To Evaluate the Effect of Prewarming in Prevention of Inadvertant Perioperative Hypothermia and Shivering

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Abstract: Core temperature is closely maintained physiological parameters as enzyme systems in the body have narrow temperature changes in which they function optimally. Inadvertent perioperative hypothermia (core temperature of <36°C) is preventable problem. Regular recording of temperature is the key to prompt identification and management. To Evaluate the Effect of Prewarming In Prevention of Inadvertant Peri-Operative Hypothermia and Shivering. To assess the effect of prewarming on intraoperative hypothermia, post anaesthetic shivering. To assess time taken for the patient from emergence from anaesthesia. 60 patients of ASA I,II and III status posted for elective ear surgery with age 18years to 60years divided in two groups,Study group (GroupP) received warming preoperatively for 20minutes,Control group (GroupC) did not receive warming preoperatively.Level1 Equator warmer used for warming.Both group received warming intraoperatively. Surface and Core temperature (Nasopharyngeal) charted intraoperatively every 15minutes and time for emergence from anaesthesia was noted.Shivering and thermal comfort were graded postoperatively. The distribution of mean core temperature,mean surface temperature and distribution of mean post anesthetic shivering score are significantly higher in GroupP compared to GroupC (P-value<0.001 for all).The distribution of mean thermal comfort score is significantly higher in GroupP compared to GroupC.The distribution of mean time of recovery is significantly higher in GroupP compared to GroupC and less IPH in patients undergoing ear surgeries under general anaesthesia.

Keywords: Anaesthesia, Core temperature, Inadvertant perioperative hypothermia (IPH), Post Anaesthetic Shivering (PAS), Prewarming.

INTRODUCTION

Core temperature is one of the most closely maintained physiological parameters as enzyme systems in the body have narrow temperature changes in which they function optimally. The normal core temperature range of adult patient is between 36.5°C and 37.5°C [1].

Inadvertent perioperative hypothermia (IPH) is a common but preventable problem. It has been defined as a perioperative core temperature of <36°C [2, 3]. Prevention of unintentional post-operative hypothermia has become standard treatment in the perioperative management of patients undergoing general anaesthesia [3]. Regular measurement and recording of temperature is the key to prompt identification and its management.

Hypothermia under Anaesthesia is caused by:-

- Altered responses to heat loss(ex-lack of shivering)
- Increased heat loss-cold environment exposure
- Cooling effect of cold anaesthetic gases and IV fluids
- Reduced heat production due to reduced metabolic activity

There are known complications attributed to IPH which includes:-

- Increased perioperative blood loss/coagulopathy: the clotting cascade is enzymatic and platelet function is temperature dependant.
- Longer post anaesthetic recovery due to altered drug metabolism
- Post-operative shivering and increased oxygen consumption
- Thermal discomfort
- Cardiac events including MI, arrhythmias

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Inclusion criteria:-
- Duration of surgery >90 minutes to 3hour.
- ASA physical status I, II and III.
- Patients 18 yr to 60yr old.
- Patient for GA and elective ENT procedures.

Exclusion criteria:-
- Febrile patients.
- Patient with thyroid disease or disturbance of autonomic function.
- Gastro-Intestinal surgeries.

Materials
Equator Warmer Level I, Hotline fluid warmer, Multipara monitor (electrocardiogram, noninvasive blood pressure, heart rate, capnography, pulse oximetry, temperature monitor).

METHOD
PRE MEDICATION
Pre medication done with Inj. Glycopyrrolate 0.2 mg.

PRE OPERATION
Patient was counselled regarding the study in the language he/she understood and was asked to sign a written informed consent. After noting preoperative surface temperature, pulse rate, SpO₂ and blood pressure, Group P patients were prewarmed using Equator Warmer Level I for 20 minutes in which temperature was set at 40°C. During the warming procedure patients were asked every 5 minutes about thermal comfort. When active warming was stopped the blanket was left on the patient’s skin without air blow. In pre-operative room surface temperature was measured using a basic thermometer. After prewarming patients were transferred to theatre. Group C did not receive prewarming. Pre-operative warming was well tolerated by the patients.

INTRA-OPERATIVE:
Intra-operative ambient temperature was set to 24°C. Standard monitors were attached and baseline vital parameters (pulse blood pressure, SpO₂ surface temperature) were recorded in both the groups. Inj Midaz 1mg i.v. was given for anxiolysis and Inj Fentanyl 2mcg/kg i.v. was given as analgesic. GA was induced with Inj. Thiopentone sodium and Inj. Scholine and maintained with inhalational agent Sevoflurane and muscle relaxant Inj. Vecuronium in both the groups. All the patients irrespective of whether group P or group C received intra-operative warming with equator warmer level 1 and inline hotline warmed intravenous fluids and monitoring was done accordingly. After the end of the surgery all patients in both the groups were reversed with inj. Neostigmine+inj. Glycopyrrolate and extubated uneventfully.

MONITORING
All patients were monitored for pulse rate, blood pressure, core and surface temperature, SpO₂, ETCO₂ and the time taken for emergence from anaesthesia.

Intra-operative core temperature monitoring done using nasopharyngeal temperature probe and surface temperature was also recorded using a standard thermometer probe. The warming was started just after induction of GA and maintained throughout surgery, in both groups.

