

Incidence of Intraoperative Hypothermia among Sample of Iraqi Patients Undergoing General Anesthesia

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Abstract: ***Background:** Inadvertent hypothermia during operation with a bodily temperature of not more than 36°C is a communal avoidable problem with numerous adverse outcomes. The purpose of this study is to assess the incidence of hypothermia during operation amongst patients undergoing surgery in Al Falluga Teaching Hospital in the duration of September to November 2019. **Methods:** This Cohort study directed to find out the occurrence of hypothermia during operation and related outcomes amongst patients operated in the Al Falluga Teaching Hospital. All patients undergoing general anesthesia whether elective or emergency surgery were included in this study. **Results:** Overall occurrence of hypothermia during operation was 44.3%. Follow up rate of hypothermia were in between 15.7%, 35.4%, 41.6%, and 43.2% in the duration of 1hour, 2 hours, 3hour or 4 hours, respectively after the initiation of anesthesia induction. Factors that associated with reduced risk of hypothermia were live warming (0.35, 95 % CI, 0.25-0.94), Body mass index greater than or equal to 25 (0.37, 95 % CI, 0.26-0.57), elevated reference point bodily temperature (0.13, 95 % CI, 0.13-0.76). **Conclusion:** This study has successfully determined that the incidence of hypothermia is exceptionally high in this sample of patients. This study has equally provided evidence about the outcomes with the consequences of hypothermia in patients.*

Keywords: Hypothermia, intraoperative, consequences

1. Introduction

A natural balance exists between heat production and loss in human body. There are organs typically involved in the regulation of body temperature. When the body lowers or increases the body temperature, this alternation is controlled via different mechanisms (1). These temperature discrepancies incorporate detrimental physiological influences and can affect subject outcomes in a harmful way (2). During operation hypothermia it is a condition, when bodily temperature becomes less than 36.0 C° during surgery (3). It is the most frequent devastating problem among surgical patients. Hypothermia occurs in relation with several undesirable outcomes (4-6).

These consequences include cardiovascular events after surgery (7, 8), unanticipated hemorrhage throughout surgical procedure (9, 10), troubled drug metabolism (11, 12), infection at surgical site (1, 13-16) and any abnormal functioning of platelets (17). Hypothermia results in reduced thermal comfort, patient fulfillment, and is associated with high cost (18). Hypothermia is a frequently occurring situation during the operation time and can have destructive influences that upsurge during operation leading to death. Similarly, a core temperature with a reduction of 34°C is vastly related to fatalities as a result of conditions like impaired clot formation associated with bleeding, metabolic acidosis, numerous organ failure, hemodynamic unsteadiness, and frequent infections (19).

According to some studies, the incidence of operation induced hypothermia is high between 4% and 72%(20) and even 90% (5, 21)(22). According to a study, incidence of inadvertent hypothermia (up to 90%) is at peak level as

compared to hyperthermia (23). Similarly, a patient undergoing Anesthesia will have the loss of sensation as the individual cannot distinguish between sensations of hot and cold then the condition with low temperature typically named as hypothermia can arise. This anesthetized patient cannot be shifted to an area that is warmer (24). Anesthesia equally changes thermoregulatory processes, thus permitting unwarmed patients to develop hypothermia (24).

This similarly happens in operation theaters as Surgeons are predominantly exposed to heat operating rooms due to the root reason of the extreme degree of tension through surgical procedure and since surgeons have to dress manifold coatings of clothing, consisting of germ-free gowns and prime aprons(24). Currently, there are numerous techniques to protect the patient from hypothermia undergoing anesthesia. These are Forced air warming device, Electrical blanket, hydro futon, heat provision through radiations, warmed blankets, heating of gel pad (25). The data on incidence and associated peril issues for hypothermia during the operation is missing in the Sanatorium. Therefore, purpose of this typical research is observation of incidence of inadvertent hypothermia together with its accompanying clinical consequences.

2. Methodology

The study design is a prospective observational study and was conducted in the Al Falluga Teaching Hospital after gaining the patients' consent. The reported sample size from previous reports was 31.6%, using a 95 percent confidence level and boundary of error 5% with smallest sample magnitude which obtained from 300 patients.

