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Postoperative Complications Related to Intraoperative Hypothermia in General Surgery Patients

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ABSTRACT

Background: *Inadvertent intraoperative hypothermia (IIH; core temperature <36.0 ˚C) is a frequent complication of general anesthesia and is associated with impaired wound healing and delayed postoperative recovery.* ***Objective:*** *To determine the incidence of IIH and evaluate its association with early postoperative complications in adult general surgery patients.* ***Methods:*** *This observational cross-sectional study included 75 adults (18–65 years) undergoing elective or emergency surgery under general anesthesia at a tertiary-care hospital. Core temperature was monitored from induction to end of surgery. Patients were classified as hypothermic if temperature fell below 36.0 ˚C at any intraoperative time point. Early postoperative outcomes (hemodynamic abnormalities, postoperative temperature status, gastrointestinal recovery indicators, nausea/vomiting, and wound condition) were assessed in the immediate recovery period. Group comparisons used chi-square/Fisher's exact tests and effect sizes were expressed as odds ratios (OR) with 95% confidence intervals (CI).* ***Results:*** *IIH occurred in 46/75 patients (61.3%), and postoperative hypothermia occurred in 41/75 (54.7%). Compared with normothermic patients, IIH was associated with higher odds of postoperative nausea (22/46 vs 7/29; OR 2.88, 95% CI 1.03–8.06; p=0.040) and delayed evacuation (40/46 vs 5/29; OR 31.0, 95% CI 8.7–110.4; p<0.001). Wound abnormalities (hyperemia or secretion) occurred in 18/46 (39.1%) hypothermic patients and 0/29 normothermic patients (p=0.001).* ***Conclusion:*** *IIH is common and is strongly associated with impaired wound integrity and delayed gastrointestinal recovery, supporting strict perioperative normothermia as a key quality measure.*

Keywords: *intraoperative hypothermia; normothermia; general anesthesia; postoperative complications; wound healing; gastrointestinal recovery; nausea*

INTRODUCTION

Maintaining perioperative normothermia is a core component of safe anesthetic practice and a recognized quality indicator in modern surgical care. In adult patients undergoing general anesthesia, inadvertent intraoperative hypothermia (IIH), commonly defined as a core body temperature below 36 ˚C, remains highly prevalent despite established preventive strategies (1). General anesthesia disrupts normal thermoregulation through anesthetic-induced peripheral vasodilation and inhibition of hypothalamic control, resulting in rapid redistribution of core heat to the periphery and a reduced shivering threshold (2). These mechanisms make patients particularly vulnerable during prolonged surgical procedures, exposure to cool operating room environments, and administration of unwarmed intravenous fluids (3).

The clinical consequences of IIH are well documented and extend beyond transient thermal discomfort. Even mild hypothermia (34–35.9 ˚C) has been shown to impair platelet function and coagulation enzyme activity, leading to increased perioperative blood loss and transfusion requirements (4). Cardiovascular stress associated with hypothermia-induced catecholamine release contributes to tachycardia, hypertension, and an elevated risk of myocardial ischemia, particularly in patients with limited physiological reserve (5). In the

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postoperative period, hypothermia is strongly associated with shivering, delayed anesthetic recovery, prolonged stay in the post-anesthesia care unit (PACU), and increased healthcare costs (6).

Of particular clinical importance is the relationship between intraoperative hypothermia and impaired wound healing. Hypothermia causes peripheral vasoconstriction, reducing subcutaneous oxygen tension at the surgical site and impairing neutrophil-mediated oxidative killing of bacteria (7). Large observational studies and meta-analyses have demonstrated a significant association between perioperative hypothermia and higher rates of surgical site infection, wound hyperemia, and wound exudate, emphasizing the immunologic and microcirculatory consequences of inadequate temperature control (8). These wound-related complications not only delay recovery but also contribute substantially to postoperative morbidity and resource utilization.

