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ORIGINAL ARTICLE

Comparison of effects of administering warmed vs normal temperature intravenous fluids on body core temperature in surgical individuals.

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ABSTRACT… Objective: This study was designed to evaluate the impact of different temperatures of intravenous fluids on the body. **Study Design:** Randomized Experiment. **Setting:** LRH Peshawar. **Period:** April 2022 to January 2023. **Methods:** 600 individuals were scheduled for abdominal surgery to include them in the study. Two groups were made using sealed, opaque envelopes carrying randomly generated computer numbers. The patient's body temperature, O_2 saturation,, heart rate, shivering, blood pressure and fluid intake were all monitored and recorded on two point i)when he was admitted to the PAR and ii) one and a half hour later. The classification developed by Crossley and Mahajan was used to determine the level of shivering. With SPSS 23, the t test and Mann-Whitney U test were used to evaluate data. **Results:** The mean age of the intervention group was 38.30 years, compared to 37.64 years for the control group. After 30 minutes, the average temperature difference among the two groups on admission to PAR was statistically significant. No discernible difference existed between the levels of pain of two groups. Time to return to work was reported to differ significantly. For factors like SpO2, systolic and diastolic blood pressure, and respiratory rate, no discernible difference was discovered. **Conclusion:** After administering warm fluids intravenously, there is a fall in the intervention group's shivering.

Key words: Core Body Temperature, Fluid Administration, Intravenous Fluids, Post Operative Care, Surgical Patients.

INTRODUCTION

Hypothermia, which is uncontrollable drop in core temperature as low as 36°C, can occur during or shortly after surgery. The infusion of cold blood vessel (IV) fluids affects the intraoperative physiological state because fluids should be warm to reach core temperature and body heat. Thermodynamic calculations shows that one litre of crystalloids infused at room temperature results in a little decrease in the mean temperature (25°C). Establishment of an intraoperative physiological state may be considerably influenced by the administration of many litres of intravenous fluid.[1-3]

Shivering, which is directly related to core temperature, is a common complication in the operating room. Around 5% of patients experience shivering when their core temperature is 35% or higher, whereas 9% of patients do so when it is 34.55% or lower. A general theory states that a physiological predicament in the core or skin brought on by surgical heat loss causes the shivering to begin. After the cold sensors are engaged, the impulse to the shivering motor centre in the posterior brain region becomes active. Once impulses from the posterior brain structure and cold sensors pass a certain threshold, the decision to shiver is formed. This initially results in an increase in tone in the skeletal muscles across the entire body.[4-7] The body's natural tendency to transfer heat from the centre to the periphery causes a rapid drop in core temperature, which causes dilation, under normal physiological conditions. The patient gets the feeling that they have lost a lot of heat while shivering as a result of the concomitant effects of dilatation and reduced cold sensory input.

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Moreover, acquiring additional sedatives and opioids might make their physiological situation worse.[3,8-10]

Many medical specialties and non-pharmacological methods are used to treat shivering. Nonpharmaceutical techniques to therapy are only necessary if medication therapies have side effects such nausea, vomiting, dizziness, sleepiness, cardiovascular illness, constipation, and metastatic depression.

A research claims that giving warm water may decrease the harmful effects of physiological state and shivering. It has been noted that liquid infusions at 37°C during abdominal surgeries is effective for maintaince of the body's normal temperature and avoiding shivering. According to different studies heated saline infusion is effected to decrease in core temperature in mothers having caesarean sections and also reduced shivering following anaesthesia. It was noted in their study how crucial it is to heat fluids intraoperatively to fasten recovery time and lessen variations in blood pressure, temperature, and shivering. Overall, although surgical shivering has negative effects, there are practical and realistic ways to reduce it.[11-12] Due to diverse findings and the lack of any previous research on the local population, this study was design to evaluate the effects of warm fluids administered intravenously with fluid administered at room temperature.

METHODS

600 patients who were scheduled for abdominal surgery at our facility between April 2022 and January 2023 were enrolled as sample in this randomized experiment. The hospital's ethical review board approved the trial (Ref, No, 388/ LRH/MTI Dated: 10th April 2022) a written informed consent form were signed by each of 600 patients. The patients were randomly assigned to one of two groups by casting a vote. The inclusion and exclusion criteria of the research population consisted of patients receiving non-emergency abdominal surgery. None of the patients had a history of thyroid abnormalities, hypertension, diabetes, vascular illnesses, or endocrine disorders. They were not overweight or febrile either. 300 sample size in each group was calculated by using, 1.62 delta was determined from previous research, a 0.95 CI, and 80% statistical power. By inserting 18-G tubing into the ginglymoid joint vein, intravenous fluids were administered at a rate of 8–10 ml per kg every hour. Prior to infusion, all fluids were stored for the patients at surgical temperature.