The study included patients from Al Falluga Teaching Hospital who experienced elective or emergency operations with a predictable episode of anesthesia of general type of greater than thirty minutes. The exclusion criteria will be as follows; Participants will be excluded if they are suffering from high central fever as a result of stroke, Brain trauma, Brain operations, the duration of seizures, and communicable illness along with body temperature 1 week earlier to surgical operation, greater than 37.6°C will be excluded. The persons having heat controlling aberrations, for instance, malignant hyperthermia, the neuroleptic malignant syndrome will equally be excluded. Similarly, fresher subjects of eighteen years (due to parentel apprehensions aimed at the menace of tympanic membrane rupture throughout temperature observation) or with a past of hypothyroidism or hyperthyroidism will not be included the study.

The prime consequence, which is involuntary during operation hypothermia, will be calculated. It was checked by means of a tympanic thermometer. The temperature was taken baseline, instantly after administration anesthesia, then each hour after completion of the operation. The temperature was equally monitored every single hour, approximately up to two hours, bearing in mind that sick persons should stay in anesthesia central unit designed for one to two hours. This reflection of temperature correspondingly was attained by operating a tympanic thermometer.

Core temperature monitoring:

Tympanic membrane temperature observation stays frequently ideal technique in the before operation and during operation cases. This tympanic membrane stands in adjacent approximation toward the carotid artery and the brain part named hypothalamus. It remains basically a non-dangerous together with precise observer of bodily temperature (26).

Anesthesia

Entirely patients obtained from anesthesia in general or general anesthesia in combination with anesthesia induction taking place a body part. Regimes of all-purpose anesthesia utilized were included drugs of Propofol (2 to 2.5 mg/kg), fentanyl (2-4 ug/kg), together with rocuronium (0.8— 1 mg/kg) as initiation, and sevoflurane (1.5-2 vol %) alongside O₂/N₂O (50%/50%) for preservation. Ropivacaine or lidocaine drugs were utilized for anesthesia of local part of the body. Drugs like non-steroidal anti-inflammatory drugs or analgesics were avoided because these drugs might influence on bodily temperature. Hence, these are not given during operative period because their effects can be mixed with the results.

Data collection

This data includes age, sex, body mass index, medical past and current history. Body mass index higher than and equal to 25 kg per m² remained stated as weighty or obese. Reference point bodily temperature (preceding to anesthesia provision), optimal heating of the surgical operation room, kind of sick person central heating system, the extent of fluid given intravenously, the over-all period of anesthesia, and level of surgical operation. Subjects reheating system types

stayed considered in place of passive (surgical clothing, panes, cotton wool winter blanket) or an active method of heating in the form of the electric heating blanket, space heater)

Follow up after operation:

A follow up of 30 days was given to the patients later surgery. Workers directed follow up were not blinded to during operation anesthesia maintenance. Period of stopover in the anesthesia care central unit, the occurrence of trembling afterwards surgery, the admittance in ICU, surgical site infection, and decrease rate after surgery in limit of duration of 30 days were observed on the typical case report file by one and only of the workers.

Statistical Analysis

Data entry procedure and analysis was completed by using version 21 of SPSS and micro soft excel 2019. Different Tables were formed to state narrative outcomes. Binary Logistic regression was done to test each factor with the related variable, and variables with a P value of less than 0.2 were supported to several different analyses. The confidence interval was 95% and the P-value of less than 0.05 was exploited by means of a finish point to aimed at outcomes of relations.

3. Results

A total of 300 patients from Al Falluga Teaching Hospital were selected in our study. The mean age of subjects was 52.51 ± 14.80 years, with Body mass index of 24.60±2.60 kg/m². Among 300 patients, 183 (44.3%) were affected with low temperature, and 117 (44.6%) were norm thermic. Overall, surgical procedures 150 (50%) and gynecologic operations 130 (43.3 %) were the two major operational procedures (Table 1). The incidence of inadvertent intraoperative hypothermia was 44.3 percent. The occurrence rates of hypothermia up to 1hour, 2hour, 3hour, and 4th hour subsequent influence of anesthesia remained 15.3%, 33.5%, 40.7%, and 42.9% respectively.