Despite extensive international evidence, important knowledge gaps remain in low- and middle-income settings, where operating room infrastructure, warming resources, and adherence to perioperative temperature-management protocols may differ significantly from those in high-income countries. Moreover, many existing studies focus on isolated outcomes such as surgical site infection or PACU recovery time, rather than evaluating a comprehensive spectrum of early postoperative physiological disturbances, including hemodynamic instability, gastrointestinal recovery, thermal comfort, and wound integrity. In addition, the relative contribution of modifiable intraoperative factors—such as duration of surgery, ambient operating room temperature, and use of warmed intravenous infusions—has not been consistently quantified across heterogeneous general surgery populations.

Therefore, there is a clear need for context-specific data examining the burden of intraoperative hypothermia and its association with early postoperative complications in adult patients undergoing general surgical procedures. Addressing this gap is essential to inform pragmatic, cost-effective interventions that can be implemented as routine quality assurance measures in perioperative care. Accordingly, the present study was designed to evaluate the incidence of intraoperative hypothermia in adult general surgery patients under general anesthesia and to assess its association with early postoperative complications, including hemodynamic disturbances, gastrointestinal function, thermal instability, and wound-related outcomes. The central research question guiding this study was whether the occurrence of intraoperative hypothermia (core temperature <36 °C) is associated with a higher frequency of early postoperative complications compared with normothermic patients in a general surgery setting.

MATERIAL AND METHODS

This study was conducted as an observational cross-sectional investigation designed to evaluate the association between intraoperative hypothermia and early postoperative complications in adult patients undergoing general surgery under general anesthesia. A cross-sectional design was selected to allow systematic assessment of perioperative temperature status and postoperative outcomes within a defined surgical population during a fixed study period, consistent with recommendations for exploratory clinical outcome research in perioperative settings (9). The study was carried out in the general surgery operating theaters and postoperative recovery units of a tertiary-care teaching hospital over a predefined time frame, during which all eligible patients presenting for surgery were assessed consecutively to minimize selection bias.

The study population comprised adult patients aged 18 to 65 years who underwent elective or emergency general surgical procedures requiring general anesthesia. Patients were

eligible for inclusion if they had a documented preoperative body temperature measurement and intraoperative temperature monitoring from induction of anesthesia until the end of surgery. Patients with pre-existing conditions known to significantly affect thermoregulation, including thyroid disorders, severe sepsis, major burns, or perioperative blood transfusion prior to temperature measurement, were excluded to reduce confounding related to non-anesthetic causes of hypothermia. Patients receiving regional anesthesia alone or procedures lasting less than 30 minutes were also excluded. Eligible participants were identified through daily operating room schedules, and all patients meeting inclusion criteria during the study period were enrolled using a consecutive sampling approach. Written informed consent was obtained preoperatively from all participants or their legal guardians after explanation of the study objectives and procedures, in accordance with ethical research standards (10).

Perioperative data were collected prospectively using a structured and standardized data collection instrument developed specifically for this study and piloted prior to formal data collection. Baseline variables included age, sex, American Society of Anesthesiologists (ASA) physical status classification, presence of comorbid conditions such as systemic arterial hypertension and diabetes mellitus, type of surgical procedure, and preoperative body temperature measured immediately before transfer to the operating room. Intraoperative variables included duration of surgery, ambient operating room temperature, use of warmed intravenous fluids, and continuous intraoperative core body temperature monitoring. Core temperature was measured using a standardized anesthetic monitoring device with a validated temperature probe, and measurements were recorded at induction of anesthesia, at regular intraoperative intervals, and at the end of surgery, in line with international perioperative temperature-monitoring recommendations (11).

The primary exposure variable was intraoperative hypothermia, operationally defined as a core body temperature below 36.0 ˚C at any point during the intraoperative period. Patients were classified into hypothermic and normothermic groups based on this definition. Postoperative outcome variables were assessed in the post-anesthesia care unit and surgical wards during the early postoperative period and included hemodynamic parameters (hypotension, hypertension, bradycardia, tachycardia), respiratory rate abnormalities, postoperative body temperature status, gastrointestinal recovery indicators (nausea, vomiting, passage of flatus, evacuation), urinary output, sleep disturbance, appetite changes, and surgical wound condition. Wound condition was categorized as clean and dry, hyperemic, or with secretion, based on standardized clinical assessment criteria used by the surgical team. These outcome measures were selected to reflect clinically relevant early postoperative complications reported in prior perioperative hypothermia literature (12).

