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### Original Research Article

## Evaluation of Shivering-Related Factors after General Anesthesia in Gynecological Surgery

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### ABSTRACT

Shivering after anesthesia is one of the unpleasant and undesirable complications after anesthesia; This complication occurs much more often in women than men, and female gender is one of the risk factors; Other risk factors have been reported differently in different populations; The aim of this study was to evaluate shivering-related factors after general anesthesia in gynecological surgery. This descriptive study was conducted during 2018 with the participation of 448 women candidates for gynecological surgeries. The prevalence of shivering as well as the factors affecting shivering in all patients were measured and recorded from the moment of entering the recovery unit, and finally the relationship between the available data and shivering after anesthesia was investigated. The prevalence of chills in our study was 18%; Factors such as the size of the surgical site, increasing the length of anesthesia, general anesthesia, anesthesia gas intake and atropine intake are effective factors in the occurrence of shivering after gynecological surgery. Finally, it can be concluded that the importance of the three agents of isoflurane used to maintain general anesthesia, intravenous injection of higher volume intravenous crystalloid fluids, and spinal anesthesia, respectively, increased the risk of postoperative shivering in anesthesia. ; Hypothermia, on the other hand, was not associated with chills.

**Keywords:** Shivering, Gynecological, Anesthesia, Surgery

## Introduction

Shivering after anesthesia are involuntary muscle movements and contractions that the patient is unable to control. It is easy to see and diagnose, and if left untreated may last for minutes or even hours after surgery (1). Postoperative chills, such as nausea and vomiting, are unpleasant side effects of anesthesia, and although the cause is still unknown, the side effects are well known (2).

Shivering is a distressing experience and many patients even remember it for years after surgery (3). Increased tissue oxygen consumption and carbon dioxide production, increased minute ventilation, tachycardia, hypertension, and decreased intravenous blood oxygen saturation are other potential side effects that can be problematic in people with coronary artery disease and patients with limited pulmonary storage. In addition, chills can increase intracranial pressure and intraocular pressure, exacerbate postoperative pain by stretching the surgical incision, and interfere with patient monitoring (4).

The prevalence of shivering after anesthesia is 5 to 65% and hypothermia, age, methods and drugs of anesthesia, extent and duration of surgery play an important role in its occurrence (5). In addition, the prevalence and factors affecting the prevalence of this complication are different between men and women, which may be related to hormonal changes in women. Knowing more about the clinical factors associated with postoperative shivering can help an anesthesiologist treat or prevent this unpleasant complication. To the best of our knowledge, few studies have been published on the prevalence of shivering after anesthesia in female patients, especially in Iran, and comprehensive information is not available (6). The aim of this study was to determine the prevalence of shivering after gynecological surgery and possible clinical factors related to its prevalence including age, surgery, anesthesia, central body temperature and venous fluids were also reported.

## Methods

**Study design:** After the approval of the hospital ethics committee and obtaining informed consent from patients, this descriptive study was performed during 2018 in the operating room of Al-Zahra Hospital (Tabriz University of Medical Sciences) with the participation of 448 women after anesthesia. Sampling in this study was available and the participants in the study were

evaluated according to the inclusion and exclusion criteria of the study. , 384 patients were counted and considering the 20% chance of losing the sample, finally 448 patients were included in the study.

**Inclusion and Exclusion Criteria:** Women who are classified as group one and two according to the American Society of Anesthesiology and undergo one of the three methods of general anesthesia, spinal cord, or palliative anesthesia as emergency and non-emergency. Entered the study; Exclusion criteria were: Patients who required mechanical ventilation of the lungs before or after surgery. Patients who underwent surgery with local anesthesia only. Patients with fever, infection, septic, patients transferred from the operating room to the intensive care unit.

**Methods:** Information about the characteristics, surgery, anesthesia, central body temperature and intravenous fluids of patients were also recorded. During the study, the average temperature of the operating and recovery rooms was 22 degrees Celsius and no physical or pharmacological intervention was performed before the onset of chills. During anesthesia, short-acting venous opioids were used and, if necessary, the last dose of short-acting intravenous opioids was given 45 minutes after the operation. Patients did not receive morphine and pethidine. Patients' central body temperature was measured before the onset of anesthesia (TB) and at the entrance to the recovery room (TR) through the external ear canal by tympanic membrane thermometer using a Ri thermo riester infrared multifunction thermometer. After the anesthesia, the patients were transferred to the recovery room and were evaluated for shivering by one of the anesthesia team specialists or anesthesia technicians with 3 years or more experience. Shivering was defined as the onset of tremors and involuntary muscle contractions in the head and face, torso, limbs, or throughout the body that were easily visible and could not be controlled by the patient and lasted more than 1 minute. In cases that did not occur until the patient recovered from the tremor recovery, it was recorded as no tremor. In cases of chills, patients were covered with a blanket and warmed, and if the chills did not stop, 20 to 25 mg of intravenous pethidine was injected. Due to the possibility of human error and clinical disagreement in measuring the severity of shivering in this study, the severity of shivering was not evaluated.