Table 1: Characteristics of study sample

Age (years) mean (SD)	52.51 ± 14.80
BMI (kg/m ²)	24.60 ± 2.60
Temperature	
Hypothermia	183 (44.3%)
Normothermic	117(44.6%)
sex	
Men	163 (54.3%)
Women	137(45.6%)
Type of surgery	
Surgical procedures	150 (50%)
Gynecological operations	130 (43.3 %)
others	20 (6.7 %)
Mode of anesthesia	
General	151(50.3%)
General plus segmental	149 (49.7%)

The duration of postanesthesia Care Unit(PACU) admission stayed suggestively longer in patients affected from low

temperature as compared to subjects whose temperature was normal (1.56 ± 3.15 h versus. 1.36 ± 1.58 h, $p < 0.0001$). Furthermore, individuals having low temperature stayed in the hospital after the operation as compared to the patients having a normal temperature, (postoperative bed days: 14.86 ± 7.85 days versus. 13.76 ± 7.38 days, $p < 0.001$). Besides, patients with decreased temperature had a greater likelihood stayed in the ICU as compared with the patients having a normal temperature (ICU admission rate after the surgery: 8.24% versus. 3.55%, $P < 0.001$). There was no statistically significant difference between hypothermia and normal temperature in surgical site infection (1.52% vs. 1.61%), or 30th day death rate after surgical operation (0.35% vs. 0.44%) was observed (Table 2).

Table 2: Impact of hypothermia on selected factors

	Hypothermia	normal	P
PACU admission	1.56 ± 3.15	1.36 ± 1.58 h	< 0.001
stayed in the hospital	14.86 ± 7.85	13.76 ± 7.38	< 0.001
Stay in ICU	8.24%	3.55%	< 0.001
Site infection baseline	1.52%	1.61%	0.061
Site infection 30 days	0.35%	0.44%	0.063

Factors associated with hypothermia are shown in the table below. Regression analysis showed protective effect of active warming (OR 0.35, 95 % CI, 0.25-0.94), Body mass index greater than or equal to 25 (OR 0.37, 95 % CI, 0.26-0.57), with raised reference line bodily temperature (OR 0.13, 95 % CI ,0.13-0.76) and greater temperature (OR 0.75, 95 % CI , 0.61-0.81). In the meantime, risk factors comprise bodily parts of surgical operation (OR 1.49, 95 % CI, 1.35-1.48), extended time period of induction of anesthesia (greater than 2 hours) (OR 1.56, 95 % CI, 1.06-3.14), non-endoscopic surgery (OR 1.15, 95 % CI, 1.25-1.67), Intravenous fluid greater than 1000ml (OR 1.76, 95 % CI , 1.35-1.67), and intraoperative irrigation fluid greater than 400ml (OR 1.26, 95 % CI , 1.26-1.78).

Table 3: Factors associated with hypothermia

Factor	OR (95%CI)
Active warming	0.35, 95 % CI, 0.25-0.94
Body mass index greater than or equal to 25	0.37, 95 % CI, 0.26-0.57
Raised reference line bodily temperature	0.13, 95 % CI, 0.13-0.76
Extended time of induction of anesthesia	1.56, 95 % CI, 1.06-3.14
Non-endoscopic surgery	1.15, 95 % CI, 1.25-1.67
Intravenous fluid greater than 1000ml	1.76, 95 % CI, 1.35-1.67
Intraoperative irrigation fluid	1.26, 95 % CI, 1.26-1.78

4. Discussion

In the United States, guidelines about the prevention of hypothermia were recommended, which demonstrated sick patients experiencing a surgical operation should be dynamically heated. (21, 28) Active warming were equally advised but comparatively infrequent in numerous western developed countries (21) During the operation hypothermia has been well-thought-out a mutual but avoidable hostile

occurrence so that it must be avoided and should be included into different clinical guidelines (29). Patients for Al Falluga Teaching Hospital were randomly selected.

