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Risk factors of post-operative hypothermia

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Abstract--The core body temperature less than 36°C or 96.8°F at the post operative period, is called hypothermia. In the postoperative phase, there are various reasons are developing the hypothermia. This may include surgical site infections, blood transfusions during or after surgery, recovery room or Intensive care unit stay etc. this factors may be modifiable through the nursing practice. Objective: objective of this study was to identify the risk factors of post operative hypothermia. Method: a hospital based case-control study was undertaken. All the postoperative patients (N=250) that underwent anaesthesia were included. The body temperature was measured after immediately after surgery at the arrival of recovery room in post operative period. Analysis was done using the software SPSS version 20.00. Results: the incidence of post operative hypothermia immediately at recovery room was 185 (74%) were having hypothermia and 65 (26%) were having no hypothermia. 't' value of Duration of surgery was 0.816 and 'p' value was 0.015, 't' value of Duration of anaesthesia was 0.758 and 'p' value was 0.007, 't' value of Post operative room temperature was -2.489 and 'p' value was 0.00, Chi-square value of Magnitude of procedure was 32.674 and 'p' value was 0.01, Chi-square value of Condition of surgery was 15.998 and 'p' value was 0.01, Chi-square value of Type of anaesthesia was 42.644 and 'p' value was 0.01, Chi-square value of Presence of co-morbidity or illness was 8.780 and 'p' value was 0.067, Chi-square value of Type of Shivering was 224.834 and 'p' value was 0.01, Chi-square value Slurred speech was 48.458 and 'p' value was 0.01, Chi-square value Lack of coordination was 10.482 and 'p' value was 0.001, Chi-square value of Drowsiness was 8.642 and 'p' value was 0.003, Chi-square value of Confusion / memory loss was 31.055 and 'p' value was 0.0, therefore Post

operative IVF, Duration of surgery, Duration of anaesthesia, Post operative room temperature, Magnitude of procedure and Condition of surgery, Type of anaesthesia, Shivering, Slurred speech, Lack of coordination, Drowsiness and Confusion / memory loss was found highly significant. Conclusions: The occurrence of post operative hypothermia in recovery room at post operative period was high. All the surgical peri-operative team should be included to reduce the risk of post operative hypothermia and other complications for better prognosis of patient.

Keywords---hypothermia, temperature, peri-operative, recovery room, ICU.

Introduction

Temperature of body performs a vital role in maintaining normal human activities. However, factors like, the use of anesthesia, operation theater temperature, skin exposure and cold irrigation or Intra Venous Fluids of a patient with the use of intravenous solutions during surgery can lead to hypothermia. Hypothermia occurs when the core body temperature of an organism is $<36^{\circ}\text{C}$, commonly affecting up to 70% of surgical patients perioperatively.¹ Postoperative hypothermia is a common but preventable problem in patients that underwent surgical interventions or procedures. It has been demonstrated that hypothermia is associated with increased mortality and morbidity rates, increases cost and reduces patient comfort by prolonging the duration of stay in the recovery room and hospital. The three major common complaints of patients recovering from surgery and anesthesia are surgical site pain, nausea and vomiting due to various medications (anesthetics, opioids, antibiotics, etc.) and shivering due to hypothermia. Temperature management within the Peri-operative period is an important part of a standard of practice in providing effective patient safety and comfort to the post operative patients.² In the postoperative phase, there are various reasons for developing hypothermia. This may include surgical site infections, blood transfusions during or after surgery, recovery room or Intensive care unit stay etc. these factors may be modifiable through the nursing practice. In our hospital the operated patients are transferred to the recovery room after the completion of surgery, that time patient having operation theatre dress and they are covered by only simple bed sheet so that patients will be exposed to the cold room temperature and environment therefore the risk of hypothermia increases. Therefore the aim of this study was to identify the risk factors of post operative hypothermia, at tertiary care hospital, Karad.

Need For the Study

Hypothermia has been linked to pressure ulcer development because there is increased length of stay in the hospital in post operative patients and also delay for the recovery and discharge from hospital. The prevention and management of hypothermia and promotion of normothermia is an international priority in the prevention of post operative complications and also the speedy recovery and generally decreases the cost of hospital stay for the patients. A majority of

researchers agreed that the temperature management is one of the essential components and that plays important role in patient's wellbeing and comfort in overall in the peri-operative period.¹¹

International anaesthesia societies such as the American Society of Anaesthesiologists (ASA) and the National Institute for Health and Care Excellence (NICE) recommend intra operative temperature monitoring and active patient warming as standard practices.^{14,15} it gives promotion of health by decreasing the risk factors and help to decrease the mortality rate due to the post operative complications associated with the hypothermia and ultimately will help the family member reduction in anxiety related to recovery of patient. Staff nurses from OT, ICUs and other Critical areas will be much benefited by updating their knowledge and practical skill in scientific management of post operative hypothermia. Monitoring of temperature helps to correct the health status to reduce complications and increase the wellness. By reducing the risk factors we can decrease the post operative hypothermia. It helps to reduce heat loss and patient can get comfort.