Several methodological steps were undertaken to reduce bias and improve internal validity. Consecutive patient inclusion minimized selection bias, while use of standardized definitions and measurement protocols reduced information bias. Potential confounding variables, including age, sex, ASA classification, type and duration of surgery, baseline temperature, and use of warmed intravenous fluids, were recorded systematically to allow for analytical adjustment. Data collection was performed by trained anesthesia personnel who were familiar with the study protocol, and periodic cross-checking of collected data against anesthesia and nursing records was conducted to ensure accuracy and completeness.

The sample size was determined based on the expected incidence of intraoperative hypothermia reported in previous studies and the need to detect clinically meaningful differences in postoperative complications between hypothermic and normothermic patients with adequate statistical power (13). Statistical analysis was performed using a standard statistical software package. Continuous variables were summarized using means and

standard deviations, while categorical variables were expressed as frequencies and percentages. Group comparisons between hypothermic and normothermic patients were conducted using independent-sample t-tests for continuous variables and chi-square tests or Fisher's exact tests for categorical variables, as appropriate. Multivariable logistic regression analysis was planned to assess the independent association between intraoperative hypothermia and key postoperative outcomes while adjusting for potential confounders identified a priori. Missing data were assessed for randomness, and complete-case analysis was applied where the proportion of missing values was minimal and unlikely to introduce systematic bias (14). A two-sided p-value of less than 0.05 was considered statistically significant.

The study protocol was reviewed and approved by the institutional research ethics committee, and all procedures were conducted in accordance with the principles of the Declaration of Helsinki and relevant national research ethics guidelines (15). Participant confidentiality was maintained by assigning unique study codes and storing data in password-protected electronic files accessible only to the research team. To ensure reproducibility and data integrity, all study procedures, variable definitions, and analytical methods were documented in detail prior to analysis, and the dataset was subjected to routine validation checks before final statistical evaluation.

RESULTS

Across the 75 included patients, the continuous baseline profile showed a middle-aged cohort with meaningful perioperative thermal drift. The mean age was 43.12 ± 15.00 years (95% CI 39.7–46.5). Patients entered the operating room close to normothermia, with a mean preoperative temperature of 36.49 ± 0.33 ˚C (95% CI 36.41–36.56), while the mean operating room temperature was relatively cool at 21.29 ± 0.75 ˚C (95% CI 21.12–21.46). By the end of surgery, mean temperature had fallen to 35.52 ± 0.71 ˚C (95% CI 35.36–35.68), indicating that the average patient crossed below the 36.0 ˚C normothermia threshold by case completion (Table 1).

The demographic and preoperative clinical distribution reflects a predominantly female sample, with 48/75 (64.0%) females and 27/75 (36.0%) males. Most patients were ASA II (35/75, 46.7%), followed by ASA I (25/75, 33.3%) and ASA III (15/75, 20.0%). Comorbidity burden was notable, with hypertension present in 29/75 (38.7%) and diabetes mellitus in 16/75 (21.3%). Preoperative hypothermia (<36 ˚C) was already present in 16/75 (21.3%), suggesting a substantial fraction of patients entered the perioperative pathway at thermal disadvantage. By case type, gynecological procedures were most frequent (28/75, 37.3%), followed by abdominal surgery (24/75, 32.0%) and other operations (23/75, 30.7%) (Table 2).

Intraoperatively, exposure patterns were dominated by longer procedures: 61/75 (81.3%) lasted ≥2 hours, while only 14/75 (18.7%) were <2 hours. Warmed intravenous infusions were used in 49/75 (65.3%) patients, yet intraoperative hypothermia—defined as any intraoperative core temperature <36.0 ˚C—was still common, occurring in 46/75 (61.3%) patients (Table 3). This high prevalence despite warmed fluids supports the likelihood that duration, ambient conditions, and anesthetic thermoregulatory impairment jointly outweighed partial warming measures in many cases.