Our outcomes demonstrate that active warming is responsible for solitarily 10.3% of entire sick patients, and the whole rate of hypothermia is at the peak of 44.3 percent. Subjects suffering from low temperature influences were correlated alongwith higher ICU admission ratios, extended PACU visits, prolongation of time period required for recovery, and lengthier hospital sojourn after the operation. The statistical figures of our study showed that occurrence rate of before operation, during operation, and after operative hypothermia in this study was 22.3%, 45.8%, and 51.7%, respectively. Hypothermia during surgical procedure was detected in 137 (56.8%) patients with temperature fluctuating from 33 to 35.9°C. This occurrence is maximum equated with study directed in Pakistan, where frequency of during operation stayed 33 percent, but decreased as compared to the occurrence of during operation hypothermia in a research conducted in Australia where the incidence was 74% , but that remain in anticipated occurrence range of during the operation hypothermia which is 30-40%. Our data equally exhibited during operation lively warming, extreme body mass index ,higher reference point bodily temperature formerly to anesthesia, and advanced temperature aid in holding during operation normal temperature. In conflicting to crucial processes, the prolonged period of anesthesia (greater than 2h), intravenous unwarmed fluid infusion greater than 1000ml, and open surgery suggestively upsurge peril of low temperature issue (30).

During operation hypothermia has been described in relation with the dangerous menaces ((9, 14-16, 31). Though our statistics did not display substantial fallouts in the duration of 30 days of surgery. This could be due to numerous explanations. First, this study could not be in full strength to consider a noteworthy change in surgical site infection (SSI) between hypothermia and normal temperature; furthermore, preoperative and postoperative antibiotics are regularly utilized in Iraq, like in sterilized surgery. Similar to some additional observational studies, there are typically are a some boundaries to our research. That awareness of hypothermia in the hospitals leads to early management of hypothermia like a warm blanket or space heater or warmed fluid was provided earlier to maintain normal temperature. Consequently, the real incident level of hypothermia could be underrated.

Therefore, this study describes that temperature is typically a crucial sign after blood pressure, pulse rate, and respiratory rate. Numerous medical training guiding principles and approval in advanced countries have evidently stated the goalmouth and maneuver decorum of temperature supervision. Though, in the 1990 or previously, a scarcity of health maintenance sources and inadequate social, economic development in Iraq delayed the accomplishment of temperature managing. Currently, underneath the background of speedy development of social finances in Iraq, shortage of health care sources is not extended the chief cause or reason for the unfamiliarity of temperature supervision. Throughout

study, grounded on casual consultation and communication with our workers, ignorance of opposing effects associated to hypothermia, and negligence of temperature may be the prime reason for hypothermia. On the contrary, either price code or compensation policy on during the operation patient warming is not accessible in Iraq, which can equally result in tremendously low exploitation of the patient warming system.

5. Conclusion

This study has concluded that the incidence of hypothermia is relatively high in our patient. The study has equally provided evidence about the outcomes with the consequences of hypothermia in patients.

