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Marwah Abdul Al-Rahman Elttayef
Department of Anesthesia, Tikrit Teaching Hospital, Salah Aldeen, Iraq

Bashar Zuhair Talib Al Naqeeb
Department of Anesthesia, Tikrit Teaching Hospital, Salah Aldeen, Iraq

Mohammed Adel Jasim
Department of Anesthesia, Tikrit Teaching Hospital, Salah Aldeen, Iraq

Iyad Abbas Salman
Department of Anesthesia, Tikrit Teaching Hospital, Salah Aldeen, Iraq

Corresponding Author:
Marwah Abdul Al-Rahman Elttayef
Department of Anesthesia, Tikrit Teaching Hospital, Salah Aldeen, Iraq

Role of irrigation fluid temperature in maintaining core temperature and hemodynamic control during Spinal-Anesthetized TURP Procedures

Marwah Abdul Al-Rahman Elttayef, Bashar Zuhair Talib Al Naqeeb, Mohammed Adel Jasim and Iyad Abbas Salman

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Abstract
Background: Transurethral resection of the prostate (TURP) requires continuous bladder irrigation, and the temperature of the irrigating solution may influence a case's thermal balance. Under spinal anesthesia, the normal thermoregulatory responses are dampened, making cases more prone to perioperative drops in body temperature and related cardiovascular disturbances.
Objective: To compare the effects of warmed versus room-temperature irrigation fluids on intraoperative core temperature and hemodynamic variables in cases undergoing TURP with spinal anesthesia.
Methods: This prospective randomized study included male cases scheduled for elective TURP. Participants received either irrigation fluid warmed to approximately 37 °C or fluid at ambient room temperature (20-22 °C). Core temperature, blood pressure values, mean arterial pressure, and heart rate were monitored from baseline and at 10-minute intervals throughout the operation. Episodes of hypothermia (temperature <36 °C), shivering, and any hemodynamic interventions were recorded.
Results: Use of room-temperature irrigation fluid resulted in a more pronounced decline in core temperature compared with warmed fluid. Hypothermia and shivering occurred more frequently in the room-temperature group. Although both groups experienced some reduction in mean arterial pressure, the room-temperature group showed a greater drop and required more vasopressor support.
Conclusion: Employing warmed irrigation fluids during TURP under spinal anesthesia helps maintain normothermia and limits undesirable hemodynamic changes. Routine warming of irrigation solutions may enhance intraoperative stability and case comfort.

Keywords: TURP, irrigation fluid, core temperature

Introduction
Transurethral resection of the prostate (TURP) is an endoscopic surgical technique used to excise the portion of prostatic adenoma that narrows the urethral channel. The procedure employs a heated wire loop that is advanced through the glandular tissue, shaving it into small fragments that can be extracted through the urethra. TURP was the earliest minimally invasive method developed for treating lower urinary tract symptoms (LUTS) arising from benign prostatic hyperplasia (BPH), and it has remained a cornerstone of urologic practice for more than five decades in various modified forms [1]. Notably, approximately one-third of individuals presenting with LUTS do not have demonstrable BPH, and persistent symptoms occur in 5%-35% of cases even after TURP [2].
TURP continues to be considered the gold standard intervention for relieving bladder outlet obstruction (BOO) secondary to BPH. Common clinical indications include acute urinary retention, recurrent macroscopic hematuria, recurrent urinary tract infections, obstructive-related renal dysfunction, and inadequate response to pharmacologic therapy [3].
The procedure typically requires large amounts of irrigation fluid to maintain bladder distension and ensure adequate visualization. As the prostatic capsule is incised and venous sinuses are opened during resection, irrigation solution may enter the systemic circulation, potentially causing complications such as fluid overload, pulmonary edema, heart failure, hyponatremia, and inadvertent cooling of the case (hypothermia) [4]. The degree of irrigation-fluid absorption depends largely on the hydrostatic pressure within the bladder relative to venous pressures. Unlike spontaneously breathing cases, those on positive-pressure ventilation exhibit higher

central venous pressure and reduced venous return, factors that can alter the extent of intravascular fluid uptake [5]

Body temperature is one of the essential vital signs, with an average core temperature of approximately 37 °C in healthy adults. Perioperative hypothermia refers to an unintended reduction in core temperature to below 36 °C during surgery or in the immediate postoperative period. Even a mild decrease of 1-3 °C from the normal baseline has been shown to negatively affect physiological function [4]. Clinical manifestations depend on how low the temperature becomes. Hypothermia is commonly categorized as mild (32-35 °C), moderate (28-32 °C), and severe (<28 °C), with some classifications adding a category of profound hypothermia for temperatures below 24 °C. As the temperature falls, both the severity of symptoms and the risk of complications and mortality increase [6].