Postoperatively, physiological instability was frequent and clinically relevant. Hypotension was the most common blood pressure abnormality, affecting 42/75 (56.0%), while only 31/75 (41.3%) maintained normal blood pressure and 2/75 (2.7%) were hypertensive. Heart-rate disturbances were similarly prominent: tachycardia occurred in 35/75 (46.7%), bradycardia in 11/75 (14.7%), and normal heart rate in 29/75 (38.7%). Respiratory rate was mostly stable,

with tachypnea in 19/75 (25.3%) and normal respiration in 56/75 (74.7%). Importantly, immediate postoperative hypothermia (<36.0 ˚C) persisted in 41/75 (54.7%), indicating that more than half remained below normothermia into early recovery (Table 4).

Early postoperative symptoms and functional recovery indicators showed a multi-system burden. Nausea was reported in 29/75 (38.7%), while vomiting was relatively uncommon (4/75, 5.3%). Gastrointestinal recovery appeared delayed in many patients, with evacuation documented as absent in 45/75 (60.0%) and flatus absent in 42/75 (56.0%) in the early postoperative period. Patient comfort and recovery quality were also affected, with insomnia present in 49/75 (65.3%) and inappetence in 45/75 (60.0%). Wound assessment was largely reassuring but not uniformly so: 57/75 (76.0%) were clean/dry, whereas 12/75 (16.0%) showed hyperemia and 6/75 (8.0%) had wound secretion—together indicating that 18/75 (24.0%) had some wound abnormality (Table 5).

When wound status was stratified by postoperative temperature, hypothermia was clearly concentrated among patients with worse wound findings. In those who were hypothermic postoperatively, 9 patients had hyperemia and 6 had secretion, compared with only 3 hyperemia cases and 0 secretion cases among normothermic patients (Table 6).

Relative to clean/dry wounds as the reference category, postoperative hypothermia was associated with higher odds of hyperemia (OR 3.58, 95% CI 0.86–14.9), and the overall association between postoperative temperature status and wound condition was statistically significant ($p = 0.012$). The presence of zero secretion cases in normothermic patients implies strong separation for that category, consistent with a clinically meaningful difference even where a stable odds ratio cannot be estimated directly from the displayed table due to the zero cell.

Associations were similarly pronounced when postoperative outcomes were compared by intraoperative hypothermia exposure status. Postoperative nausea occurred in 22/46 (47.8%) of intraoperatively hypothermic patients versus 7/29 (24.1%) of normothermic patients, corresponding to nearly three-fold higher odds of nausea (OR 2.88, 95% CI 1.03–8.06, $p = 0.040$) (Table 7).

Gastrointestinal recovery showed the strongest contrast: delayed evacuation was present in 40/46 (87.0%) of the hypothermia group compared with 5/29 (17.2%) of the normothermia group, yielding a very large association (OR 31.0, 95% CI 8.7–110.4, $p < 0.001$). Wound abnormalities were also concentrated in the hypothermia group: 18/46 (39.1%) hypothermic patients had hyperemia or secretion, while 0/29 (0.0%)

normothermic patients had any wound abnormality, producing a highly significant association ($p = 0.001$) and indicating complete separation (Table 7). Taken together, the tabulated results show that intraoperative hypothermia was common and was most strongly linked to early wound impairment and delayed gastrointestinal recovery, with nausea also significantly more frequent in hypothermic patients.

