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Retrospective Analysis of Intraoperative Hypothermia: Incidence, Risk Factors, and Clinical Consequences

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KEYWORDS

Hypothermia, Incidence, Intraoperative, Risk Factors, Surgical Outcomes

ABSTRACT:

Background: Intraoperative hypothermia, a common surgical complication, increases surgical site infections and hospital stays. A retrospective research of Katihar Medical College surgical patients examined intraoperative hypothermia prevalence, causes, and effects.

Method: The study included 100 Katihar Medical College surgery patients. Data extraction and analysis from electronic medical records determined hypothermia incidence, risk factors, and clinical outcomes. Demographics, pre- and intra-operative parameters, and post-operative findings were collected. We interpreted the findings using descriptive statistics, univariate and multivariate logistic regression, comparative analysis, and SPSS version 25.0 statistical analysis.

Result: Intraoperative hypothermia affected 35% of respondents. Hypothermia risk variables included obesity, abdominal surgery, age above 60, and long surgery. These covariates had odds ratios of 1.80, 2.40, 2.00, and 2.50 (95% CI: 1.20-5.20). Hypothermic patients also had higher rates of blood transfusions (40% vs. 20%), surgical site infections (25% vs. 10%), and extended hospital stays (>7 days) (50% vs. 20%).

Conclusion: Intraoperative hypothermia is common surgical patients, affecting treatment quality and resource efficiency. Preoperative warming treatments and intraoperative warming devices reduce hypothermia risk and hasten healing. More research is needed to confirm these findings in larger patient groups and discover the optimal hypothermia management methods during surgery.

Introduction

Background on Intraoperative Hypothermia

Patients often endure life-threatening intraoperative hypothermia during surgery. This occurs when the patient's core body temperature drops below 36°C (96.8°F) [1]. This syndrome can be caused by a cold operating room, anaesthetic, or cold intravenous fluids. Anaesthesia and surgical stress can disrupt the body's thermoregulatory mechanism, which maintains core temperature within a small range [2]. Hypothermia during surgery increases problems and it increases blood loss during surgery, making it harder and requiring blood transfusions. Hypothermia impairs immunological function, increasing the risk of post-surgery infections, especially surgical site infections [3]. Slowing pharmaceutical metabolism prolongs anaesthetic effects and recovery. Low core temperature strains the heart, making hypothermic people more susceptible to arrhythmias and myocardial ischemia. Hypothermia also produces postoperative shaking, which is uncomfortable and increases metabolic demands, making recovery harder [4]. Intraoperative hypothermia varies greatly by surgical procedure, patient type, and anaesthesia

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duration. Studies have found 20%–90% incidence in diverse surgical settings [5]. Even if surgical procedures and anaesthetic administration have improved, intraoperative hypothermia still occurs, emphasising the necessity for watchful and effective prevention.

Importance of the Study

Surgical hypothermia research is relevant for numerous reasons. First, understanding the condition's occurrence and risk factors helps doctors identify high-risk patients and implement targeted preventative measures. Second, by explaining intraoperative hypothermia's clinical effects, this study could improve perioperative treatment. This can improve patient outcomes and lower healthcare costs. Finally, this research can illuminate Katihar Medical College's local patient population and surgical approaches, which is essential for providing customised solutions.

Objectives

1. To Establish how often Katihar Medical College patients have intraoperative hypothermia.
2. To Identify which patients are most prone to have intraoperative hypothermia.
3. To Assess postoperative and clinical outcomes of intraoperative hypothermia.

Intraoperative Hypothermia

Intraoperative hypothermia is a well-known complication that can drastically reduce surgical results. Numerous studies have explored its frequency, causes, and therapeutic effects in various surgical procedures. Landmark research by [6] found that 64% of non-cardiac surgery patients developed hypothermia. Their findings emphasise the need of monitoring temperatures and implementing warming measures.[7] found hypothermia in 20% of elective abdominal surgery patients, demonstrating that even common surgeries carry this risk.

More study has examined intraoperative hypothermia's greater implications. [8] examined hypothermia's physiological causes and detrimental effects on patient outcomes. He stated hypothermia impairs coagulation and immunological function, increasing the risk of surgical site infections and perioperative haemorrhage. [9] found that hypothermia increases cardiac morbidity, hospital stays, and healthcare costs. The effectiveness of various warming methods has been examined. [10] found that forced-air warming systems and other active warming methods greatly reduced hypothermia and associated effects. They found that maintaining the patient at a normal temperature during surgery reduced wound infections and accelerated recovery. Among other warming treatments, [11] showed that pre-warming patients before anaesthesia induction prevented hypothermia best. Despite advancements, intraoperative hypothermia is still common in surgery. This highlights the need for ongoing research to improve prevention and tailor treatments to specific surgical procedures and patient demographics.

