

**Original Research Article**

**Volume 7, Issue 4 -2021**

**DOI:** <http://dx.doi.org/10.22192/ijcrms.2021.07.04.002>

## **The Incidence of Postanesthesia Shivering in Iranian patients: A systematic review and meta-analysis**

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### **Abstract**

**Introduction:** Shivering in surgery or involuntary muscle activity is a common and unpleasant complication of the operation that occurs in up to 70% of patients and can increase body heat production up to 60% above baseline. The aim of this study was to evaluate the Incidence of Postanesthesia Shivering in Iranian patients.

**Methods:** The searches were performed by two independent researchers and the purpose of the search was to find published studies from 1/1/2000 to 12/30/2020.

**Results:** According to the random effect model, the prevalence of shivering in 1032 patients with surgery was 14% (in the 95% confidence interval and  $I^2$  85.9% equal to 12-16%).

**Conclusion:** Due to the fact that the incidence of shivering after surgery is relatively high and can cause dangerous and irreparable problems and complications for the patient, recognizing the causes of postoperative shivering can prevent its occurrence.

**Keywords:** Postanesthesia shivering, anesthesia techniques, surgery, Iran

### **Introduction**

Shivering in surgery or involuntary muscle activity is a common and unpleasant complication of the operation that occurs in up to 70% of patients and can increase body heat production up to 60% above baseline (1). Although various causes such as pain, decreased sympathetic activity, uncontrolled spinal reflexes, release of pyrogenic substances or adrenal suppressor, etc (2). have been suggested as causes of chills, but disruption of thermoregulation due to a degree of hypothermia due to a degree of hypothermia is accepted as the most common factor (3). Shivering interferes with pulse oximetry monitoring, blood pressure and ECG measurements, and increases

oxygen consumption by up to 50%, which in turn increases the need for cardiac output and increases ventilation in patients (4). Or in patients with underlying cardiovascular disease, it causes cardiorespiratory failure (5). Shivering also causes lactic acidosis, increased carbon dioxide production, and muscle fatigue, as well as increased intraocular pressure (IOP) and intracranial pressure (ICP) (6). In operated patients, shivering causes increased pain during operation due to tremor (7). It is important to note that the incidence of chills in regional anesthesia is not less than general anesthesia and patients' hypothermia continues until the effects of the block below the surface of the block disappear, because in regional anesthesia not only sending

sensory messages from the limb. The lower extremities are disrupted by nerve centers, but due to the paralysis of the lower extremity muscles, heat production is virtually reduced, resulting in local anesthesia with almost twice the duration of the patient's reheating time under general anesthesia (8-10). Nowadays, various pharmacological and non-pharmacological solutions have been developed and used for the prevention and treatment of hypothermia and chills. Keeping the patient warm before and during the operation and preventing the operating room from cooling down is one of the most important methods (11).

## Method

### Inclusion criteria (eligibility criteria).

The methods used in this systematic review have been developed based on the Checklist Guidelines (PRISMA). The study includes cross-sectional studies, case studies, and cohort studies, and excludes case studies, letters to editors, case reports, clinical trials, study protocols, systematic reviews, and reviews. Sampling methods and sample size: All observational studies, regardless of their design, were included in the systematic review. The minimum sample size was 25 patients or more.

### Search strategy

The searches were performed by two independent researchers and the purpose of the search was to find published studies from 1/1/2000 to 12/30/2020. Published studies were searched in Persian and English. To ensure the adequacy of the studies, a list of relevant research sources or studies found by the search was read. Keywords used in search strategy are Postanesthesia shivering, anesthesia techniques, surgery, Iran

### Select study and extract data

The two researchers independently analyzed the titles and abstracts of the articles according to the eligibility criteria. After eliminating additional studies, the full text of the studies was collected based on the eligibility criteria and information about the authors if necessary. General

information (relevant author, province and year of publication), information about the study (sampling technique, diagnostic criteria, data collection method, research conditions, sample size and risk of bias) were collected.