According to the National Institute for Health and Care Excellence (NICE), up to 70% of cases arriving in the recovery area experience some degree of hypothermia. The likelihood of perioperative ischemic cardiac events—such as myocardial infarction, unstable angina, or cardiac arrest—rises threefold in hypothermic individuals. In addition, hypothermia interferes with normal coagulation and tissue repair, contributing to delayed wound healing and a higher need for postoperative blood transfusion [7].

Postoperative hypothermia has been documented in 26% to 90% of cases undergoing elective procedures. The risk is particularly significant in older adults (especially those over 60 years), individuals with malnutrition, and those with pre-existing disorders that impair thermoregulation, such as diabetic neuropathy. Cases undergoing extensive or prolonged operations are also highly susceptible [8].

In the United States, an estimated 700-1,500 deaths annually list hypothermia as a contributing factor, although the actual incidence is likely higher due to underreporting. Even with optimal in-hospital management, mortality associated with moderate to severe hypothermia may approach 50% [9]

Hypothermia occurs when the body loses heat faster than it can generate or retain it, ultimately disrupting normal physiologic balance and impairing organ function. A variety of conditions may contribute to this imbalance [6, 9-11]:

- Exposure to cold environments, physical stress, or reduced internal heat production (i.e., impaired thermogenesis).
- Extremes of age, such as infants and older adults, who have limited thermoregulatory capacity.
- Disorders that diminish heat generation, including hypoglycemia, malnutrition, and certain endocrine abnormalities.
- Skin diseases such as psoriasis or burns, and conditions that cause abnormal peripheral vasodilation or nerve dysfunction (e.g., peripheral neuropathy, spinal cord injury), all of which increase heat loss.
- Neurologic disorders and substance use that alter hypothalamic control of temperature regulation.
- Impaired behavioral responses to cold, particularly in individuals with dementia, psychiatric illness, or drug intoxication.
- Operating room conditions, as well as medications like general anesthetics, beta-blockers, meperidine, clonidine, neuroleptics, and alcohol.
- Use of irrigation fluids, especially when chilled.

Many factors in the perioperative setting also predispose cases to hypothermia [7, 12-15]:

Spinal anesthesia, which interrupts autonomic thermoregulatory pathways.

- Premedication agents such as benzodiazepines.
- Administration of unwarmed intravenous fluids.
- Cold antiseptic skin preparations.
- Low ambient temperature in the operating room.
- Long or extensive surgical procedures.
- Low body mass index or reduced nutritional reserve.
- Pre-existing hypothermia before surgery begins.

Mechanisms of Heat Loss and Regulation

Core temperature reflects the equilibrium between internal heat generation and heat dissipation to the environment. Heat is lost through four primary pathways: radiation, conduction, convection, and evaporation [16].

- Radiation involves transfer of heat via electromagnetic waves.
- Conduction occurs when heat moves from the body to a cooler surface in direct contact with it.
- Convection involves heat carried away by moving air or fluid around the body.
- Evaporation is the heat consumed when liquid converts to vapor.

Although radiation is the most common form of heat loss under normal conditions, unintentional hypothermia most frequently develops through convective loss, especially in cold air or water, or when clothing is wet from immersion or perspiration [6].

Thermoregulation is primarily governed by the hypothalamus, which integrates signals from peripheral and central temperature receptors. When exposed to cold stress, the hypothalamus initiates physiological responses to enhance heat production. Baseline muscle tone increases, and metabolic activity rises, effectively doubling basal heat output.