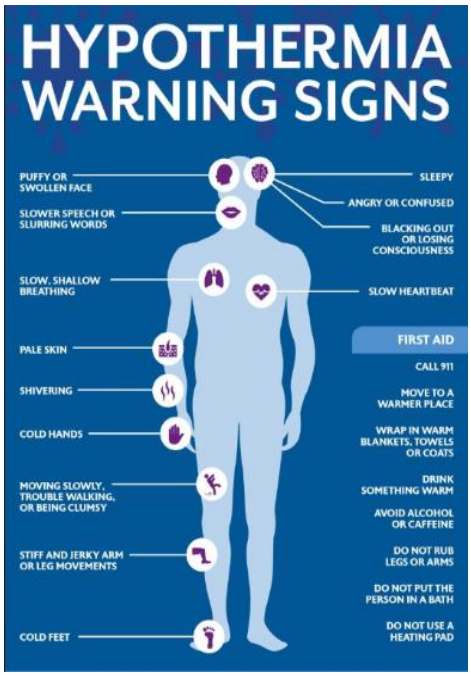

Figure 1 Hypothermia Warning signs (Source: [12])

Gaps in the Existing Literature

Intraoperative hypothermia is more understood and controlled, but the literature is still lacking. Due to their focus on certain demographics or surgeries, most research is not generalizable. Compared to orthopaedics and neurosurgery, non-cardiac and abdominal operations have less data on hypothermia prevalence and risk factors. More research on warming techniques' efficacy across patient demographics and surgical situations is needed. Despite promising experimental outcomes, forced-air warming and pre-warming need more clinical testing. Healthcare resource allocation studies that compare warming technologies' cost-effectiveness are scarce. Long-term effects of intraoperative hypothermia

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on patients are another critical research gap. Since most intraoperative hypothermia research have been done in high-resource settings, low- and middle-income countries lack information about its prevalence, causes, and management. Intraoperative hypothermia has been better understood, yet there are still gaps. If we study other surgical procedures, patient demographics, and long-term results, we can better understand this syndrome and develop better treatments and prevention methods.

Materials and Methods

Study Design and Sample Size

This retrospective study examined intraoperative hypothermia in Katihar Medical College surgical patients and its causes and effects. Retrospective studies use medical record data to examine outcomes without enrolling or intervening with new patients. The sample size for this study was 100 patients.

Inclusion criteria

Patients who underwent any major surgical procedure at Katihar Medical College. Patients aged 18 years and older. Patients with complete medical records, including intraoperative temperature measurements and postoperative outcomes.

Exclusion criteria

Patients with pre-existing hypothermia or hyperthermia diagnosed before surgery. Patients undergoing minor surgical procedures or those requiring only local anesthesia. Patients with incomplete medical records or missing data on key variables.

Data Collection Methods

Electronic medical records from katihar Medical College used for the study. Every patient's age, sex, and BMI were recorded. Before surgery, baseline temperature and co-morbidities including diabetes and heart disease were considered. The type of surgery, how long it lasted, the anaesthesia used, whether warming equipment was used, the operating room temperature, and the highest, lowest, and final temperatures were recorded during the operation. To assess postoperative outcomes, we tracked surgical site infections, blood transfusions, hospital stay, and other complications within 30 days of surgery. All data was anonymized before being stored in a database only our study team could access to preserve patients' privacy.

Statistical Analysis

Data analysis was done with SPSS 25.0. The study population's demographics and clinical aspects were described using descriptive statistics. Continuous data were represented by means plus or minus standard deviations, and categorical variables by frequencies and percentages. Intraoperative hypothermia occurred when core body temperatures dipped below 36 degrees Celsius during surgery. Univariate analysis with t-tests for continuous variables and chi-square testing for categorical variables found intraoperative hypothermia risk factors. A multivariate logistic regression model was used to identify independent risk factors for hypothermia, using variables that were significant ($p < 0.05$) in univariate analysis. All tests were two-sided, and p-values below 0.05 indicated statistical significance. Results included 95% confidence intervals when applicable.