### Quality evaluation

The developed scale of Hoy et al. Was used to assess the quality of the method and the risk of bias in each observational study. This is a 10-item scale to assess the quality of studies according to their external validity (items 1 to 4 of the target population, sampling framework and minimum participation bias) and internal validity (items 5 to 9 of data collection, problem statement, Evaluates the research scale and data collection tools while item 10 evaluates the data analysis bias). The risk of bias was measured independently by the two researchers and the differences were resolved by agreement.

### Collecting data

All eligible studies were included in the data collection after systematic review and the data were integrated using the accumulation diagram. The random effects model was evaluated based on the overall prevalence of the disease among the participants. The heterogeneity of the initial studies was assessed using the  $I^2$  test. In addition, subgroups were analyzed to determine heterogeneity based on age of participants, year of publication, and country. Finally, a meta-analysis was performed in STATA14 statistical software.

### Study selection

A total of 218 articles were extracted through initial searches in various databases. Out of 218 essential studies identified by analyzing titles and abstracts, 189 studies were omitted due to irrelevant titles. Out of 29 available studies, 24 articles were deleted. 5 studies had inclusion criteria.

## Results

A total of 1,032 patients who underwent surgery were evaluated. All studies are retrospective. A total of 5 studies from 4 provinces that met the

inclusion criteria were reviewed. Among these studies, 2 studies from Tehran, 3 studies from Isfahan, Rasht and Shahrekord) were included in the study. Easy sampling method was used to select the sample. In most studies, the risk of bias was low. The main method of data collection was medical records. The main study sites were hospitals.

**Meta-analysis of shivering after anesthesia:**

According to the random effect model, the prevalence of shivering in 1032 patients with surgery was 14% (in the 95% confidence interval and  $I^2 = 85.9%$  equal to 12-16%) (Figure 2).