Aim of the study

Hypothermia is a common post operative as well as important risk factor for mortality and morbidity, our aim of study was, 'to identify the risk factors of post operative hypothermia in post operative phase at recovery room.'

Research Methodology

After institutional ethical approval the present study was started. Observational case-control study was conducted from April 2021 to April 2022. Purposive Sampling Technique was used to collect samples. The study was conducted at Krishna Hospital & Medical Research Centre, Karad, Maharashtra and the areas was Recovery Room, Surgical ICU and Surgery wards. It is the largest super speciality, tertiary care hospital in Satara district which has different wards and ICU's. It has total 10 operation theatres and total bed strength of hospital is 1300 beds. Before transfer to ward patients are transferred to recovery room until vital signs are stable. Study participants were Post operative patients who were above 18 years and operated under anaesthesia at Krishna Hospital & Medical Research Centre, Karad, Maharashtra. Patients who are having mental illness, Burn patient and non Cardiac surgery patients were excluded. The independent variables were all socio demographical variables and risk factors of post operative hypothermia. The structured data collection tool was used among the post operative patients. Individually purpose of study were explained to patients and taken informed consent. axiliary temperature was measured by using digital thermometer. (Dr. Odin digital thermometer type MT-101, with an accuracy $\pm 0.1^{\circ}\text{C}$ ($\pm 0.2^{\circ}\text{F}$), in the range of 32°C to 42.6°C that is 90.0°F to 109.9°F) The digital thermometer was calibrated in accordance with the manufacturer's instruction before each reading. The room temperature was measured with thermocouple room thermometer. After assessment the post operative patient were divided into hypothermia ($<36^{\circ}\text{C}$) and no hypothermia ($\geq 36^{\circ}\text{C}$). Data was analysed by with the objectives of the study by using descriptive and inferential statistics. The plan of data analysis and interpretation was developed under the guidance of statistical expert. The data

were entered in excel sheet and clean up then by using software SPSS version 20.00 analysis was done. 'p' value <0.05 was considered statistically significant.

Results

Table 1: Assessment factors of post operative patients (n=250)

Factors	Frequency (%)	Mean	SD	't' value	'p' value
Body temperature:					
• Hypothermia	185 (76%)	96.168	1.2005	-22.018	0.09
• No hypothermia	65 (24%)	98.389			
Post operative IVF:					
• Hypothermia	185 (76%)	1336.76	506.758	1.305	0.013
• No hypothermia	65 (24%)	1241.54			
Duration of surgery:					
• Hypothermia	185 (76%)	1.61	0.569	0.816	0.015
• No hypothermia	65 (24%)	1.54			
Duration of anaesthesia:					
• Hypothermia	185 (76%)	1.60	0.562	0.758	0.007
• No hypothermia	65 (24%)	1.54			
Post operative room temperature:					
• Hypothermia	185 (76%)	67.66	1.940	-2.489	0.01
• No hypothermia	65 (24%)	68.35			

Table 1, shows that, Out of 250 patients, 185 (74%) were having hypothermia and 65 (26%) were having no hypothermia in factors of Body temperature, Post operative IVF, Duration of surgery, Duration of anaesthesia, Post operative room temperature. 't' value of Body temperature was -22.018 and 'p' value was 0.09, 't' value of Post operative IVF was 1.305 and 'p' value was 0.013, 't' value of Duration of surgery was 0.816 and 'p' value was 0.015, 't' value of Duration of anaesthesia was 0.758 and 'p' value was 0.007, 't' value of Post operative room temperature was -2.489 and 'p' value was 0.00. Therefore Body temperature was not significant and Post operative IVF, Duration of surgery, Duration of anaesthesia, Post operative room temperature was significant.