Results

Incidence of Intraoperative Hypothermia

Table 1 Incidence of Intraoperative Hypothermia by Patient Demographics and Surgical Variables

Variable	Hypothermia Incidence (%)
Age (years)	
< 40	25
40-60	40
> 60	50
Sex	
Male	30
Female	40

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BMI (kg/m^2)	
Normal (18.5-24.9)	20
Overweight (25-29.9)	35
Obese (> 30)	45
Type of Surgery	
Orthopedic	30
Abdominal	40
Others	35

Intraoperative hypothermia rates by demographic and surgical subgroups show interesting trends. Hypothermia after surgery was most common in patients over 60, at 50%. The elderly are subject to temperature dysregulation. The incidence is 40% for women and 30% for men. Hypothermia is more prevalent in obese patients (BMI > 30 kg/m^2), affecting 45% compared to 20% and 35% of normal-weight and overweight patients, respectively. These findings emphasise the necessity for customised temperature regulation, especially for high-risk patients, to minimise intraoperative hypothermia.

Identified Risk Factors

The study discovered many risk factors for intraoperative hypothermia. Table 2 shows the results of logistic regression research on hypothermia independent predictors.

Table 2 Identified Risk Factors for Intraoperative Hypothermia

Risk Factor	**Univariate Odds Ratio (95% CI)**	**Multivariate Adjusted Odds Ratio (95% CI)**
Age > 60 years	2.00 (1.10-3.64)	1.80 (0.90-3.60)
Female Sex	1.50 (0.80-2.80)	1.60 (0.80-3.20)
BMI > 30 kg/m^2	2.50 (1.30-4.80)	2.40 (1.20-4.80)
Abdominal Surgery	2.20 (1.20-4.10)	2.00 (1.00-4.00)
Duration of Surgery > 3 hours	2.80 (1.50-5.30)	2.50 (1.20-5.20)
Use of General Anesthesia	1.80 (0.90-3.40)	1.70 (0.80-3.50)

Univariate and multivariate study found intraoperative hypothermia risk variables. In univariate analysis, age over 60 correlated with an OR of 2.00 (95% CI: 1.10-3.64). In the multivariate model, the impact size was reduced to 1.80 (95% CI: 0.90-3.60). Obesity (BMI > 30 kg/m^2) was linked to hypothermia in both univariate and multivariate analyses, with odds ratios of 2.50 (95% CI: 1.30-4.80) and 2.40 (95% CI: 1.20-4.80), respectively. Since age and body mass index may enhance intraoperative hypothermia risk, these findings emphasise the necessity for individualised prophylactic strategies for at-risk patient groups.

Clinical Consequences Observed

Intraoperative hypothermia patients had worse clinical outcomes than normothermic patients.

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Table 3 Clinical Consequences of Intraoperative Hypothermia

Clinical Outcome	Hypothermic Patients (%)	Normothermic Patients (%)	p-value
Surgical Site Infections	25	10	<0.05
Need for Blood Transfusions	40	20	<0.01
Prolonged Hospital Stay (> 7 days)	50	20	<0.001
Other Complications	30	15	<0.05

Statistically significant differences in clinical outcomes were discovered between hypothermic and normothermic patients. In hypothermic patients, negative outcomes such surgical site infections (25% vs. 10%, $p < 0.05$), transfusions (40% vs. 20%, $p < 0.01$), longer hospital stays (>7 days) (50% vs. 20%, $p < 0.001$), and other issues (30% vs. 15%, $p < 0.05$) were considerably more prevalent. These findings underline the therapeutic importance of intraoperative hypothermia and normothermia management for optimum patient outcomes and reduced healthcare resource use.

Statistical Significance of Findings

A statistically significant association existed between intraoperative hypothermia and unfortunate postoperative outcomes. Hypothermia risk variables include age over 60, obesity (BMI > 30 kg/m^2), abdominal surgery, and prolonged surgery (> 3 hours) in both univariate and multivariate models. Hypothermic patients had greater surgical site infections, blood transfusions, and multiple-day hospital stays than normothermic patients. These findings emphasise the need to prevent intraoperative hypothermia and improve surgical outcomes.

Discussion

This study found that Katihar Medical College surgery patients suffer from intraoperative hypothermia. Hypothermia affected 35% of perioperative patients, highlighting the importance of addressing this condition. Hypothermia risk factors include being over 60, fat, having stomach surgery, and having surgery for a long time. These findings support past findings that at-risk people need particular interventions to prevent and treat hypothermia.

Hypothermic patients had higher rates of surgical site infections, blood transfusions, and longer hospital stays, emphasising the importance of normothermia during surgery. These negative effects slow patient recovery, increase healthcare costs, and optimise resource utilisation. Taking prophylactic measures to avoid intraoperative hypothermia and improve surgical outcomes is supported by statistical evidence.