## Data analysis

Data were analyzed using SPSS software version 20. Chi-Square test was performed for rank variables and analysis of variance and T-test were performed for continuous variables. In cases where analysis of variance was significant, Tukey test was used for double comparisons. Logistic regression analysis was performed to determine the variables that were effective in predicting shivering. p-value less than 0.05 was considered significant.

## Ethical considerations

This study has been approved by the ethics committee of Tabriz University of Medical Sciences. Written informed consent was obtained from all participants in the study. No fees were charged to patients for participating in the study, and the available information was recorded with the utmost honesty.

## Results

The mean age, weight and height of study participants were  $31.51 \pm 3.49$ ,  $65.59 \pm 6.12$  and  $161.36 \pm 10.41$ , respectively. The mean length of surgery was  $81.33 \pm 12.29$  minutes. General balance anesthesia was performed in 75.2%, spinal anesthesia in 18.5% and palliative anesthesia in 6.3% of participants. The only halogenated anesthetic gas used was isoflurane, and in all patients' intravenous fluids injected intraoperatively were crystalloid and kept at operating room temperature. Surgeries included major procedures (including cesarean section, hysterectomy and laparotomy), moderate procedures (including ovarian cyst surgeries, hernia repair, cysto-rectocele repair, appendectomy and laparoscopy) and small procedures (including diagnostic and therapeutic curettage and cystoscopy). Since only 5 patients received premedication before the operation, this variable was not statistically tested. In general anesthesia, balance for induction and maintenance of anesthesia is a balanced combination of intravenous anesthetic drugs (including midazolam, thiopental sodium or propofol), short-acting intravenous drugs (including fentanyl or sufentanil or alfentanil), anesthetic inhaled gases, and N<sub>2</sub> Intramuscular agents (including atracurium or succinylcholine) and a combination of atropine with neostigmine or intravenous prostigmine were prescribed to relieve muscle relaxation. Patients under palliative anesthesia received small, sedative doses of short-acting intravenous drugs, including thiopental,

midazolam, fentanyl, sufentanil, or alfentanil. In spinal anesthesia, depending on the type of surgery, marcaine was injected through the spinal needle No. 25 in the lumbar region. 18.5% of patients developed shivering after anesthesia. There was no significant difference between patients with and without chills in terms of age, weight, length of operation, temperature, emergency and non-emergency surgery, transfusion and previous anesthesia history (Table 1), but their differences in terms of scope of operation, volume Intravenous crystalloids, anesthesia methods and general anesthetic drugs were significant (Table 2). As shown in Table 2, the prevalence of shivering in palliative anesthesia was significantly lower than general and spinal anesthesia ( $p = 0.001$ ), but there was no significant difference between general and spinal anesthesia ( $p = 0.632$ ). The prevalence of shivering in small surgeries was significantly lower than in large and medium surgeries ( $p = 0.002$ ) but the difference between large and medium surgeries was not significant ( $p = 0.831$ ). TR was similar in large, medium and small surgeries ( $p = 0.683$ ). Also, in patients who received isoflurane and atropine, there was no significant difference compared to the group who did not receive them ( $p = 0.227$ ). TR in patients receiving palliative anesthesia was significantly higher than the other two methods of anesthesia ( $p = 0.001$ ) but was the same in both general and spinal anesthesia ( $p = 0.688$ ). Palliative anesthesia was significantly used in small, medium and large surgeries ( $p = 0.002$ ) and the volume of venous crystalloids was significant in large, medium and small surgeries ( $p = 0.001$ ). Logistic regression was one of the factors that had a significant effect on the incidence of shivering after anesthesia. they give.

**Table 1:** Distribution of clinical factors related to gynecological surgery by presence or absence of shivering

Variable		With shivering (83)	Without shivering((365)	P Value
Age	Mean	30.89 ± 3.59	31.66 ± 3.25	0.50
	15-40	20%	80%	0.156
	40-61	13.5%	86.5%	
weight		66.01 ± 6.41	65.15 ± 6.41	0.1
height		163.95±10.74	158.85±10.40	0.188
Surgery time	Mean	80.25 ± 12.14	83.03 ± 12.01	0.188