Shivering—brief involuntary muscle contractions lasting more than 15 seconds—increases heat production by two to five times. However, shivering also heightens oxygen consumption, triggers lactic acidosis, and increases carbon dioxide production. Catecholamine release leads to elevated heart rate, blood pressure, and cardiac output. These responses may worsen cardiac ischemia and interfere with monitoring, and they may raise intraocular and intracranial pressures. Additionally, shivering can contribute to discomfort, postoperative bleeding, pain, and a higher risk of infection.

Cold exposure also stimulates endocrine responses involving the thyroid gland, adrenal system, and sympathetic nervous system. Behavioral modifications—such as adding clothing, seeking shelter, or physical activity—supplement physiologic mechanisms.

As hypothermia progresses, the body attempts to preserve vital organ function by increasing ventilation, metabolic rate, and cardiac output. However, with further cooling, multiple organ systems—neurologic, metabolic, and cardiovascular—begin to fail, ultimately leading to death if uncorrected [11]

General anesthesia significantly disrupts the body's central thermoregulatory mechanisms, lowering the temperature thresholds at which vasoconstriction and shivering are initiated. As a result, most cases who undergo general anesthesia without the aid of active warming measures experience a decline in core temperature. Although spinal anesthesia also alters

thermoregulation, the pattern differs: it elevates the sweating threshold while reducing the vasoconstriction and shivering thresholds, though not to the same extent as general anesthesia [17].

There are reports of hypotension during spinal anesthesia that failed to respond to vasopressor therapy, with hypothermia identified as the underlying cause [18]. When core temperature drops severely, marked cardiovascular depression can occur; cases of pulseless electrical activity have been documented in profound hypothermia. Initially, exposure to cold activates the sympathetic nervous system in an attempt to conserve heat through peripheral vasoconstriction and increased cardiac output, leading to elevated blood pressure. However, as hypothermia progresses to moderate or severe stages, catecholamine levels fall back toward baseline, organ function becomes globally suppressed, and both mean arterial pressure (MAP) and cardiac output gradually decline. Restoration of core temperature has been shown to improve blood pressure as thermoregulatory and cardiac function recover [19].

The purpose of this study is to compare the changes in core body temperature and hemodynamic parameters in cases undergoing TURP under spinal anesthesia when warm irrigation fluid is used versus when room-temperature irrigation fluid is employed.

Methods

Study Design, Setting, and Period of Data Collection

A randomized clinical trial was carried out in the urology operating theaters of Al-Yarmouk and Al-Imamain Al-Kadhmain Teaching Hospitals in Baghdad, Iraq. The study spanned one year, from September 2019 to September 2020.

Study Population and Sample Size

A total of 40 male cases scheduled for elective transurethral resection of the prostate under spinal anesthesia were recruited. Participants were randomly assigned to one of two groups:

1. Group A: 20 cases who received irrigation fluid maintained at room temperature (21 °C).
2. Group B: 20 cases who received warmed irrigation fluid (37 °C).

Randomization was performed by allocating cases with odd registration numbers to Group A and those with even numbers to Group B.

Inclusion Criteria

- Cases classified as American Society of Anesthesiologists (ASA) physical status I-II
- Elective TURP under spinal anesthesia.
- Age between 50 - 75 years.
- Weight between 70 - 100 kg.
- Height between 160 - 180 cm

Exclusion criteria:

1. Cases contraindicated to subarachnoid block.
2. Cases with known hypersensitivity to the local anesthetic agents.
3. Cases with severe anemia that need blood transfusion.

All cases were exposed to the following

A. Full history.
B. Examination with vital signs.
C. Laboratory investigation.
D. All cases were kept fasting for six hrs.
E. Mean Arterial Blood Pressure, Systolic, diastolic, Heart Rate, and the core body temperature were documented before anesthesia (Baseline readings).
F. The duration of surgery, the amount of an irrigation fluid that used, the need for vasopressor were also recorded both intra and postoperatively.