Table 2: Assessment of Magnitude of procedure and Condition of surgery of post operative patients (n=250)

Factors	Hypothermia (%)	No hypothermia (%)	χ^2 value	'p' value
Magnitude of procedure:				
a) Major surgery	151 (81.6%)	29 (44.6%)		
b) Minor surgery	34 (18.4%)	36 (55.4%)	32.674	0.01
Condition of surgery:				
a) Elective / preplanned	116 (62.7%)	58 (89.2%)		

b)	Emergency	69 (37.3%)	7 (10.8%)	15.998	0.01
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Table 2, shows that, Out of 250 patients, 151 (81.6%) were having hypothermia and 29 (44.6%) were having no hypothermia in Major surgery, 34 (18.4%) were having hypothermia and 36 (55.4%) were having no hypothermia in Minor surgery and 116 (62.7%) were having hypothermia and 58 (89.2%) were having no hypothermia in Elective / preplanned surgery whereas, 69 (37.3%) were having hypothermia and 7 (10.8%) were having no hypothermia in Emergency surgery. Chi-square value of Magnitude of procedure was 32.674 and 'p' value was 0.01, Chi-square value of Condition of surgery was 15.998 and 'p' value was 0.01, therefore Magnitude of procedure and Condition of surgery was significant.

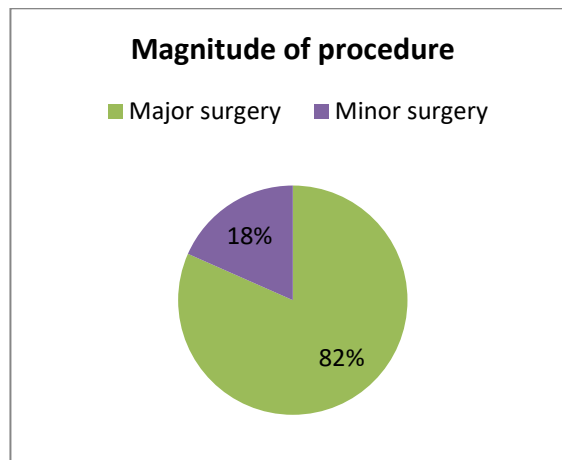


Fig.1 percentage distribution of magnitude of procedure

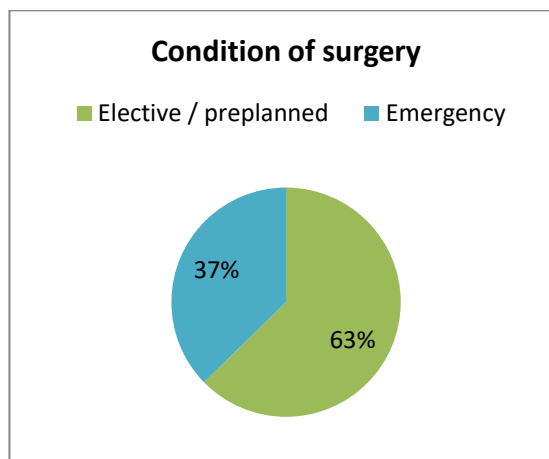


Fig.2 percentage distribution of condition of surgery

Table 3: Assessment of Type of anaesthesia and Presence of co-morbidity or illness of post operative patients (n=250)

Factors	Hypothermia (%)	No hypothermia (%)	χ^2 value	'p' value
Type of anaesthesia:				
a) Spinal	136 (73.5%)	26 (40.0%)	42.644	0.01
b) General	43 (23.2%)	23 (35.4%)		
c) Local	2 (1.1%)	14 (21.5%)		
d) Combined	4 (2.2%)	2 (3.1%)		
Presence of co-morbidity or illness:				
a) Hypertension	18 (9.7%)	1 (1.5%)	8.780	0.067
b) Diabetes M	11 (5.9%)	2 (3.1%)		
c) Anemia	7 (3.8%)	0 (0.0%)		
d) Any other	16 (8.6%)	6 (9.2%)		
e) No any	133 (71.9%)	56 (86.2%)		

Table 3, shows that, Out of 250 patients, 136 (73.5%) were having hypothermia and 26 (40.0%) were having no hypothermia in spinal anaesthesia, 43 (23.2%) were having hypothermia and 23 (35.4%) were having no hypothermia in general anaesthesia, 2 (1.1%) were having hypothermia and 14 (21.5%) were having no hypothermia in local anaesthesia 4 (2.2%) were having hypothermia and 2 (3.1%) were having no hypothermia in combined. whereas, 18 (9.7%) were having hypothermia and 1 (1.5%) were having no hypothermia in Hypertension, 11 (5.9%) were having hypothermia and 2 (3.1%) were having no hypothermia in Diabetes Mellitus, 7 (3.8%) were having hypothermia and 0 (0.0%) were having no hypothermia in anemia, 16 (8.6%) were having hypothermia and 6 (9.2%) were having no hypothermia in any other illness and 133 (71.9%) were having hypothermia and 56 (86.2%) were having no hypothermia in no any illness. Chi-square value of Type of anaesthesia was 42.644 and 'p' value was 0.01, Chi-square value of Presence of co-morbidity or illness was 8.780 and 'p' value was 0.067, and therefore Type of anaesthesia was significant and Presence of co-morbidity or illness was not significant.