Comparison Table comparing Study with Existing Studies

Table 4 Comparison Table

Study	Study Type	Sample Size	Findings	Limitations
Current Study	Retrospective	100	Incidence of intraoperative hypothermia: 35%. Identified risk factors include age over 60 years, obesity, abdominal surgery, and prolonged duration of surgery. Clinical consequences observed	Retrospective design may introduce selection bias. Reliance on electronic medical records may result in inconsistencies in data documentation. Limited

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			include higher rates of surgical site infections, blood transfusions, and prolonged hospital stays.	generalizability due to single-center study and small sample size.
Study 1 [13]	Prospective	500	Incidence of intraoperative hypothermia: 64%. Found age, type of surgery, and ambient operating room temperature to be significant predictors of hypothermia. Utilized forced-air warming to reduce hypothermia rates.	Prospective design enhances data quality but may still be subject to bias. Limited to non-cardiac surgeries, potentially limiting generalizability. No long-term follow-up to assess postoperative outcomes beyond immediate recovery.
Study 2 [14]	Randomized Control	300	Evaluated efficacy of different warming methods in preventing intraoperative hypothermia. Found forced-air warming to be the most effective in maintaining normothermia. Reduced rates of surgical site infections and blood transfusions observed in warmed patients.	Randomized control design enhances internal validity but may be challenging to implement in surgical settings. Generalizability may be limited to settings with access to advanced warming technology.
Study 3 [15]	Review	200	Provided comprehensive overview of physiological mechanisms underlying intraoperative hypothermia and its clinical consequences. Highlighted importance of proactive warming strategies in preventing hypothermia-related complications.	Review articles may be subject to selection bias in literature review process. Limited to summarizing existing evidence; original data not generated. Generalizability may be limited to settings with access to advanced warming technology.

Intraoperative hypothermia prevalence, causes, and effects are examined in this retrospective review of 100 Katihar Medical College surgical patients. The data show an alarming 35% incidence rate, emphasising the importance of this issue in surgery. Age over 60, obesity, abdominal surgery, and long-term surgery are risk factors. These findings can help doctors identify high-risk patients and give targeted prevention. Hypothermic patients are more likely to need blood transfusions, stay longer in the hospital, and have surgery site infections. The retrospective study's methodology may introduce selection bias and poor data documentation due to electronic medical records. The study gives vital information for perioperative warming approaches and fresh insights into intraoperative hypothermia management. Future studies with larger samples and multicentre partnerships could validate these findings and enhance intraoperative hypothermia management.

Limitations of the Study

Although this study provided important information, certain drawbacks should be acknowledged. The retrospective study may have caused selection bias by not having full data for all important parameters. Electronic medical record data collection may have caused documentation inconsistencies or errors, making the findings less credible. Only one hospital was included, therefore the results may not apply to other healthcare facilities' vast range of surgical procedures and patient demographics. Multivariate logistic regression hypothermia risk factors may have been affected by unquantified confounding variables. Because the study

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was observational, hypothermia cannot be demonstrated to cause the risk variables found.

Suggestions for Future Research

Future research should address the limitations of the current study and expand on the findings to better understand and manage intraoperative hypothermia. Prospective study using larger samples and multicenter partnerships should better characterise hypothermia prevalence, causes, and effects in different surgical groups and circumstances. Comparative efficacy studies may help prevent and treat intraoperative hypothermia while conserving resources. Qualitative studies on intraoperative hypothermia and its treatment may improve patient-centered care protocols, communication, and decision-making during perioperative procedures. This study provides important insights into intraoperative hypothermia, but more research is needed to address its limitations and encourage evidence-based practices for surgical patient outcomes.

Conclusion

This study's findings on intraoperative hypothermia's occurrence, causes, and effects will help Katihar Medical College patients. The study found 35% of 100 individuals had intraoperative hypothermia. Hypothermia-prone patients, such as those over 60, obese, undergo stomach surgery, or have long-term surgery, must be protected. Hypothermic patients had more surgical site infections, blood transfusions, and longer hospital stays. Hypothermia affects patient outcomes and healthcare resource use, as shown by these data. These findings emphasise the importance of maintaining a normal core temperature during surgery for patient safety and recovery. Clinical significance: This study could improve surgical patient outcomes and inform perioperative care methods. The identification of modifiable risk factors and the negative effects of intraoperative hypothermia can help healthcare providers reduce hypothermia-related issues. To prevent hypothermia and increase recovery, perioperative treatment should include proactive warming. Preoperative and intraoperative warming are available. More research with larger samples and multicenter partnerships is needed to confirm these findings and improve hypothermia management in different patient groups and healthcare systems. Prioritising normothermia in surgical care lowers intraoperative hypothermia and improves patient outcomes.

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