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Analytical study on intraoperative temperature management for reducing complications in cardiac surgery

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Abstract:
Intraoperative temperature control affects postoperative problems following heart surgery. Hence, a group of 128 adult patients who were having elective heart surgery were observed. According to normothermic and hypothermic temperature control techniques, patients were divided into groups. The normothermic group experienced noticeably fewer problems, such as bleeding and arrhythmias, according to the results. Thus, we show critical accurate heat management is to better surgical outcomes.

Keywords: heart surgery, postoperative results, surgical problems, hypothermia, normothermia, intraoperative temperature

Background:
An essential part of anaesthetic and surgical treatment is intraoperative temperature control, especially in cardiac surgery where problems are a known possibility **[1]**. Maintaining a constant core body temperature of 37°C is essential for survival, through maintaining optimal organ, tissue and cellular function. Tight temperature regulation is achieved through a complex, integrated system of thermogenesis and heat loss. Different levels of hypothermia for defined periods of time can be protective. Temperature management during and after cardiac surgery, as well as after accidental hypothermia can have major effects on both immediate and long-term outcome **[2,3]**. Historically, hypothermia has been utilized to lower metabolic demand during cardiopulmonary bypass, protecting important organs **[4]**. But according to new research, unchecked or excessive cooling may raise the risk of negative consequences like coagulopathy, infections, extended hospital stays and arrhythmias **[5]**. On the other hand, preserving normothermia has been linked to greater overall recovery, decreased inflammatory responses and enhanced coagulation profiles **[6]**. There is still disagreement on the ideal intraoperative temperature range, despite increased interest in thermal regulation techniques. Therefore, it is of interest to analyse the connection between intraoperative temperature control and the prevalence of postoperative problems in patients having heart surgery.

Materials and Methods:
This 12-month analytical cohort research involved 128 adult patients at a tertiary care facility undergoing elective heart surgery (valve replacements and coronary artery bypass grafting). Group A (normothermia: 36–37°C) and Group B (moderate hypothermia: 32–35°C) were the two groups of patients that were separated according to the intraoperative temperature management method. Continuous temperature monitoring was done with oesophageal probes and forced-air warming devices and cardiopulmonary bypass settings were used to maintain thermal control. Patient demographics, comorbidities, length of surgery, blood loss, arrhythmias, wound infections and intensive care unit stay were all recorded. Exclusion criteria included emergency surgeries, pre-existing coagulopathies and intraoperative conversion to off-pump techniques. Outcomes were compared between groups using descriptive statistics and appropriate analytical tests.

Results:
Patients managed with normothermia experienced significantly fewer postoperative complications compared to those managed under mild hypothermia. Differences were notable in outcomes such as arrhythmias, bleeding, ICU stay and infection rates, suggesting that tighter thermal regulation positively influenced recovery. **Table 1** shows patients in both groups had comparable baseline demographics, ensuring uniformity for outcome comparisons. **Table 2** shows the types of surgeries performed were similar across both groups, with no significant difference in distribution. **Table 3** shows operative duration was slightly shorter in the normothermic group, but not statistically significant. **Table 4** shows postoperative arrhythmias were significantly less common in the normothermic group. **Table 5** shows mean blood loss and transfusion requirements were significantly lower in the normothermic group. **Table 6** shows postoperative infections were more frequent in the hypothermic group. **Table 7** shows ICU and hospital stay durations were notably shorter in the normothermic group. **Table 8** shows ventilator dependency was reduced in the normothermic cohort. **Table 9** shows postoperative lactate levels, a marker of perfusion, were lower in the normothermic group. **Table 10** shows reoperation for bleeding was significantly higher in the hypothermic group.