Procedure

- Prior to the induction of spinal anesthesia, two wide bore I.V cannulas were placed and preload with I.V fluid of 1000 ml ringer solution was administered for all cases.
- All of the intravenous fluids that used during the surgery was kept at the room temperature.
- The Core body temperature of all cases was recorded with the aid of infrared tympanic membrane thermometer.
- All cases were assumed subarachnoid block in a sitting situation, by means of 22G Quincke Spinal Needle and a 10 mg, 0.5% of a hyperbaric bupivacaine under all aseptic condition to achieve the target level of T10. The fluid replacement was maintained by ringer solution. The cases were head up at the beginning after that they shifted to supine position and the level of a block was examined by a pinprick method.
- The temperature of room was sustained at 21 °C When the level of the block grasped T10, the surgeon started his work, then a monopolar resection was achieved by means of a cautery with a cutting and a coagulation situation of a 100 and a 60 W respectively.
- The irrigation fluid reservoir was positioned at a fixed height of 60 cm for all cases. In Group A, the distilled water used for irrigation remained at ambient room temperature throughout the procedure.
- Group B, Included 20 cases received irrigation fluid which taken from distillation device, being cool to 37 °C, measured by thermometer.
- All of the cases had been covered from the level of a neck to the umbilicus to keep against the loss of heat throughout a procedure.
- Shivering was measured during surgery by bedside shiver assessment score at 15 mints. interval. This score was graded as the following [1]:

1. **Grade 0:** No shivering.
2. **Grade 1:** Shivering that is restricted to the neck and /or the thorax and could be perceived only as an artifact on the electrocardiography, or to be sensed by the palpation.
3. **Grade 2:** upper extremities and thorax that are Intermittently involved.
4. **Grade 3:** Widespread shivering or a continuous upper, and lower limbs shivering.

- Blood pressure and the heart rate were monitored with an automated cuff blood pressure monitor every three mints and recording them at 15-mints. intervals (baseline, 15, 30, 45, and 60 mints.) till the end of the operation. Any SBP ≤ 90 mmHg or decrease the MAP ≤ 20% from any drop in blood pressure below the baseline value was regarded as hypotension and was managed promptly by increasing the infusion rate of Ringer's solution, along with administering an intravenous bolus of 5 mg ephedrine.
- ECG and SPO_2 monitoring was done during the operation.

Data Analysis

All collected data were processed and analyzed using SPSS version 25. Continuous variables were presented as means, standard deviations, and ranges, while categorical variables were

expressed as frequencies and percentages. Comparisons of continuous data between groups were performed using the independent samples t-test (two-tailed). Associations between categorical variables and study groups were evaluated using the chi-square test, with the Fisher's exact test applied when expected cell counts were below five. A p-value < 0.05 was considered statistically significant.

Ethical Approval and Considerations

Cases were informed verbally about the study and provided consent to participate. All personal identifiers were kept confidential, and the data were used solely for research purposes. The study received administrative approval from the Scientific Council of Anesthesia and Intensive Care, Arab Board.

Results

A total of 40 male cases undergoing TURP under spinal anesthesia were enrolled in the study and randomly divided into two groups. Group A included 20 cases who received irrigation fluid at room temperature (21 °C), while Group B consisted of 20 cases who received irrigation fluid warmed to 37 °C.

General Characteristics

The general characteristics of the study population are summarized in Table 1. Cases' ages ranged from 50 to 72 years, with a mean of 63.5±5.98 years. The majority of participants in Group A and Group B were between 60 and 69 years old (50% and 65%, respectively).

Comparison of general characteristics between the two groups revealed no statistically significant differences in age, body mass index (BMI), duration of surgery, volume of irrigation fluid used, medical history, or ASA physical status classification ($P \geq 0.05$), as detailed in Table 2

Table 1: Comparison between study groups by general characteristics

General Characters	Study Group (mean ± SD)		P- Value
	Group A	**Group B**	
Age (Years)	63.6±6.22	63.4±5.89	0.917
BMI level	27.17±2.64	27.18±6.97	0.131
Duration of Surgery	44.5±18.33	43.5±7.96	0.824
Amount Irrigation in Fluid	16.0±1.37	16.1±1.07	0.799

Table 2: Comparison by ASA and medical history

Variable	Study Group		Total (%) n= 40	P- Value
	Group A n= 20	**Group B n= 20**		
ASA				
I	12 (60.0)	12 (60.0)	24 (60.0)	**1.0**
II	8 (40.0)	8 (40.0)	16 (40.0)	
Medical history				
Hypertension	4 (20.0)	2 (10.0)	6 (15.0)	**0.73**
Hypertension + DM	4 (20.0)	4 (20.0)	8 (20.0)	**0.67**
No	12 (60.0)	14 (70.0)	26 (65.0)	**0.9**

Mean Arterial Pressure (MAP)

The comparison of mean arterial pressure (MAP) between the two study groups is presented in Table 3. Throughout the entire duration of surgery, there were no statistically significant differences in mean MAP values between Group A and Group B ($P \geq 0.05$).