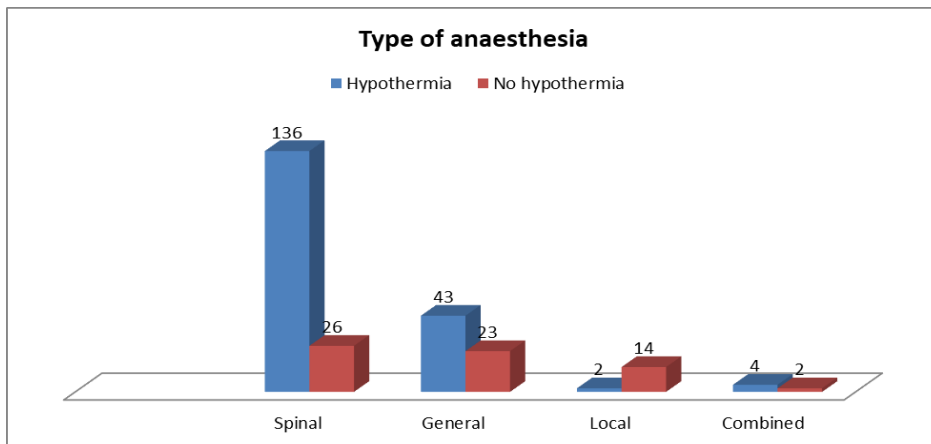


Fig.3 frequency distribution of type of anaesthesia

Table 4: Assessment of Shivering, Slurred speech and Shallow breathing of post operative patients (n=250)

Factors	Hypothermia (%)	No hypothermia (%)	χ^2 value	'p' value
Shivering:				
a) Yes				
b) No	182 (98.4%) 3 (1.6%)	2 (3.1%) 63 (96.9%)	224.834	0.01
Slurred speech:				
a) Yes				
b) No	179 (96.8%) 6 (3.2%)	42 (64.6%) 23 (35.4%)	48.458	0.01
Shallow breathing:				
a) Yes				
b) No	6 (3.2%) 179 (96.8%)	2 (3.1%) 63 (96.9%)	0.004	0.948

Table 4, shows that, Out of 250 patients, 182 (98.4%) were having hypothermia and 2 (3.1%) were having no hypothermia in Shivering present patients whereas 3 (1.6%) were having hypothermia and 63 (96.9%) were having no hypothermia in Shivering not present patients, 179 (96.8%) were having hypothermia and 42 (64.6%) were having no hypothermia in Slurred speech patients. whereas 6 (3.2%) were having hypothermia and 23 (35.4%) were having no hypothermia in no Slurred speech patients, 6 (3.2%) were having hypothermia and 2 (3.1%) were having no hypothermia in Shallow breathing patients, whereas 179 (96.8%) were having hypothermia and 63 (96.9%) were having no hypothermia in no Shallow breathing patients. Chi-square value of Type of Shivering was 224.834 and 'p' value was 0.01, Chi-square value Slurred speech was 48.458 and 'p' value was 0.01, Chi-square value Shallow breathing was 0.004 and 'p' value was 0.948 and therefore Shivering was significant, Slurred speech was significant and Shallow breathing was not significant.

Table 5: Assessment of Weak pulse, Lack of coordination and Drowsiness of post operative patients (n=250)

Factors	Hypothermia (%)	No hypothermia (%)	χ^2 value	'p' value
Weak pulse:				
a) Yes				
b) No	11 (5.9%) 174 (94.1%)	2 (3.1%) 63 (96.9%)	0.803	0.370
Lack of coordination:				
a) Yes				
b) No	182 (98.4%) 3 (1.6%)	58 (89.2%) 7 (10.8%)	10.482	0.001
Drowsiness:				
a) Yes				
b) No	185 (100%) 0 (0.0%)	62 (95.4%) 3 (4.6%)	8.642	0.003

Table 5, shows that, Out of 250 patients, 11 (5.9%) were having hypothermia and 2 (3.1%) were having no hypothermia in Weak pulse patients whereas 174 (94.1%) were having hypothermia and 63 (96.9%) were having no hypothermia in no Weak pulse patients, 182 (98.4%) were having hypothermia and 58 (89.2%) were having no hypothermia in Lack of coordination patients. whereas 3 (1.6%) were having hypothermia and 7 (10.8%) were having no hypothermia in no Lack of coordination patients, 185 (100%) were having hypothermia and 62 (95.4%) were having no hypothermia in Drowsiness patients, whereas 0 (0.0%) were having hypothermia and 3 (4.6%) were having no hypothermia in no Drowsiness patients. Chi-square value of Weak pulse was 0.803 and 'p' value was 0.370, Chi-square value Lack of coordination was 10.482 and 'p' value was 0.001, Chi-square value of Drowsiness was 8.642 and 'p' value was 0.003 and therefore Weak pulse was not significant, Lack of coordination was significant and Drowsiness was significant.