**Subgroup analysis:**

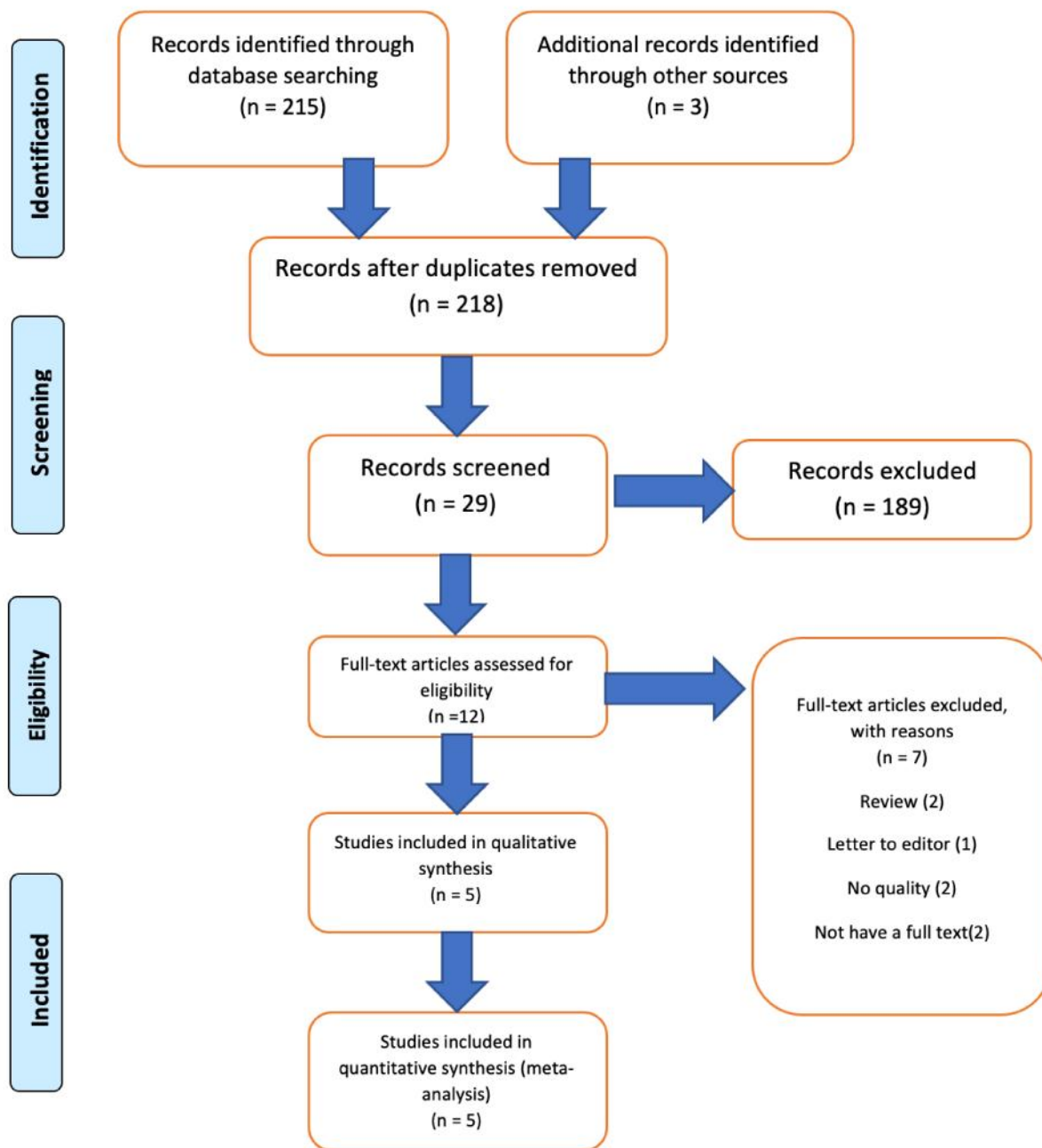


Figure 1: PRISMA flow diagram

**Meta-regression results:**

**Results of meta-regression between participants' age and shivering after anesthesia in patients undergoing surgery:**

The regression of the study was evaluated according to the relationship between the

prevalence of chills after anesthesia and the age of participants and the total prevalence of chills. There was no significant linear trend in metaregression to explain the change in the effect of participants' age and the prevalence of chills.

Table 1: Summary of included studies

Author	Publication year	Province	Patients	Prevalence	Men	Women	Mean of age(Year)
Sajedi <sup>19</sup>	2007	Isfahan	200	7%	109	91	N/A
Dabir <sup>20</sup>	2010	Tehran	448	18.5%	----	448	N/A
Akhlaghi <sup>21</sup>	2011	Shahrkord	117	17.9%	82	35	35.8
Kheirandish <sup>22</sup>	2015	Tehran	112	12.5%	69	43	44.2
Poorsheykhian <sup>23</sup>	2011	Rasht	155	22%	N/A	N/A	N/A