Table 3: Comparison by mean of MAP

Time	MAP (mmHg) (**Mean ± SD**)		P- Value
	Group A Mean ± SD	**Group B**	
Before induction	106.73±11.7	107.93±6.9	0.694
At Induction	94.5±10.7	97.91±5.8	0.217
After 15 Mints	87.8±10.1	91.13±5.6	0.208
After 30 Mints	83.59±10.4	88.13±6.6	0.124
After 45 Mints	90.61±11.2	91.81±7.7	0.730
After 60 Mints	95.00±10.0	90.33±13.0	0.727
At the End	90.79±8.9	93.24±5.9	0.354

Heart Rate (HR)

The mean heart rate values for the two groups are summarized in Table 4. No statistically significant differences were observed between Group A and Group B at any time point during the operation ($P \geq 0.05$).

Table 3.4: Comparison by mean of HR.

Time	Heart Rate (beats/mint) (mean ± SD)		P - Value
	Group A	**Group B**	
Before induction	89.66±118	92.6±7.9	0.367
At Induction	90.55±11.2	89.0±7.7	0.618
After 15 Mints	82.25±17.1	85.0±8.3	0.531
After 30 Mints	81.37±8.0	84.1±7.9	0.313
After 45 Mints	79.75±8.9	81.22±7.1	0.655
After 60 Mints	81.0±5.8	79.0±4.0	0.313
At the End	80.11±4.2	81.65±5.5	0.336

Core temperature

The comparison of mean core body temperature between the two groups is presented in Table 5. During the operation, Group A (room-temperature irrigation) consistently showed significantly lower core temperatures compared to Group B (warmed irrigation) at 10, 15, 30, 45, 60 minutes, and at the end of surgery (36.1 vs. 36.63 °C, P = 0.021; 36.0 vs. 36.79 °C, P = 0.043; 36.73 vs. 35.8 °C, P = 0.033; 36.56 vs. 35.66 °C, P = 0.013; 36.62 vs. 35.7 °C, P = 0.001, respectively). No significant differences were observed between the groups in baseline core temperature or at the time of induction ($P \geq 0.05$).

Table 5: Comparison by mean of core temperature

Time	Core temperature (°C) (mean ± SD)		p-value
	Group A	**Group B**	
Before Induction	36.80±0.9	36.86±0.9	0.073
At Induction	36.59±0.2	36.69±0.1	0.081
After 15 Mints	35.10±0.3	35.63±0.2	0.023
After 30 Mints	35.0±0.26	35.79±0.22	0.033
After 45 Mints	34.80±0.18	35.73±0.29	0.025
After 60 Mints	34.66±0.35	35.56±0.25	0.013
At the end	34.70±0.2	35.62±0.24	0.001

Shivering Score

The comparison of mean shivering scores between the study groups is presented in Table 6. During the operation, Group A (room-temperature irrigation) exhibited significantly higher shivering scores than Group B (warmed irrigation) at 30 and 45 minutes (0.66 vs. 0.2, P = 0.014; and 1.0 vs. 0.22, P = 0.001, respectively). At all other time points, no statistically significant differences in shivering scores were observed between the groups ($P \geq 0.05$).

Table 6: Comparison between study groups by mean of shivering score

Time	Shivering Score (mean ± SD)		P-Value
	Group A	**Group B**	
At induction	0.2±0.41	0.1±0.3	0.389
After 15 Mints	0.55±0.7	0.2±0.41	0.062
After 30 Mints	0.66±0.68	0.2±0.41	0.014
After 45 Mints	1.0±0.66	0.22±0.42	0.001
After 60 Mints	0.7±0.4	0.3±0.5	0.134
At the End	0.4±0.5	0.2±0.41	0.176

Comparison of the two groups regarding the requirement for vasopressor therapy is presented in Table 7. There was no statistically significant difference between Group A and Group B in the use of vasopressors ($P \geq 0.05$).