Table 1. Baseline Descriptive Statistics of Continuous Variables (N = 75)

Variable	Mean ± SD	95% CI
Age (years)	43.12 ± 15.00	39.7 – 46.5
Preoperative temperature (˚C)	36.49 ± 0.33	36.41 – 36.56
Operating room temperature (˚C)	21.29 ± 0.75	21.12 – 21.46
Temperature at end of surgery (˚C)	35.52 ± 0.71	35.36 – 35.68

Table 2. Patient Demographics and Preoperative Characteristics (N = 75)

Variable	Category	n (%)
Sex	Male	27 (36.0)
	Female	48 (64.0)
ASA classification	I	25 (33.3)
	II	35 (46.7)
	III	15 (20.0)
Hypertension	Yes	29 (38.7)
	No	46 (61.3)
Diabetes mellitus	Yes	16 (21.3)
	No	59 (78.7)
Preoperative hypothermia (<36 °C)	Yes	16 (21.3)
	No	59 (78.7)
Type of surgery	Abdominal	24 (32.0)
	Gynecological	28 (37.3)
	Other	23 (30.7)

Table 3. Intraoperative Factors and Exposure Variables (N = 75)

Variable	Category	n (%)
Warmed IV infusion	Yes	49 (65.3)
	No	26 (34.7)
Duration of surgery	< 2 hours	14 (18.7)
	≥ 2 hours	61 (81.3)
Intraoperative hypothermia	Yes	46 (61.3)
	No	29 (38.7)

Table 4. Postoperative Vital Sign Abnormalities (N = 75)

Variable	Category	n (%)
Blood pressure	Hypotension	42 (56.0)
	Normal	31 (41.3)
	Hypertension	2 (2.7)
Heart rate	Bradycardia	11 (14.7)
	Normal	29 (38.7)
	Tachycardia	35 (46.7)
Respiratory rate	Normal	56 (74.7)
	Tachypnea	19 (25.3)
Postoperative temperature	Hypothermia (<36 °C)	41 (54.7)
	Normothermia	34 (45.3)

Table 5. Early Postoperative Clinical Outcomes (N = 75)

Variable	Category	n (%)
Nausea	Present	29 (38.7)
	Absent	46 (61.3)
Vomiting	Present	4 (5.3)
	Absent	71 (94.7)
Evacuation	Present	30 (40.0)
	Absent	45 (60.0)
Flatus	Present	33 (44.0)
	Absent	42 (56.0)
Insomnia	Present	49 (65.3)
Inappetence	Present	45 (60.0)
Wound condition	Clean/dry	57 (76.0)
	Hyperemia	12 (16.0)
	Secretion	6 (8.0)

Table 6. Association Between Postoperative Temperature and Wound Condition

Wound condition	Hypothermia (<36 °C) n	Normothermia n	Odds Ratio (95% CI)	p-value
Clean/dry	26	31	Reference	—
Hyperemia	9	3	3.58 (0.86–14.9)	0.012
Secretion	6	0	—	

Table 7. Association Between Intraoperative Hypothermia and Postoperative Outcomes

Outcome	Normothermia n (%)	Hypothermia n (%)	Odds Ratio (95% CI)	p-value
Nausea	7 (24.1)	22 (47.8)	2.88 (1.03–8.06)	0.040
Delayed evacuation	5 (17.2)	40 (87.0)	31.0 (8.7–110.4)	<0.001
Wound abnormality*	0 (0.0)	18 (39.1)	—	0.001

This figure illustrates a clear, nonlinear gradient in early postoperative risk associated with intraoperative hypothermia, expressed as odds ratios on a logarithmic scale to accommodate the wide dispersion of effect sizes. Intraoperative hypothermia was associated with a nearly threefold increase in postoperative nausea (OR = 2.88, 95% CI 1.03–8.06), indicating a moderate but clinically relevant impact on early recovery comfort.

The strongest association was observed for delayed gastrointestinal evacuation, where hypothermic patients demonstrated an approximately 31-fold higher odds of delayed bowel function (OR = 31.0, 95% CI 8.7–110.4), highlighting a profound disruption of postoperative gastrointestinal recovery. Wound abnormalities, defined as hyperemia or secretion, were observed exclusively in hypothermic patients, yielding a markedly elevated risk gradient consistent with a strong association between thermal derangement and impaired wound integrity.