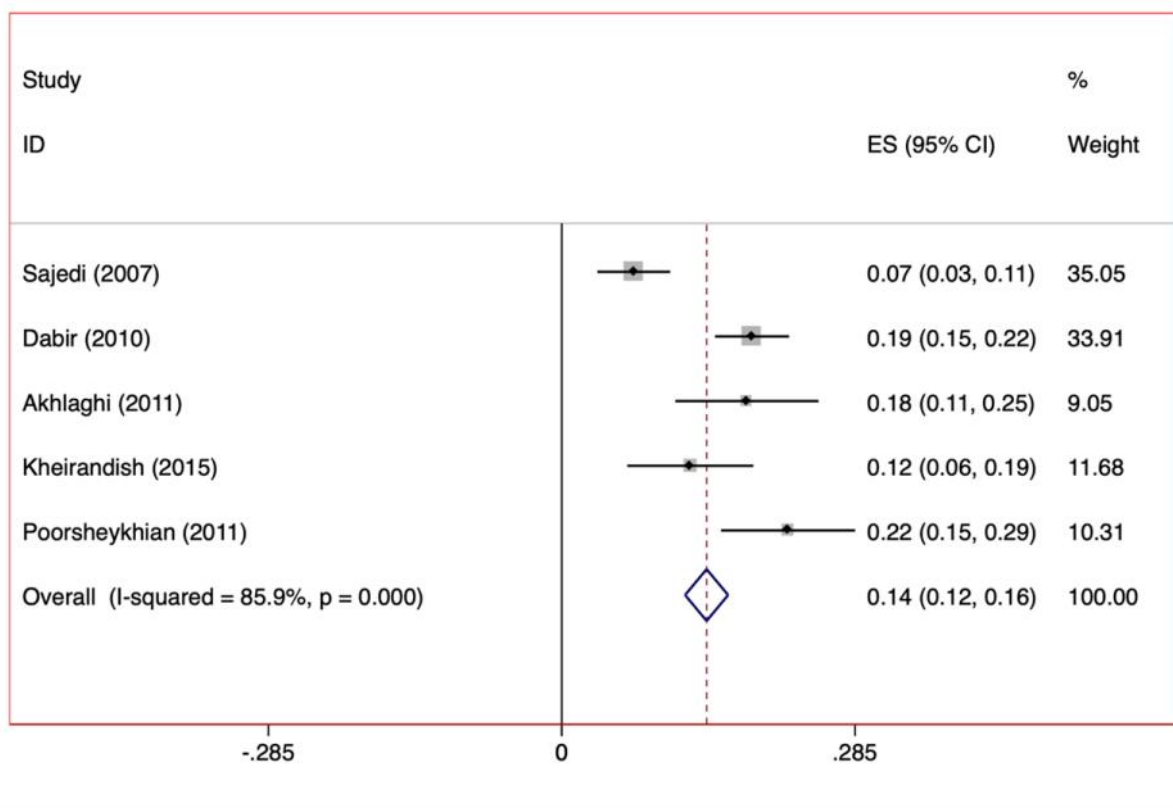


Figure 2 :Meta-analysis the Incidence of Postanesthesia Shivering in Iranian patients

## Discussion

Central human temperature is usually maintained in a small range. Adjustment of temperature changes during awakening is in the range of 0.2 ° C. Induction of anesthesia disrupts this natural phenomenon and these changes are in the range of 3 to 5 ° C during anesthesia (12). Therefore, patients lose heat during anesthesia and therefore hypothermia during anesthesia is a common phenomenon. The onset of chills is a way to deal with hypothermia. The activity of the body temperature regulation system is disrupted by many factors, including drugs and diseases, and being in a cold environment exacerbates this disorder (13). Postoperative shivering, which involves muscle tremors and stiffness, is usually accompanied by heat loss and hypothermia (14). Hypothermia during anesthesia and surgery has several complications, including cardiovascular, metabolic, hematologic, delayed recovery from anesthesia, prolonged drug metabolism, and increased oxygen consumption (15). Recognizing the clinical factors associated with the onset of post-operative shivering can help the anesthesiologist in treating or preventing this unpleasant complication (16). Postoperative shivering may cause vasoconstriction, hypoperfusion, and metabolic acidosis, and it may impair platelet-specific function and repolarization of the heart, delaying the metabolism of most drugs (17). In addition to destroying the patient's comfort, chills are sometimes associated with serious complications such as increased heart rate, blood pressure, stroke volume, intracranial pressure, and increased postoperative pain. On the other hand, inhibition of chills reduces metabolic and cardiac work needs. Given the above, the need to prevent postoperative shivering is obvious (18). Medication is the most well-known method of preventing postoperative shivering. Due to the fact that the incidence of shivering after surgery is relatively high and can cause dangerous and irreparable problems and complications for the patient, recognizing the causes of postoperative shivering can prevent its occurrence.

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How to cite this article:

Mohammad Iman Abili Nezhad, Nooshee Pormehr Yabandeh. (2021). The Incidence of Postanesthesia Shivering in Iranian patients: A systematic review and meta-analysis. Int. J. Curr. Res. Med. Sci. 7(4): 12-18.

DOI: <http://dx.doi.org/10.22192/ijcrms.2021.07.04.002>