Table 7: Comparison between study groups by the need to vasopressor therapy

Vasopressor Therapy	**Study Group**		**Total (%) n= 40**	**P- Value**
	Group A n= 20	**Group B n= 20**		
Yes	4 (100.0)	0 (0.0)	4 (10.0)	**0.109**
No	16 (44.4)	20 (55.6)	36 (90.0)	**0.103**

Discussion

In this study, a total of 40 cases undergoing TURP under spinal anesthesia were enrolled and divided into two groups: Group A included 20 cases who received irrigation fluid at room temperature (21 °C), and Group B included 20 cases who received warmed irrigation fluid (37 °C). There were no statistically significant differences between the groups in mean arterial pressure (MAP) at any time during the operation ($P \geq 0.05$). Similarly, the requirement for vasopressor therapy did not differ significantly between the two groups ($P \geq 0.05$).

These findings are consistent with those reported by Singh *et al*. (2014), in which cases receiving irrigation fluid at room temperature (21 °C) and those receiving fluid at 37 °C showed some changes in hemodynamic parameters, including MAP, but these differences were not statistically significant (P > 0.05) [20]. Other literature done by Hahn and colleagues in 2006 demonstrated that the cases with more fluid absorption in the TURP, 75% had perioperative hypertension are explain by rapid volume expansion that can reach up to 200ml/min [21]. This may due to the circumstance that, the cases who are spontaneously breathing under the regional anesthesia absorb much more of the irrigation fluids as equated to the cases who are undergoing a general anesthesia with a significantly reduced central venous pressure observed before the initiation of irrigation during positive-pressure ventilation should be considered a potential contributor to this effect, therefor revealing much more drop in the core temperature of the body and variations in hemodynamic components (as MAP and heart rate) [22].

There were no significant differences, in a present study, in means of heart rate. An agreement observed in study done by Singh *et al* study in 2014, in which variations in a hemodynamic constraints like the heart rate was existing, but had not touched the level of significance (P>0.05) [20]. In circumstance, decrease in the heart rate was distinguished in the cases participated in both studies were probably owing to the sympathetic block consequence of a spinal anesthesia.

In this study, means of core temperature was lesser in a significant level; among group A than that in the group B, while no significant differences in mean of core temperature before and at induction ($P \geq 0.05$). By comparison to a study conducted in 2018, by Rajeev Kumar and colleagues, a close results observed, in that amongst cases underwent TURP under spinal anaesthesia, all the cases exhibited constantly reduction of the core body temperature that was significant (p<0.05) at different intervals of the study.

The Core body temperatures were much more less in the group that got an un-warmed irrigation fluids in comparison with the pre-warmed irrigation fluids group when surgery ended [23]. Similar findings were reported by Cao *et al*. (2019), who observed that the incidence of hypothermia was lower in cases receiving warmed irrigation fluid compared to those receiving room-temperature fluid. Cases in the room-temperature fluid group experienced a significantly greater decrease in core body temperature than those in the warmed fluid group (P < 0.001) [24].

Similarly, Singh *et al* study in 2014, reported a finding designated that subjects whom consumed an ambient fluids showed a statistically significant decrease in the perioperative temperature as compared to subjects that consumed a warmed irrigation fluids, they reach a conclusion that usage of a warmed irrigation fluids during a transurethral resection of the prostate decreases the danger of the perioperative hypothermia [20]. Finally, current findings closely agree with a study conducted by Okeke and colleagues in 2007, in which established that subjects that consumed iso-thermic irrigation fluids had significantly slight variations in a body temperature as compared to those received it at the room temperature [25]. In contrary to the current results, Jaffe and colleagues in their study found no association between the irrigation fluid temperatures and reduction in the core body temperature in a TURP [26].