POST-OPERATIVE: (IMMEDIATELY AFTER EXTUBATION)
- Patient’s vital parameters (pulse, blood pressure, SpO₂ and temperature) were measured.
- Patient’s recovery from anaesthesia was seen.
  - Eye Opening
  - Motor Activity
  - Obeying Commands
  - Regaining of Protective Reflexes
- Shivering was graded by four point scale every 5min.
- Thermal comfort was evaluated by 100mm Visual Analogue Scale every 15min.

POST-OPERATIVE (RECOVERY ROOM)
Vital parameters pulse rate, blood pressure, skin surface temperature were recorded.

POSTANESTHETIC SHIVERING (PAS) SCALE
The intensity of PAS was graded using the scale described by Crossley and Mahajan:
0 = no shivering;
1 = no visible muscle activity but piloerection, peripheral vasoconstriction or both are present (other causes excluded);
2 = muscular activity in only one muscle group;
3 = moderate muscular activity in more than one muscle group but no generalized shaking;
4 = violent muscular activity that involves the whole body.

THERMAL COMFORT: EVALUATED BY 100 MM VISUAL ANALOGUE SCALE AT 15 MIN INTERVAL
0mm- Worst Imaginable Cold
50mm- Thermally Neutral
100mm- Insufferably Hot

OBSERVATION AND RESULTS
The Entire Data is Statistically Analyzed using Statistical Package for Social Sciences (SPSS ver 21.0, IBM Corporation, USA) for MS Windows.

The demographic distribution of our study population was comparable in relation to age and sex.
Graph-1: As evident from the above graph the distribution of mean core temperature is significantly higher in Group P compared to Group C (P-value<0.001 for all).

Graph-2: As evident from the above graph the distribution of mean surface temperature is significantly higher in Group P compared to Group C (P-value<0.001 for all).

Graph-3: As evident from the graph 3 the distribution of mean time of recovery is significantly higher in Group C compared to Group P (P-value<0.05 for all).

Graph-4: As evident from above graph the distribution of mean post anesthetic shivering score is significantly higher in Group P compared to Group C (P-value<0.001 for all).
Graph-5: As evident from the above graph the distribution of mean thermal comfort score is significantly higher in GroupP compared to GroupC.

DISCUSSION

Prevention of unintentional postoperative hypothermia has become standard treatment in the peri-operative management of patients undergoing general anaesthesia. New guidelines recommend specific measures to maintain patients’ core temperature > 36 °C, postoperatively. Temperature monitoring is an integral part of management of anaesthesia during surgeries. Core temperature is considered more reliable for monitoring.

Hypothermia can occur in patients who undergo major surgeries, by up to 20%, which is also accompanied by various symptoms that can increase the clinical consequences of patients, especially high-risk patients [2]. These consequences include apnea, hypoxia, carbon dioxide retention, metabolic acidosis, hypoglycemia, left shift of oxygenation curve, heart disorders, platelet dysfunction, dysfunction of coagulation enzymes, increased bleeding, increased transfusion requirements, increased lesion infection, change in drug metabolism and thermal discomfort [13-16].

Core temperature was measured intraop by Nasopharyngeal probe in both the groups and found that the distribution of mean core temperature, at baseline, induction and at every 15 minute intervals over 3 hour is significantly higher in Group P compared to Group C (P-value<0.001 for all). Horn et al., in 2012 conducted a similar study and observed that forced-air pre-warming of 10, 20 or 30 min considerably reduced the risk of peri-operative hypothermia and postoperative shivering and concluded that surgical access blanket is effective in preventing post anaesthetic shivering [17].

Mean time of recovery from anaesthesia was noted in both groups by assessing eye opening, motor activity, obeying commands, regaining of protective reflexes and found that the distribution of mean time of recovery is significantly higher in Group C compared to Group P (P-value<0.05). Rainer Lenhardt in 1997 did a study on mild intraoperative hypothermia prolongs postanaesthetic recovery and concluded that maintaining core normothermia decreases the duration of post anesthetic recovery and may therefore reduce costs of care [18].

The intensity of PAS was graded using the scale described by Crossley and Mahajan in postoperative at 5 minutes interval over 1 hour in both groups. The distribution of mean post anesthetic shivering score (PAS scale) is significantly higher in Group C compared to Group P (P-value<0.001 for all). Ihn C, Joo J, Chung H, Choi J, Kim D, Jeon Y, Kim Y, Choi W. in 2008 did a study on comparison of warming devices for the prevention of core hypothermia and post-anaesthetic shivering and concluded that surgical access blanket is effective in preventing post anaesthetic shivering [19]. Same results were obtained by Horn et al in 2012 in his study.

Thermal comfort was evaluated by 100mm visual analogue scale at 15 min interval over 1 hour in both groups. The distribution of mean thermal comfort score is significantly higher in Group P compared to Group C (P-value<0.05 for all). The distribution of mean thermal comfort score (VAS scale) at 60-min did not differ significantly between two study groups (P-value>0.05). Perl et al., in 2013 did a study on efficacy of prewarming in prevention of perioperative hypothermia described that active prewarming reduces perioperative hypothermia and postop shivering and also resulted in better thermal comfort in postop period [20].

CONCLUSION

From present study, we conclude that:
- Prewarming the patient for 20 minutes, development of Inadvertant Perioperative Hypothermia can be prevented.
- Prewarming decreases the time of recovery from anaesthesia
- Prewarming also reduces the incidence of postoperative shivering
- Prewarming also leads to better thermal comfort in postoperative period
REFERENCES