Table 6: Assessment of Confusion / memory loss and Loss of consciousness of post operative patients (n=250)

Factors	Hypothermia (%)	No hypothermia (%)	χ^2 value	'p' value
Confusion / memory loss:				
a) Yes	82 (44.3%)	4 (6.2%)	31.055	0.01
b) No	103 (55.7%)	61 (93.8%)		
Loss of consciousness:				
a) Yes	3 (1.6%)	0 (0.0%)	1.067	0.302
b) No	182 (98.4%)	65 (100%)		

Table 6, shows that, Out of 250 patients, 82 (44.3%) were having hypothermia and 4 (6.2%) were having no hypothermia in Confusion / memory loss patients whereas 103 (55.7%) were having hypothermia and 61 (93.8%) were having no hypothermia in no Confusion / memory loss patients, 3 (1.6%) were having hypothermia and 0 (0.0%) were having no hypothermia in Loss of consciousness patients. whereas 182 (98.4%) were having hypothermia and 65 (100%) were having no hypothermia in no Loss of consciousness patients, Chi-square value of Confusion / memory loss was 31.055 and 'p' value was 0.01, Chi-square value Loss of consciousness was 1.067 and 'p' value was 0.302 and therefore Confusion / memory loss was significant, Loss of consciousness was not significant.

Discussion

The most common complications in the recovery room are hypothermia, which is associated with anaesthesia and surgical intervention.^{3,4} Early study indicate that the incidence of hypothermia range from 50% to 90%.⁵ Old and recent observational studies also describes to a high prevalence of hypothermia in the peri-operative period. Poveda et al., this study with 70 patients, observed a significant drop in patients' temperature in the first hour of surgery, reaching a mean of 33.6 °C by the end of the fourth hour.¹³ Vaughan and colleagues, in a study with 198 patients, observed a 60% prevalence of hypothermia in the Post

operative Care Unit (PACU).¹² The present study showed that 185 (74%) patients had body temperature of less than 36 °C on post operative period at the recovery room. In this study significant factors found were Post operative IVF, Duration of surgery, Duration of anaesthesia; Post operative room temperature, Magnitude of procedure and Condition of surgery, type of anaesthesia, Shivering, Slurred speech, Lack of coordination, Drowsiness and Confusion / memory loss was significant. While considering the p- value < 0.05 is significant and ≥ 0.05 is considering not significant. Therefore these significant factors were risk factors found in the present study. In this study, the incidence of hypothermia was found to be 74% among them the patients that underwent major surgical intervention were developed high risk of hypothermia that was 151 (81.6%) out of 250 patients. Major risk factor to develop the post operative hypothermia were found anaesthesia type, the spinal anaesthesia patients were having more risk of developed post operative hypothermia that was 136 (73.5%) out of 250 patients. Majority of post operative patients with a sign of drowsiness were developed the hypothermia that was 185 patients out of 250. We were able to confirm that our study, like other studies, was safe, easy to apply, fast to run, low cost, with the possibility of analyzing several data through a simple observation of the patients in the recovery room. We state that a larger number of samples or patients are necessary for a more accurate analysis or results.

Conclusion

The occurrence of post operative hypothermia in recovery room at post operative period was high. The post operative room temperature, duration and type of anaesthesia, magnitude of procedure, condition of surgery, shivering, slurred speech, confusion or memory loss and lack of coordination were strongly significant factors for developing the post operative hypothermia. All the surgical peri-operative team should be included to reduce the risk of post operative hypothermia and other complications for better prognosis of patient. More than half of the analyzed patients were developed hypothermia through postoperative care unit admission. There are a various risk factors for the post operative hypothermia but which is commonly observed in our setting that can be modified or prevented by the nursing management. Identification of risk factors is one of the important and first steps towards the prevention and management of post operative hypothermia by management of pre and intra operative nursing management.

Conflict of Interest

The authors certify that they have no involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this paper.

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Ethical approval

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