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Impact of Intraoperative Hypothermia on Postoperative Complications in Abdominal Surgery: A Randomized Controlled Trial.

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ABSTRACT

Intraoperative hypothermia is a common occurrence during abdominal surgeries, often associated with adverse postoperative outcomes. This study aimed to assess the impact of intraoperative hypothermia on postoperative complications in patients undergoing abdominal surgery. This randomized controlled trial included 30 patients undergoing elective abdominal surgery. Patients were randomized into two groups: the hypothermia group, managed without active warming measures, and the normothermia group, maintained at a core temperature ≥36°C using active warming devices. Outcomes assessed included surgical site infections (SSIs), wound healing, cardiovascular and respiratory complications, and length of hospital stay. Statistical analysis was performed using SPSS software, with p-values <0.05 considered significant. The hypothermia group had significantly higher rates of SSIs (40% vs. 13%, p=0.04) and delayed wound healing (33% vs. 7%, p=0.03). Cardiovascular and respiratory complications were more frequent in the hypothermia group, though not statistically significant. The mean hospital stay was longer in the hypothermia group (9.3 ± 2.5 vs. 6.5 ± 1.8 days, p=0.01). Intraoperative hypothermia significantly increases postoperative complications and prolongs recovery. Maintaining normothermia with active warming measures improves surgical outcomes and patient safety, emphasizing its critical role in perioperative care.

Keywords: Intraoperative hypothermia, abdominal surgery, postoperative complications

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INTRODUCTION

Intraoperative hypothermia, defined as a core body temperature below 36°C, is a common occurrence during abdominal surgeries, often resulting from anesthesia-induced thermoregulation impairment and the exposure of body cavities [1, 2]. Despite advancements in perioperative care, hypothermia remains an underrecognized complication that can significantly affect surgical outcomes. Maintaining normothermia is essential, as hypothermia has been linked to adverse outcomes such as increased blood loss, prolonged wound healing, heightened risk of surgical site infections, and cardiovascular events [3-5].

The intricate relationship between intraoperative hypothermia and postoperative complications has been a subject of growing clinical interest. While numerous studies suggest that hypothermia exacerbates postoperative morbidity, others indicate minimal impact when preventive measures are applied. However, the lack of consensus in existing literature highlights the need for well-designed trials to quantify the risks and establish evidence-based interventions [6, 7].

This randomized controlled trial aims to evaluate the impact of intraoperative hypothermia on postoperative complications in patients undergoing abdominal surgery. By assessing outcomes such as infection rates, wound healing, and length of hospital stay, this study seeks to provide critical insights into the role of temperature regulation during surgery. The findings will contribute to optimizing perioperative protocols and improving patient safety in abdominal surgical procedures.

METHODOLOGY

This randomized controlled trial was conducted to assess the impact of intraoperative hypothermia on postoperative complications in abdominal surgery. The study was carried out at a tertiary care center over a period of six months. Ethical clearance was obtained from the institutional ethics committee, and written informed consent was secured from all participants. A total of 30 patients undergoing elective abdominal surgery were recruited for the study based on predefined inclusion and exclusion criteria.

Patients were randomized into two groups using a computer-generated randomization sequence: the hypothermia group and the normothermia group. The hypothermia group was managed without active warming measures, allowing for natural intraoperative hypothermia to occur, while the normothermia group was maintained at a core body temperature of ≥36°C using forced-air warming devices and warmed intravenous fluids. Core temperature was monitored throughout the surgery using an esophageal temperature probe.

Data collection included patient demographics, surgical details, and perioperative temperature recordings. Postoperative outcomes were evaluated in both groups, including surgical site infections, wound healing, duration of hospital stay, and incidence of cardiovascular or respiratory complications. Standardized criteria were used to diagnose postoperative complications, and follow-ups were conducted until hospital discharge or resolution of any adverse events.

The collected data were statistically analyzed using SPSS software version 23. Descriptive statistics were used to summarize patient characteristics and postoperative outcomes. Comparative analysis between the groups was performed using the chi-square test for categorical variables and the independent t-test for continuous variables. A p-value of <0.05 was considered statistically significant, ensuring the reliability of the findings.

RESULTS

Table 1: Demographic and Baseline Characteristics of Study Participants.

Variable	Hypothermia Group (n=15)	Normothermia Group (n=15)	p-value
Mean Age (years)	45.2 ± 12.3	46.8 ± 11.7	0.76
Gender (Male/Female)	8/7	9/6	0.71
BMI (kg/m^2)	26.1 ± 4.2	25.8 ± 4.0	0.88
ASA Classification (I/II)	10/5	11/4	0.65

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Table 2: Intraoperative Parameters.

Parameter	Hypothermia Group (n=15)	Normothermia Group (n=15)	p-value
Mean Core Temperature (°C)	34.5 ± 0.8	36.2 ± 0.4	<0.001
Mean Surgery Duration (hours)	2.8 ± 0.9	2.7 ± 0.8	0.84
Blood Loss (mL)	400 ± 50	380 ± 45	0.38
Use of Warming Devices (%)	0	100	<0.001

Table 3: Postoperative Complications.