References

- [1] Poveda VdB, Galvao CM, Dantas RAS. Hipotermia no período intra-operatório em pacientes submetidos a cirurgias eletivas. *J Acta Paulista de Enfermagem*. 2009; 22:361-6.
- [2] Bindu B, Bindra A, Rath G. Temperature management under general anesthesia: Compulsion or option. *J Anaesthesiol Clin Pharmacol*. 2017;33(3):306-16.
- [3] Sessler DJ. *NEJM*. Mild perioperative hypothermia. 1997;336(24):1730-7.
- [4] Slotman GJ, Jed EH, Burchard KW. *JAMA*. Adverse effects of hypothermia in postoperative patients. 1985;149(4):495-501.
- [5] Tappen RM, Andre SP. *JAMA*. Inadvertent hypothermia in elderly surgical patients. 1996;63(3):639-45.
- [6] Long KC, Tanner EJ, Frey M, Leitao Jr MM, Levine DA, Gardner GJ, et al. Intraoperative hypothermia during primary surgical cytoreduction for advanced ovarian cancer: risk factors and associations with postoperative morbidity. 2013;131(3):525-30.
- [7] Frank SM, Beattie C, Christopherson R, Norris EJ, Perler BA, Williams GM, et al. Unintentional hypothermia is associated with postoperative myocardial ischemia. The Perioperative Ischemia Randomized Anesthesia Trial Study Group. 1993;78(3):468-76.
- [8] Frank SM, Fleisher LA, Breslow MJ, Higgins MS, Olson KF, Kelly S, et al. Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events: a randomized clinical trial. 1997;277(14):1127-34.
- [9] Schmied H, Reiter A, Kurz A, Sessler D, Kozek SJ. *TL*. Mild hypothermia increases blood loss and transfusion requirements during total hip arthroplasty. 1996;347(8997):289-92.
- [10] Rajagopalan S, Mascha E, Na J, Sessler DJ. *ATASoA*. The effects of mild perioperative hypothermia on blood loss and transfusion requirement. 2008;108(1):71-7.
- [11] Heier T, Caldwell JE, Sessler DI, Miller RD. *JA*. Mild intraoperative hypothermia increases duration of action and spontaneous recovery of vecuronium blockade during nitrous oxide-isoflurane anesthesia in humans. 1991;74(5):815-9.
- [12] Leslie K, Sessler DI, Bjorksten AR, Moayeri AJA, Analgesia. Mild hypothermia alters propofol pharmacokinetics and increases the duration of action of atracurium. 1995;80(5):1007-14.
- [13] Bock M, Muller J, Bach A, Bohrer H, Martin E, Motsch J. *Bjoa*. Effects of preinduction and intraoperative warming during major laparotomy. 1998;80(2):159-63.
- [14] Kurz A, Sessler DI, Lenhardt R. *JNEJoM*. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. 1996;334(19):1209-16.
- [15] Aasen AO, Barie PS, Faist E, Ford HR, Fry DE, Hau T. *JSi*. Panel discussion: current issues in the prevention and management of surgical site infection—part 1. 2002;3(SI):s1-s7.
- [16] Barie P. *JSi*. Surgical site infections: epidemiology and prevention. 2002;3(SI):s9-s21.
- [17] Scott EM, Buckland R. *Jaj*. A systematic review of intraoperative warming to prevent postoperative complications. 2006;83(5):1090-113.
- [18] Wong P, Kumar S, Bohra A, Whetter D, Leaper DJ. *BJoS*, Surgery S. Randomized clinical trial of perioperative systemic warming in major elective abdominal surgery. 2007;94(4):421-6.
- [19] Bondok R. *JAA*. Hypothermia in trauma: fluid and blood warming. 2009; 2:45-7.
- [20] Burns SM, Piotrowski K, Caraffa G, Wojnakowski M. *JPN*. Incidence of postoperative hypothermia and the relationship to clinical variables. 2010;25(5):286-9.
- [21] Burger L, Fitzpatrick J. *BJoN*. Prevention of inadvertent perioperative hypothermia. 2009;18(18):1114-9.
- [22] Di S. *Temperature disturbances* Gregory G.A's pediatric anesthesia. (4th ed.). 2002:53-84.
- [23] Moola S, Lockwood C. *JEBH*. Effectiveness of strategies for the management and/or prevention of hypothermia within the adult perioperative environment. 2011;9(4):337-45.
- [24] Hart SR, Bordes B, Hart J, Corsino D, Harmon D. Unintended perioperative hypothermia. *Ochsner J*. 2011; 11(3):259-70.
- [25] National Collaborating Centre for Nursing and Supportive Care (UK). *The Management of Inadvertent Perioperative Hypothermia in Adults* London: Royal College of Nursing (UK); 2008 Apr [Available from: Available from: <https://www.ncbi.nlm.nih.gov/books/NBK53777/>].
- [26] Lenhardt R. *JBP*, Anaesthesiology RC. Monitoring and thermal management. 2003;17(4):569-81.
- [27] Amoateng-Adjepong Y, Del Mundo J, Manthous CA. *JC*. Accuracy of an infrared tympanic thermometer. 1999;115(4):1002-5.
- [28] Forbes SS, Eskicioglu C, Nathens AB, Fenech DS, Laflamme C, McLean RF, et al. Evidence-based guidelines for prevention of perioperative hypothermia. 2009;209(4):492.
- [29] Jeran U. *JPN*. Patient temperature: an introduction to the clinical guideline for the prevention of unplanned perioperative hypothermia. 2001;16(5):303-4.
- [30] Kongsayreepong S, Chaibundit C, Chadpaibool J, Kormoltri C, Suraseranivongse S, Suwannanonda P, et al.

Predictor of core hypothermia and the surgical intensive care unit. 2003;96(3):826-33.

- [31] Hedrick TL, Heckman JA, Smith RL, Sawyer RG, Friel CM, Foley EFJotACoS. Efficacy of protocol implementation on incidence of wound infection in colorectal operations. 2007;205(3):432-8.