but is more apparent to casual clinical observation because the larger muscle mass in males makes severe postoperative shivering²¹.

In the present study there was no significant relationship between duration of bed rest (onset of anesthesia) until beginning of surgery with gender variables and occurrence of postoperative shivering. Therefore, as a result, there was no relationship between the intensity of shivering and the gender of the person with the length of time that they stay in bed until the operation begins. However, as shown in table 4, intensity of shivering increased with the increasing of duration of bed rest until surgery (not significant, correlation coefficient= 0.07).

In 1992, Crossley using 2595 data reported that several variables impact on postoperative shivering development such as longer surgery duration (length of the operative procedure) male sex, premedication (e.g., atropine), spontaneous ventilation and general versus orthopedic surgery²⁰. Our findings indicated a positive relationship between duration of bedtime (surgery duration) and occurrence of postoperative shivering; this suggests that an increase in duration of surgery would result in a higher stage of postoperative shivering. There have been

DISCUSSION

Postoperative shivering is one of the most common adverse effects after surgery. It has been defined as an involuntary movement of the muscles which can lead to an increase in patients' metabolism two times more than the normal which cannot be controlled by them⁷. Postoperative shivering has different adverse effects on health and welfare of patient, therefore; due to the importance of the subject, a study to investigate the relationship between the patient's time in bed and the onset of surgery with postoperative shivering was designed and performed using 35 patients. Since the lower body temperature resulted in the higher grade of shivering, one of the main cause for shivering which discussed in the literature review is the thermoregulation, therefore we maintain normothermia throughout the perioperative period, in the current study.

Previous researches demonstrated that older age and administration of morphine were the most important protective factors against postoperative shivering. However, these results have not been further verified^{20,21}. Eberhart et al. (2005) using stepwise multivariate analysis, reported three independent risk predictors for postoperative shivering: younger age, endoprosthetic surgery, and low body temperature²¹. Because of the thermoregulatory responses to cold and heat are attenuated in older patients, it is expected that age to be the most important risk factor for postoperative shivering²². Results of the present study

many reports to show that this results in wastage of operating room time and prolongation of patients' hospitalization, leading to increased cost and emotional involvement²⁷. Findings of the present study showed a significant correlation between intensity of shivering after operation with variables including difficulty of induction and duration of bedtime (surgery duration). Overall, delays of surgical procedures as an issue of health care quality are common occurrences throughout the world²⁷. There has been mixed evidence in the general surgical literature for an adverse effect of late operative start time on operation outcome²⁸. A study by Davis et al²⁹ showed that teaching delays the start time of surgery by an average of 4.5±3.2 minutes, but represented only 3% of the mean surgical case length (207±132 min). Longer surgery times increase the overall costs of procedures by lengthening the period for which the operating room and its personnel are needed. The surgery duration is an independent predictor of adverse outcomes remains unknown. Chu et al³⁰ reported that although surgery duration did not affect short-term survival after coronary artery bypass grafting, surgical duration independently predicted length of surgical intensive care unit stays. Efforts to reduce the length of operations may promote more efficient use of hospital resources.

CONCLUSION

In conclusion, the results of this study indicate a significant positive association between age and surgery duration with postoperative shivering in patients undergoing abdominal surgery, so that, increasing patient age and longer duration of surgery (bedtime) resulted in significantly more postoperative shivering. It seems that decreasing surgery duration can reduce the risk and incidence of postoperative shivering in patients undergoing abdominal surgery.

Conflict of Interests: No ethical problem or conflict of interests is acknowledged.

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