Complication	Hypothermia Group (n=15)	Normothermia Group (n=15)	p-value
Surgical Site Infection (%)	6 (40%)	2 (13%)	0.04
Delayed Wound Healing (%)	5 (33%)	1 (7%)	0.03
Cardiovascular Events (%)	3 (20%)	1 (7%)	0.15
Respiratory Complications (%)	4 (27%)	2 (13%)	0.25

Table 4: Length of Hospital Stay.

Parameter	Hypothermia Group (n=15)	Normothermia Group (n=15)	p-value
Mean Length of Stay (days)	9.3 ± 2.5	6.5 ± 1.8	0.01
Patients Discharged by Day 7 (%)	5 (33%)	12 (80%)	0.02

DISCUSSION

The findings of this randomized controlled trial underscore the clinical significance of maintaining intraoperative normothermia in patients undergoing abdominal surgeries. The comparison of outcomes between the hypothermia and normothermia groups reveals compelling evidence of the impact of intraoperative hypothermia on postoperative complications, including surgical site infections, wound healing, and hospital stay. These results contribute to the growing body of literature on perioperative temperature management and its influence on surgical outcomes [7, 8].

Impact on Postoperative Complications

One of the key findings in this study is the significant difference in surgical site infection (SSI) rates between the hypothermia and normothermia groups (40% vs. 13%, p=0.04). This aligns with previous studies suggesting that intraoperative hypothermia impairs the immune response, leading to increased susceptibility to infections. Hypothermia reduces tissue perfusion and oxygen delivery to surgical sites, which are critical for effective wound healing and infection resistance. Normothermia, on the other hand, preserves optimal microcirculation and enhances the ability of leukocytes to combat bacterial invasion, thereby reducing SSI rates [9].

Delayed wound healing, observed in 33% of the hypothermia group compared to 7% in the normothermia group (p=0.03), further highlights the detrimental effects of hypothermia. The process of wound healing involves a complex interplay of inflammatory, proliferative, and remodeling phases, all of which are temperature-sensitive. Hypothermia is known to prolong the inflammatory phase, delaying subsequent stages of healing. This delay not only impacts recovery but also increases the likelihood of secondary infections and patient discomfort [10, 11].

Cardiovascular and Respiratory Complications

Although not statistically significant, cardiovascular events were more frequent in the hypothermia group (20% vs. 7%, p=0.15). This trend warrants attention, as hypothermia has been shown

to increase the risk of cardiac events through mechanisms such as heightened sympathetic activity, coagulopathy, and arrhythmias. These findings suggest that intraoperative temperature management could play a role in mitigating cardiovascular risks, especially in patients with preexisting comorbidities.

Respiratory complications were also observed more frequently in the hypothermia group (27% vs. 13%, p=0.25). Hypothermia may contribute to respiratory issues by impairing ciliary function and reducing pulmonary compliance, thereby increasing the risk of atelectasis and infections such as pneumonia. While the differences in this study were not statistically significant, the trend suggests the potential for improved respiratory outcomes with normothermia.

Hospital Stay and Recovery

The study demonstrates a significant difference in the length of hospital stay between the two groups, with the hypothermia group requiring a mean of 9.3 ± 2.5 days compared to 6.5 ± 1.8 days in the normothermia group (p=0.01). Additionally, only 33% of patients in the hypothermia group were discharged by day 7, compared to 80% in the normothermia group (p=0.02). Prolonged hospital stays not only increase healthcare costs but also expose patients to additional risks such as nosocomial infections and psychological stress.

The extended hospital stays observed in the hypothermia group can be attributed to the higher incidence of postoperative complications, particularly SSIs and delayed wound healing. These complications often require extended antibiotic therapy, additional interventions, and prolonged monitoring, all of which contribute to delayed discharge. This finding emphasizes the economic and clinical advantages of maintaining normothermia during surgery.

Intraoperative Temperature Management

The intraoperative parameters highlight the effectiveness of active warming measures in maintaining normothermia. The mean core temperature in the normothermia group was significantly higher than in the hypothermia group (36.2 ± 0.4°C vs. 34.5 ± 0.8°C, p<0.001). The use of forced-air warming devices and warmed intravenous fluids in the normothermia group played a critical role in achieving these results. These findings support the implementation of active warming strategies as a standard of care in abdominal surgeries.

The lack of significant differences in surgery duration and blood loss between the two groups suggests that the observed outcomes are specifically related to temperature management rather than procedural differences. This strengthens the argument for the independent role of normothermia in improving surgical outcomes [12, 13].

Clinical Implications

The findings of this study have important clinical implications for perioperative care. They highlight the need for routine temperature monitoring and active warming measures to prevent intraoperative hypothermia. Healthcare providers should prioritize the use of evidence-based interventions, such as forced-air warming systems and warmed fluids, to maintain normothermia throughout the surgical procedure.

Furthermore, preoperative assessment should identify patients at higher risk of hypothermia, such as those with low BMI, elderly individuals, or those undergoing prolonged surgeries. Tailored strategies can be implemented to address the specific needs of these populations, thereby reducing the risk of complications.

CONCLUSION

Intraoperative hypothermia has a significant impact on postoperative outcomes in abdominal surgery, as evidenced by higher rates of SSIs, delayed wound healing, and prolonged hospital stays. Maintaining normothermia through active warming measures significantly reduces these complications and improves recovery. This study underscores the importance of temperature management as a critical

component of perioperative care, offering valuable insights for enhancing surgical outcomes and patient safety.

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