Factors, that might impact variances in the occurrence of the hypothermia among the current results and other studies might be a dissimilar sample size enrolled in each study, dissimilar age groups, the variation in the temperature of a warm irrigating fluid (33.05 °C vs. 37 °C), sensory block levels, Non active case warming, Usage of an unwarm intravenous fluids along with length of operation, subsequently restraining surgical time to one hour to avoid hypothermia due to reduced absorption of fluid regardless of fluid temperature and smaller use of the irrigation fluid [21].

In comparison to a data reported by Cao and colleagues in 2019, an agreement observed, as found that incidences of shivering in the group of warm irrigation were significantly lower than the group having room-temperature fluid [24]. Another similarity observed in Singh *et al* study in 2014, in which, incidence of shivering was significantly higher in Group 1 (Cases received Irrigation fluid at room temperature 21 °C) (45%), as compared to Group 2 (Cases received Irrigation fluid at temperature 37 °C) (15%) [20].

Perioperative hypothermia is associated with multiple adverse effects, including delayed emergence from anesthesia, hypotension, and shivering. Shivering can cause discomfort, heightened anxiety, and increased oxygen consumption. It also raises cardiac workload, potentially triggering cardiovascular complications. Sympathetic nervous system activation during

hypothermia may reduce renal blood flow and glomerular filtration rate, contributing to renal dysfunction. Additionally, some studies have reported a higher incidence of myocardial infarction in cases who experience perioperative shivering [24].

Consequently 33 cases completed Akelma *et al* study in 2020, in which, cases were randomly assigned to either the warming group (Group P) or the standard care group (Group C). The two groups were comparable in terms of age, gender, BMI, ASA classification, operating room temperature, volume of irrigation fluid, and intravenous fluid administration ($P > 0.05$) [27]. By comparison to other studies, a close results observed in Rajeev Kumar *et al* study in 2018, as enrolled 80 cases posted for TURP under spinal anaesthesia. Age of the participants was ranging between 18-75 years, with mean and SD of 66.4±9.02 years. The results also agreed in that no significant differences in both groups regarding the age, the height, the weight, the ASA grade, the length of the operation and amount of irrigation fluid used [23]. Similarly, Singh *et al*. (2014) conducted a study involving 40 male patients undergoing TURP under spinal anesthesia. In their study, 20 patients received irrigation fluid at room temperature (21 °C, Group 1), while the other 20 received warmed irrigation fluid at 37 °C (Group 2). They found no significant differences between the groups in baseline characteristics, including age, height, weight, ASA classification, duration of surgery, volume of irrigation fluid used, or operating room temperature. The mean and SD of age of group 1 and 2 were 68.1±9.07 years, 65.6±9.90 years, respectively (in range of 50-85 years) [20].

Conclusion

Using warmed irrigation fluid is an effective strategy to reduce the risk of hypothermia and shivering during TURP. Administration of irrigation fluid at body temperature has been shown to lower the incidence of perioperative hypothermia in patients undergoing TURP under spinal anesthesia.