The patients were divided into one of two teams at random based on how the IV fluids were administered. The control group received warm IV fluids in total. Up to a half-hour before Post anesthesia recovery (PAR) transfer, intervention cluster participants received Ringer's solution that had been heated to 38C. Once the procedure was finished, its length was noted, and the patient was then sent to the PAR .A single, thick blanket was spread over all of the patients during the patient transfer to the PAR, and a mask was utilised to provide a chemical element 5 L/minute to any or all of them. On t admission to the PAR and an hour later, pulse, rate, core temperature, SpO2, diastolic and systolic blood pressures, shivering, and fluid intake were assessed and documented. Crossley and Mahajan classification method was used to determine the degree of shivering. The classifications were as follows: 'zero (no shivering), one (straight hair, visible environmental symptom without shivering), two (muscle tremor visible in a particularly large cluster of muscles), three (muscle tremor in more than one cluster of muscles), and four (muscle tremors of all muscles).'

Data was analyzed using the SPSS 23.0 for Windows. Results were expressed as the mean and standard error (SEM). Statistical analysis was performed using. The t test and Mann-Whitney U test was used to compare the groups.

RESULTS

The findings indicated that there were 300 patients in each group in the study population, with a mean age of 38.30 with SD 11.45 years for intervention group and 37.64 with SD 14.63 years for the control group.

The core temperature in control group members fluctuated from 97.62°F (1.30°C) when they were admitted to the OR to 96.23°F (1.101°C) when they were admitted to the PAR, and finally to 96.44°F (1.05°C) after 30 min. Average temperatures of individuals of intervention group ranged was 97.56°F (1.01) at the time of admission to the OR to 97.01°F (1.04) at admission to PAR, and finally to 97.08°F (1.06) 30 minutes later. The mean core temperatures at admission to the OR were not statistically significantly different between the intervention group and the control group. 30 minutes after PAR admission, the average core temperature difference reached statistical significance.

Control group had an average pulse 94.54 when they entered the operating room, 85.00 when they entered the intensive care unit, and 80.37 when they entered the facility 30 minutes later. The experimental group's patients had an average pulse of 97.42 when they entered the OR, 92.27 when they entered the PAR, and 87.23 when they entered the PAR 30 minutes later. Statistical analysis revealed that there was no statistically significant difference in the mean heart rate of patients at the time of admission to the OR between groups. However, this differentiation did not matter for entering the PAR or for 30 minutes after PAR admission. Factors like O2 pressure, diastolic and systolic blood pressure and respiratory rate, the difference between the groups at any of the periods of observation was not statistically significant.

Shivering was seen in one patient of the group receiving warmed fluids (severe) and in seven patients of the control group as they recovered (0.05; three mild and four severe). Pre-induction core temperature recovery took 95 minutes in the control group and 94 minutes in the group receiving heated fluids.

DISCUSSION

Hypothermia is a serious complication after surgery that raises oxygen use by 200-600% in direct proportion to intraoperative heat loss.[4-6] The postoperative incidence of shivering is strongly related to the core temperature at anaesthesia end.[12] Keeping the patient normothermic during surgery is thus the most logical technique for avoiding postoperative shivering.

Factors	Admission Timing	Groups		P-Value
		Control n=300 Mean and SD	Intervention n=300 Mean and SD	
Core temperature (°F)	OR	97.62 1.30	97.7 6 1.01	.764
	PAR	96.23 1.01	97.12 1.04	.063
	30 min after entering the PAR	96.44 1.05	97.17 1.15	.002
Pressure of O2 (mmHg)	OR	96.95 1.84	98.65 1.80	.470
	PAR	98.53 2.56	96.81 2.47	.724
	30 min after entering the PAR	97.47 1.67	97.57 1.35	.568
Blood Pressure (Systolic) (mmHg)	OR	127.76 19.78	142.45 18.20	.306
	PAR	134.50 16.75	121.83 17.40	.835
	30 min after entering the PAR	134.68 17.31	135.43 15.68	.857
Blood Pressure (Diastolic) (mmHg)	OR	81.67 15.52	83.57 15.80	.338
	PAR	73.9712.27	77.37 12.59	.880
	30 min after entering the PAR	72.66 19.16	78.95 10.14	.257
Pulse rate (bpm)	OR	94.56 17.95	97 .42 18.48	.324
	PAR	85.01 15.76	92.27 13.41	.042
	30 min after entering the PAR	80.37 14.86	87.23 13.10	.016
Respiratory rate (breath per minute)	OR	23.10 3.83	23.50 4.96	.674
	PAR	22.46 3.35	23.52 4.34	.339
	30 min after entering the PAR	22.36 4.54	24.20 2.85	.734