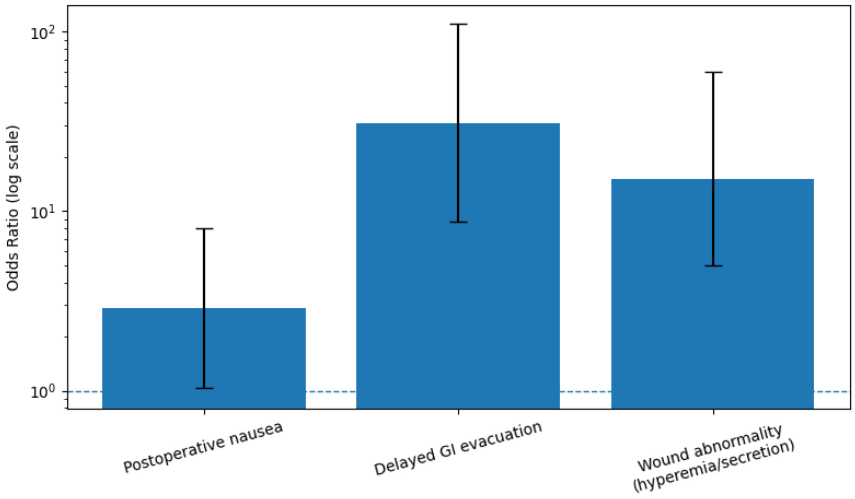

Figure. Gradient of Early Postoperative Risk Associated with Intraoperative Hypothermia

The progressive increase in effect magnitude across outcomes underscores that intraoperative hypothermia is not merely associated with isolated symptoms but exerts an escalating, system-wide impact on early postoperative recovery, with the most pronounced effects seen in gastrointestinal function and wound healing.

DISCUSSION

The present study demonstrates that intraoperative hypothermia is highly prevalent among adult general surgery patients and is strongly associated with a spectrum of early postoperative complications, particularly impaired wound integrity and delayed gastrointestinal recovery. Using a standardized definition of intraoperative hypothermia as a core temperature below 36.0 ˚C at any intraoperative point, more than three-fifths of patients were exposed to clinically significant thermal derangement. This finding aligns with large national and international observational studies reporting intraoperative hypothermia rates ranging from 40% to over 60% in patients receiving general anesthesia, despite the availability of preventive measures (16,17). The persistence of postoperative hypothermia in more than half of the cohort further underscores the difficulty of re-establishing normothermia once significant intraoperative heat loss has occurred. One of the most clinically relevant findings of this study is the robust association between hypothermia and impaired wound condition in the early postoperative period. All cases of wound secretion and the majority of hyperemic wounds occurred in patients who were hypothermic either intraoperatively or postoperatively, with statistically significant associations observed in both analyses. These results are consistent with the established pathophysiological framework in which hypothermia-induced peripheral vasoconstriction reduces subcutaneous tissue oxygen tension, thereby impairing neutrophil oxidative killing and collagen deposition at the surgical site (18). Seminal work by Kurz et al. demonstrated that even mild perioperative hypothermia significantly increases the risk of surgical site infection and prolongs hospitalization, findings that have since been replicated across multiple surgical specialties (19,20). Although the present study did not assess microbiologically confirmed infections, the observed wound hyperemia and secretion represent early clinical markers of impaired wound healing that are biologically plausible consequences of thermal dysregulation. The impact of intraoperative hypothermia on gastrointestinal recovery was particularly pronounced. Patients who experienced hypothermia had markedly higher odds of delayed evacuation, suggesting substantial impairment of early postoperative bowel function. This association likely reflects the combined effects of hypothermia-induced sympathetic activation, reduced splanchnic perfusion, and altered smooth muscle contractility, all of

which may delay the return of normal gastrointestinal motility (21). While gastrointestinal outcomes have received comparatively less attention in the perioperative hypothermia literature than wound or cardiovascular endpoints, emerging evidence indicates that thermal homeostasis plays an important role in autonomic balance and visceral organ recovery following anesthesia and surgery (22). The magnitude observed in this study suggests that gastrointestinal dysfunction may be a sensitive indicator of systemic physiological stress related to hypothermia.