	<40 Min	19.4%	80.6%	0.188
	>40 Min	14.5%	85.5%	
Surgery Type	Elective	17%	83%	0.220
	Emergency	21.8%	78.2%	
Temperatures	Preoperative	36.21 ± 0.91	36.25 ± 0.95	0.786
	Recovery	35.74 ± 0.78	35.85 ± 0.75	0.4
Blood Transfusion	Yes	16.7%	83.3%	0.726
	no	18.8%	81.3%	
Previous Anesthesia	Yes	16%	84%	0.342
	no	19.8%	80.2%	

**Table 2:** Distribution of factors related to anesthesia methods and drugs in gynecological surgery by presence or absence of shivering

Variable		With shivering(83)	Without shivering((365)	P Value
Anesthesia Methods	General	19.3%	80.7%	0.001
	Spinal	21.7%	78.3%	
	Relief	0%	6.3%	
Surgery size	Major	21.3%	78.7%	0.002
	medium	22.6%	77.4%	
	Little	5%	95%	
Isoflurane	Yes	24.2%	75.8%	0.001
	No	8.5%	91.5%	
N2O	Yes	21.3%	78.7%	0.018
	No	6.5%	93.5%	
Atropine	Yes	21.6%	78.4%	0.02
	no	8.5%	91.5%	
Previous Anesthesia	Yes	16%	84%	0.342
	no	19.8%	80.2%	

## Discussion

The overall prevalence of shivering after anesthesia has been reported in a wide range of 5 to 65% and different and sometimes contradictory results have been presented about the prevalence and related factors. The findings of this study also confirm some of the results of previous research and others are contradictory. In this study, the prevalence of shivering after anesthesia in women was 18.8%. A study conducted in this field has halved the prevalence of shivering in head and neck, orthopedic and general surgeries in female patients compared to men. Possible reasons for the difference in the extent and factors associated with the prevalence of chills in men and women may be related to hormonal changes in women. For example, they have seen that women respond to shivering treatment earlier than men after anesthesia, and they feel cold after treatment (7-10). Although the most common cause of post-anesthesia shivering is a slight drop in patients' core body temperature during anesthesia; But in some studies, hypothermia has not always been associated with chills. In the present study, although all female patients had mild hypothermia, no shivering occurred in all of them. In line with our findings, similar studies in this area are consistent (11,12). Other studies have shown that the rate of decrease in core body temperature is the same in patients with and without chills. Also, electromyographic studies performed on women during recovery from isoflurane anesthesia did not confirm the hypothesis that post-anesthesia tremor is the body's natural response to cold; Another study found that central body temperature was the only factor associated with chills and severity in female patients recovering from general anesthesia. Some studies have also shown that the central body temperature was lower in patients with chills than in patients without chills (13-15). Unlike previous studies, in our study, the length of time surgery and anesthesia and whether emergency surgery or non-emergency surgery was not associated with chills. While injecting higher volumes of intravenous crystalloids increased the prevalence of chills. In the present study, large and medium surgeries, general and spinal anesthesia, use of isoflurane and N<sub>2</sub>O anesthetic gases to maintain general anesthesia, and use of atropine and prostigmine to relax laxity (16,17). Muscles were associated with an increased incidence of chills after anesthesia. On the other hand, our results, like other studies, showed that atropine and the anesthetic isoflurane predispose the patient to shivering after anesthesia (18). Limited studies have examined the association between palliative anesthesia and the occurrence of chills, and some have found no association

between postoperative relief and chills. On the other hand, our study similar to a number of previous studies showed that the prevalence of shivering with general and spinal anesthesia is significantly higher than palliative anesthesia. Our findings indirectly support the evidence that the onset of shivering after anesthesia is inversely related to the patient's level of consciousness. Are used together. Our results in indirect confirmation of this theory also showed a higher prevalence of shivering in large and medium surgeries compared to small surgeries. One possible explanation is that these surgeries are usually more complex and invasive and cause more severe tissue damage. Damaged tissue may also release febrile substances that cause chills after surgery by raising the body's normal temperature. In addition, in longer and more invasive surgeries, the plasma concentration of interleukin-6 is often higher than in shorter-term surgeries, which in turn stimulates the thermoregulatory system and raises body temperature after surgery. Interestingly, the higher volume of venous crystalloids, which was one of the three main causes of shivering in this study, was higher than average in large surgeries and more than small in moderate surgeries.

### **Limitation**

The limitations of this study are the uniqueness of this research and different methods of anesthesia with different doses performed by different anesthesiologists for patients.

### **Conclusion**

Finally, it can be concluded that the importance of the three agents of isoflurane used to maintain general anesthesia, intravenous injection of higher volume intravenous crystalloid fluids, and spinal anesthesia, respectively, increased the risk of postoperative shivering in anesthesia. ; Hypothermia, on the other hand, was not associated with chills.

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