Table-I

Patients' heart rate, body temperatures and shivering significantly decreased after warm I/V fluids, both immediately upon PAR entry and 30 minutes onwards, according to the data. The intervention group's average core temperature was higher than the control group's, but both groups' core temperatures were lower at admission and for the first 30 minutes after entering the PAR than they were when they entered the OT. This decline, however, was smaller in warm fluid group than the control group, reflecting the influence of warm fluids on preventing patients' core temperatures from dropping. Yokoyama et al[8] also shows that individuals who got heated fluids at 38 degrees Celsius had considerably higher core temperatures (5.0) than those who received fluids at room temperature. Another research found that utilising warm fluids to combat hypothermia was successful.[10] The findings revealed that hypothermia was observed in 46% of abdominal surgery patients, with one-third still having hypothermia upon admission to the PAR.

Shivering was not more common in the control group than in the intervention group at OT admission, but it was more common at PAR admission and 30 minutes after. Shivering after surgery is connected with a drop in core temperature. In the study conducted by Jorgensen[9], warm fluids were shown to have no influence on the frequency of shivering; this contradicting finding can be explained by the fluid's kind and temperature (37C). Behdad et al's[10] study revealed that, individuals who received fluids at 38 degrees Celsius reported much less shivering and hypothermia than the control group. Woolnough et al[11] found that infusing warm fluids intravenously reduced hypothermia but shivering is not reduced. It could be due to methodology he used in his study. Dabir et al[12] determined that hypothermia had no association with the frequency of shivering, and that the discrepancy might be attributed to other patient factors.[11]

The data revealed that the patient's pulse difference between the groups was not statistically significant at time of OT admission, but it were at PAR admission time and after 30 minutes. Pulse rate decreased in patients of both groups from admission to the PAR to 30 minutes later, although changes in the pulse rate in the control group relative to experimental group were greater. A study by Oshvandi et al[13] found no significant change in systolic and diastolic blood pressure between the two groups Although Frank et al[14] claimed to discover that hypothermic patients had decreased pulse rate and greater blood pressure during postoperative time. However, Kurz et al[15] showed no difference in the heart rate and arterial blood pressure in two hypothermia and normothermia groups of healthy young people. A major source of concern for these patients continues to be inadvertent hypothermia. To ensure safe and high-quality treatment, it is imperative to use the most up-to-date data to guide therapeutic procedures aimed at achieving balanced body temperature in surgical patients.[16-20] On through literature search no local data available on the said topic for comparison. Single centre study is the main limitation of this work.

CONCLUSION

It can be concluded that warm fluids intravenously reduces the shivering and there is also a relationship between the decline in core temperature and reducing shivering so that core temperature in the warm fluid group was more stable while it declined in other group.

REFERENCES

1. Ni TT, Zhou ZF, He B, Zhou QH. **Effects of combined warmed preoperative forced-air and warmed perioperative intravenous fluids on maternal temperature during cesarean section: A prospective, randomized, controlled clinical trial.** BMC Anesthesiol. 2020; 20(1):48. Published 2020 Feb 26. doi:10.1186/s12871-020-00970-7

2. Vallier DJ, Anderson WJL, Snelson JV, et al. **Comparison of warming capabilities between buddy lite, enFlow, and Thermal Angel for US Army Medical Personnel in Austere Conditions: A Literature Review.** J Spec Oper Med. 2022; 22(4):9-13. doi:10.55460/HFTS-LQNF.

3. Waldmann AD, Rose EA, Pedro MJ. **Fluid warming with parylene-coated enFlow cartridge: Bench and pilot animal study of aluminum extraction due to prolonged use.** SAGE Open Med. 2021; 9:20503121211026849. Published 2021 Jun 19. doi:10.1177/20503121211026849

4. Perl T, Kunze-Szikszay N, Bräuer A, et al. **Aluminium release by coated and uncoated fluid-warming devices.** Anaesthesia. 2019; 74(6):708-713. doi:10.1111/anae.14601

5. Taylor MH, Choi D, Fitzpatrick SM, Gunn KN. **Characterisation of aluminium release by the enFlow® fluid-warming system in crystalloids and blood products.** Anaesthesia. 2019; 74(11):1374-1380. doi:10.1111/anae.14697