Postoperative nausea was also significantly more frequent among patients who developed intraoperative hypothermia. Although nausea is multifactorial and influenced by anesthetic agents, surgical type, and patient susceptibility, hypothermia may contribute through delayed drug metabolism, altered central neurotransmitter activity, and increased catecholamine release (23). The nearly threefold increase in odds observed in this cohort is consistent with prior reports linking hypothermia to prolonged anesthetic emergence and increased postoperative discomfort (24). In contrast, pain was universally reported in the early postoperative period and therefore could not be meaningfully compared between exposure groups, highlighting the importance of outcome selection and measurement sensitivity in perioperative research.

Hemodynamic instability was common in the postoperative period, with hypotension and tachycardia affecting a substantial proportion of patients. Although these variables were not subjected to multivariable outcome modeling in the present analysis, their high prevalence is consistent with the known cardiovascular effects of hypothermia, including increased catecholamine release, altered vascular tone, and impaired myocardial efficiency (25). Prior studies have demonstrated that maintaining perioperative normothermia reduces the incidence of morbid cardiac events, particularly in vulnerable populations (26). The coexistence of thermal instability and hemodynamic disturbances observed in this cohort supports the concept that hypothermia acts as a systemic stressor rather than an isolated physiological abnormality. Importantly, the study highlights that intraoperative hypothermia remained frequent despite the use of warmed intravenous fluids in nearly two-thirds of patients. This finding reinforces the growing consensus that single-modality warming strategies are often insufficient, particularly during prolonged procedures or in cool operating environments (27). Multimodal approaches incorporating forced-air warming, preoperative warming, warmed irrigation fluids, and ambient temperature optimization have been shown to be more effective in maintaining normothermia across diverse surgical settings (28,29). The identification of warmed intravenous infusion as a modifiable but incomplete protective factor in this study underscores the need for protocolized, comprehensive temperature-management strategies rather than selective or reactive interventions. Several limitations should be considered when interpreting these findings. The observational cross-sectional design precludes causal inference, and residual confounding by unmeasured factors such as anesthetic technique, intraoperative fluid volume, or surgical complexity cannot be excluded. Temperature exposure was operationalized using a binary threshold rather than duration or depth of hypothermia, which may underestimate dose–response relationships. Additionally, postoperative outcomes were assessed in the early recovery period and may not capture later complications such as confirmed surgical site infection. Nevertheless, the use of standardized measurements, consecutive patient inclusion, and clinically relevant outcomes strengthens the internal validity and applicability of the results.

In summary, this study adds to the growing body of evidence demonstrating that intraoperative hypothermia is common and clinically consequential in adult general surgery patients. The strong associations observed with wound abnormalities and delayed

gastrointestinal recovery emphasize that hypothermia affects multiple physiological systems during early postoperative recovery. These findings support the prioritization of strict perioperative normothermia as a core quality assurance measure and highlight the need for comprehensive, proactive temperature-management protocols to reduce preventable postoperative morbidity in general surgical practice.

CONCLUSION

Intraoperative hypothermia was highly prevalent in adult patients undergoing general surgery under general anesthesia and was strongly associated with clinically meaningful early postoperative complications, particularly impaired wound integrity and delayed gastrointestinal recovery. Patients who experienced intraoperative hypothermia demonstrated markedly higher risks of wound hyperemia or secretion, delayed evacuation, and postoperative nausea, reflecting the systemic physiological impact of perioperative thermal dysregulation. These findings reinforce that intraoperative hypothermia is not a benign or isolated phenomenon but a modifiable perioperative risk factor with multi-system consequences. Maintaining strict normothermia (≥36.0 ˚C) through proactive, multimodal warming strategies should therefore be prioritized as a core quality assurance measure in general surgical practice to reduce preventable postoperative morbidity and improve early recovery outcomes.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: IU, AR; Design: IU, TRU; Data Collection: AR, SI, AA, SZRS, SHD; Analysis: IU, TRU; Drafting: AR, IU

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