Table 1: Baseline demographic characteristics of study participants

Variable	Group A (Normothermia, n=64)	Group B (Hypothermia, n=64)	p-value
Mean Age (years)	58.4 ± 9.1	59.2 ± 8.7	0.62
Male (%)	42 (65.6%)	45 (70.3%)	0.55
BMI (kg/m²)	26.3 ± 3.1	26.6 ± 3.5	0.49
Diabetes Mellitus (%)	30 (46.9%)	28 (43.8%)	0.73
Hypertension (%)	37 (57.8%)	40 (62.5%)	0.58
Smoking History (%)	18 (28.1%)	20 (31.3%)	0.70

Table 2: Type of cardiac surgery performed

Surgery Type	Group A (n=64)	Group B (n=64)	p-value
CABG	36 (56.3%)	34 (53.1%)	0.71
Valve Replacement (AVR/MVR/DVR)	20 (31.3%)	22 (34.4%)	0.70
Combined CABG + Valve	8 (12.5%)	8 (12.5%)	1.00

Table 3: Operative duration (in minutes)

Duration Metric	Group A (Normothermia)	Group B (Hypothermia)	p-value
Mean Operative Time	213 ± 26	219 ± 28	0.21
CPB Time	98 ± 14	101 ± 13	0.18
Aortic Cross Clamp Time	64 ± 11	66 ± 10	0.29

Table 4: Incidence of postoperative arrhythmias

Type of Arrhythmia	Group A (n=64)	Group B (n=64)	p-value
Atrial Fibrillation	6 (9.4%)	14 (21.9%)	0.04
Ventricular Tachycardia	1 (1.6%)	5 (7.8%)	0.09
Bradyarrhythmia's	3 (4.7%)	6 (9.4%)	0.30
Total Arrhythmias	10 (15.6%)	25 (39.1%)	0.002

Table 5: Intraoperative and postoperative blood loss

Parameter	Group A	Group B	p-value
Mean Blood Loss (ml)	610 ± 120	790 ± 135	<0.001
Blood Transfusion Required	28 (43.8%)	44 (68.8%)	0.004

Table 6: Incidence of postoperative infections

Infection Type	Group A (n=64)	Group B (n=64)	p-value
Surgical Site Infection	3 (4.7%)	9 (14.1%)	0.06
Pneumonia	2 (3.1%)	7 (10.9%)	0.09
UTI	1 (1.6%)	5 (7.8%)	0.09
Total Infections	6 (9.4%)	17 (26.6%)	0.01

Table 7: Duration of ICU and hospital stay

Parameter	Group A (Normothermia)	Group B (Hypothermia)	p-value
ICU Stay (days)	2.8 ± 0.6	3.6 ± 0.9	<0.001
Hospital Stay (days)	7.9 ± 1.3	9.4 ± 1.8	<0.001

Table 8: Duration of mechanical ventilation

Duration	Group A (n=64)	Group B (n=64)	p-value
<12 hours	45 (70.3%)	32 (50.0%)	0.02
12–24 hours	15 (23.4%)	20 (31.3%)	0.28
>24 hours	4 (6.3%)	12 (18.8%)	0.03

Table 9: Mean postoperative lactate levels (mmol/L)

Time post-surgery	Group A	Group B	p-value
0 hours (Immediate)	1.8 ± 0.4	2.3 ± 0.5	<0.001
6 hours	1.6 ± 0.3	2.1 ± 0.4	<0.001
12 hours	1.4 ± 0.3	1.9 ± 0.4	<0.001

Table 10: Incidence of reoperation due to bleeding

Group	Reoperations	p-value
Normothermia (Group A)	2 (3.1%)	
Hypothermia (Group B)	9 (14.1%)	0.03

Discussion:

In order to improve postoperative outcomes following heart surgery, intraoperative temperature control is crucial, according to the analytical study's findings **[7]**. The incidence of arrhythmias, blood loss, infections and intensive care unit stays was much lower in patients treated with normothermia than in those treated with mild hypothermia **[8]**. According to new research, hypothermia protects the heart during cardiopulmonary bypass, but it can also affect coagulation and immunological function, which can lead to higher morbidity **[9]**. The normothermic group's lower lactate levels and shorter mechanical breathing duration further suggest improved systemic perfusion and recuperation **[10]**. In order to reduce problems and maximize recovery for patients undergoing heart surgery, these findings corroborate the increasing clinical preference for maintaining intraoperative temperatures close to physiological levels **[11]**.

Conclusion:

When compared to mild hypothermia, intraoperative normothermia dramatically lowers postoperative problems in cardiac surgery. Better hemodynamic stability, less bleeding and shorter hospital and intensive care unit stays are all linked to it.

Normothermic techniques may improve surgical results and patient recovery when used regularly.

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