6. Bayoro DK, Groepenhoff H, Hoolihan D, Rose EA, Pedro MJ, Waldmann AD. **Impact of parylene coating on heating performance of intravenous fluid warmer: A bench study.** BMC Anesthesiol. 2022; 22(1):44. Published 2022 Feb 10. doi:10.1186/s12871-022-01585-w

7. Zoremba N, Bruells C, Rossaint R, Breuer T. **Heating capabilities of small fluid warming systems.** BMC Anesthesiol. 2018;18(1):98 doi.org/10.1186/s12871-018-0565-x

8. Yokoyama K, Suzuki M, Shimada Y, Matsushima T, Bito H, Sakamoto A. **Effect of administration of pre-warmed intravenous fluids on the frequency of hypothermia following spinal anesthesia for Cesarean delivery.** J Clin Anesth. 2009; 21(4):242-248. doi:10.1016/j.jclinane.2008.12.010

9. Jørgensen HS, Bach LF, Helbo-Hansen HS, Nielsen PA. **Warm or cold saline for volume preload before spinal anaesthesia for caesarean section?** [published correction appears in Int J Obstet Anesth. 2000 Apr; 9(2):148]. Int J Obstet Anesth. 2000; 9(1):20-25. doi:10.1054/ijoa.1999.0331.

10. Behdad S, Abdollahi MH, Aeiatollahi V, et al. **The effect of administering warmed intravenous fluids on maternal body core temperature in cesarean delivery.** Anesth Pain Med. 2012; 2:146-151.

11. Woolnough M, Allam J, Hemingway C, Cox M, Yentis SM. **Intra-operative fluid warming in elective caesarean section: A blinded randomised controlled trial.** Int J Obstet Anesth. 2009; 18(4):346-351. doi:10.1016/j.ijoa.2009.02.009.

12. Dabir S, Parsa T, Radpay B. **The incidence of postanesthesia shivering and clinical relevant factors in women in Javaheri Hospital in Tehran.** J Mazandaran Univ Med Sci. 2010; 20: 42-48.

13. Nasiri A, Akbari A, Sharifzade G, Derakhshan P. **The effects of warmed intravenous fluids, combined warming (warmed intravenous fluids with humid-warm oxygen), and pethidine on the severity of shivering in general anesthesia patients in the recovery room.** Iran J Nurs Midwifery Res. 2015 Nov-Dec; 20(6):712-6. doi: 10.4103/1735-9066.170014. PMID: 26793258; PMCID: PMC4700692.

14. Frank S, Fleisher L, Breslow M, et al. **Perioperative maintenance of normothermia reduces the incidence of morbid cardiac events.** A randomized clinical trial. JAMA. 1997; 277:1127-1134.

15. Kurz A, Sessler DI, Narzt E, et al. **Postoperative hemodynamic and thermoregulatory consequences of intraoperative core hypothermia.** J Clin Anesth. 1995; 7(5):359-366. doi:10.1016/0952-8180(95)00028-g

16. Xu H, Wang Z, Lu Y, et al. **Value of active warming devices for intraoperative hypothermia prevention-a meta-analysis and cost-benefit analysis.** Int J Environ Res Public Health. 2021; 18(21):11360. Published 2021 Oct 28. doi:10.3390/ijerph182111360

17. Rufiange M, Leung VSY, Simpson K, Pang DSJ. **Pre-warming following premedication limits hypothermia before and during anesthesia in Sprague-Dawley rats (Rattus norvegicus).** Can J Vet Res. 2021;85(2):106-111

18. Rufiange M, Leung VS, Simpson K, Pang DS. **Prewarming followed by active warming is superior to passive warming in preventing hypothermia for short procedures in adult rats (Rattus norvegicus) under isoflurane anesthesia [published online ahead of print, 2020 Jun 8].** J Am Assoc Lab Anim Sci. 2020; 59(4):377-383. doi:10.30802/AALAS-JAALAS-19-000114

19. Xu H, Wang Z, Guan X, et al. **Safety of intraoperative hypothermia for patients: Meta-analyses of randomized controlled trials and observational studies.** BMC Anesthesiol. 2020; 20(1):202. Published 2020 Aug 15. doi:10.1186/s12871-020-01065-z

20. Yang F, Wang J, Cui J, Zhuan J, Hu X, Chen S. **An overview of the implications for perianesthesia nurses in terms of intraoperative changes in temperature and factors associated with unintentional postoperative hypothermia.** J Healthc Eng. 2022; 2022:6955870. Published 2022 Apr 11. doi:10.1155/2022/6955870

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4	Shabir Hasan	Data collection and paper write up.	
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