References

1. Welliver C, Helo S, McVary KT. Technique considerations and complication management in transurethral resection of the prostate and photoselective vaporization of the prostate. Transl Androl Urol. 2017;6(4):695-703.
2. Sokhal AK, Sinha RJ, Purkait B, Singh V. Transurethral resection of prostate in benign prostatic enlargement with underactive bladder: a retrospective outcome analysis. Urol Ann. 2017;9(2):131-135.
3. Levi A, Deters EDK. What are the indications for the transurethral resection of the prostate (TURP) in the treatment of benign prostatic hyperplasia (BPH)? Medscape; 2019 Jan 15. Available from: https://www.medscape.com/answers/437359-90431/what-are-the-indications-for-transurethral-resection-of-the-prostate-turp-in-the-treatment-of-benign-prostatic-hyperplasia-bph
4. Park HP. Irrigation fluids used for the transurethral resection of the prostate: a double-edged sword. Korean J Anesthesiol. 2019;72(2):87-88.
5. Hawary A, Mukhtar K, Sinclair A, Pearce I. Transurethral resection of the prostate syndrome: almost gone but not forgotten. J Endourol. 2009;23(12):2013-2020.
6. Petrone P, Asensio JA, Marini CP. In brief: hypothermia. Curr Probl Surg. 2014;51(10):414-415.
7. Emmert A, Gries G, Wand S, Buentzel J, Bräuer A, Quintel M, *et al*. Association between perioperative hypothermia and case outcomes after thoracic surgery: a single-center retrospective analysis. Medicine. 2018;97(17):e0528.
8. Moola S, Lockwood C. Effectiveness of strategies for the management and/or prevention of hypothermia within the adult perioperative environment. Int J Evid Based Healthc. 2011;9(4):337-345.
9. Petrone P, Asensio JA, Marini CP. Management of accidental hypothermia and cold injury. Curr Probl Surg. 2014;51(10):417-431.
10. Epstein E, Anna K. Accidental hypothermia. BMJ. 2006;332(7543):706-709.
11. Duong H, Pandya G. Hypothermia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Mar 18. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545239/
12. İnal MA, Ural SG, Çakmak HŞ, Arslan M, Polat R. Approach to perioperative hypothermia by anaesthesiology and reanimation specialists in Turkey: a survey investigation. Turk J Anaesthesiol Reanim. 2017;45(3):139-145.
13. Bräuer A, Müller MM, Wetz AJ, Quintel M, Brandes IF. Influence of oral premedication and prewarming on core temperature of cardiac surgical cases: a prospective, randomized, controlled trial. BMC Anesthesiol. 2019;19(1):55.
14. Abelha FJ, Castro MA, Neves AM, Landeiro NM, Santos CC. Hypothermia in a surgical intensive care unit. BMC Anesthesiol. 2005;5:7.
15. Torossian A, Bräuer A, Höcker J, Bein B, Wulf H, Horn EP. Preventing inadvertent perioperative hypothermia. Dtsch Arztebl Int. 2015;112(10):166-172.
16. Zafren K. Out-of-hospital evaluation and treatment of accidental hypothermia. Emerg Med Clin North Am. 2017;35(2):261-279.
17. Sessler DI. Temperature monitoring and perioperative thermoregulation. Anesthesiology. 2008;109(2):318-338.
18. Vanamoorthy P, Pandia MP, Bithal PK, Valiaveedan SS. Refractory hypotension due to intraoperative hypothermia during spinal instrumentation. Indian J Anaesth. 2010;54(1):56-58.
19. Kempainen RR, Brunette DD. The evaluation and management of accidental hypothermia. Respir Care. 2004;49(2):192-205.
20. Singh R, Asthana V, Sharma JP, Lal S. Effect of irrigation fluid temperature on the core temperature and hemodynamic changes in transurethral resection of prostate under spinal anesthesia. Anesth Essays Res. 2014;8(2):209-215.
21. Hahn R. Fluid absorption in endoscopic surgery. Br J Anaesth. 2006;96(1):8-20.
22. Gehring H, Nahm W, Baerwald J, Fornara P, Schneeweiss A, Roth-Isigkeit A, *et al*. Irrigation fluid absorption during a transurethral resection of prostate: spinal vs general anaesthesia. Acta Anaesthesiol Scand. 1999;43(4):458-463.
23. Kumar RM, Asthana V, Sharma JP, Lal S. Effect of the irrigation fluid temperature on core temperature in transurethral resection of prostate cases under spinal versus general anaesthesia. Indian J Anaesth. 2018;62(4):294-300.
24. Cao J, Sheng X, Ding Y, Zhang L, Lu X. Effect of warm bladder irrigation fluid for benign prostatic hyperplasia cases on perioperative hypothermia, blood loss and shiver: a meta-analysis. Asian J Urol. 2019;6(2):183-191.
25. Okeke L. Effect of warm intravenous and irrigating fluids on body temperature during transurethral resection of the prostate gland. BMC Urol. 2007;7:15.
26. Jaffe JS, McCullough TC, Harkaway RC, Ginsberg PC.

Effects of the irrigation fluid temperature on core body temperature during transurethral resection of the prostate. Urology. 2001;57(6):1078-1081.
27. Akelma FK, Ergil J, Özkan D, Arık E, Akkuş İB, Aydın GB. The effect of preoperative warming on perioperative hypothermia in transurethral prostatectomies. Turk J Anaesthesiol Reanim. 2015;43(5):308-313.

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