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Research Article

# To Compare the Effects of Perioperative IV Ringer Lactate and Balanced Salt Solution on Post Operative Serum Electrolytes in Turp Surgeries Using Glycine 1.5% as an Irrigating Fluid

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## Abstract

**Background:** The TURP technique is a surgical operation that is used to address urinary issues caused by an enlarged prostate. The obstructive prostatic tissue is removed in this procedure, leaving the surgical capsule intact. Through a resectoscope, a metallic wire loop that is electrically heated is used to cut the prostatic tissue and coagulate blood arteries. During TURP surgery mild to severe organ dysfunction can occur due to various factors like excessive absorption of irrigating fluid, bladder perforation or excessive intra operative fluid administration. Hence due to these factors peri-operative fluid management is imperative.

**Objectives**: To compare the effects i/v Ringer lactate and i/v Balanced salt solution on post-operative serum electrolytes in TURP surgeries and also to observe the hemodynamic response change intra operatively.

**Study Design**: Randomized prospective study

**Material and Methods**: In present study 100 patients were taken randomly and equally divided into two groups group I - i/v RL and group II - i/v BSS. Central neuraxial block was performed aseptically using Quincke's needle 25G with Bupivacaine (H) 0.5% drug 3 ml injected at L2-3 or L3-4 intervertebral disc space in sitting posture producing satisfactory analgesia to dermatome level up to T10. The TURP procedure was started with warm 1.5 percent glycine irrigation fluid, keeping the irrigation fluid column at a height of 60 cm, with the patients in lithotomy position. Intra operative vitals were monitored closely. The serum levels of sodium, potassium and chloride were also measured after 1 hr. post- operatively. The values of pre and post-operative serum sodium, potassium and chloride levels were compared and significance of the difference in their values were assessed.

**Results**: The study participants of age group of 40 - 70 years of ASA grade I and II were comparable in both the groups. Between the two groups, there was no significant difference in HR, SBP, DBP, or MAP. There was decrease in serum sodium, potassium and chloride level observed one hour post- operatively as compared to baseline in both the groups but there was no significant difference between the two groups.

**Conclusion**: Hence we conclude that both i/v RL and i/v BSS can be used as intravenous fluid perioperatively in TURP surgeries using glycine 1.5% as an irrigating fluid as both have no significant effect on serum electrolytes.

***Keywords**: SBP (Systolic Blood Pressure); DBP (Diastolic Blood Pressure); MAP (Mean Arterial Pressure); TURP (Transurethral Resection of Prostate)*

## Introduction

A surgical treatment known as transurethral resection of the prostate (TURP) is used to treat urinary issues caused by an enlarged prostate. It's done by passing a rectoscope into the urethra and resecting prostatic tissue using an electrically powered cutting coagulating metal loop or laser vaporisation. This can be accomplished with either a monopolar TURP or bipolar TURP technique. The prostatic capsule is normally retained, but as much prostatic tissue as feasible is removed with each procedure. If the capsule is violated, large amount of irrigating solution can be absorbed into the circulation via the peri-prostatic, retroperitoneal or peritoneal space [1]. Regional anesthesia technique is chosen in my study, spinal level upto T10 is maintained to eliminate the discomfort caused by bladder distension and other aspects of procedure.

Due to excessive intravascular absorption of irrigating fluid (usually glycine 1.5%) leads to dilutional hyponatremia and hypochloremia. Severe CNS symptoms are associated with acute serum hypo-osmolality that allows movement of water into cells and causes cerebral edema. Irritability, apprehension, disorientation, and headache are early warning indications of quickly increasing hyponatremia in the CNS. CVS symptoms include QRS widening, ST segment elevation, arrhythmia, hypotension and pulmonary edema [2].

Another complication is hyperammonemia which is caused due to oxidative biotransformation of glycine into ammonia. Hypothermia is also another complication which is caused due to use of irrigating fluid in room temperature, which leads to decrease in body temperature and shivering [2].

Intravenous (IV) fluid administration is frequently the first step in any anaesthesia or surgical procedure. The goal of peri-operative IV fluid administration is to maintain or restore intravascular volume, which is typically depleted due to peri-operative fasting, surgical blood loss, evaporation, urinary excretion, anesthesia-induced vasodilation, loss of fluid in the third space, and transcapillary albumin leak caused by mediators of inflammation. Effective circulating blood volume and pressure are critical components of ensuring adequate organ perfusion while avoiding the risk of organ hypo- or hyperperfusion. A significant volume of blood is required for the transport of oxygen and nutrients. There can be significant mortality and morbidity due to mistakes in fluid administration. Therefore, IV fluids should be utilised carefully to maintain both micro and macro hemodynamics and to avoid interstitial fluid excess.

IV fluids can be classified into crystalloids and colloids, with crystalloids being the most common. Crystalloids are a type of real solution that can pass through semipermeable barriers. Isotonic, hypertonic, and hypotonic are the three types.

Sodium 136 - 145 mmol/l, chloride 98 - 108 mmol/l, potassium 3 - 5 mmol/l, magnesium 1.6 - 2.4 mmol/l, bicarbonate 21 - 30 mmol/l, and osmolality 280 - 310 mosmol/L are the normal plasma compositions [3].

526 mg of Sodium Chloride, 502 mg of Sodium Gluconate, 368 mg of Sodium Acetate Trihydrate, 37 mg of Potassium Chloride, and 30 mg of Magnesium Chloride are included in each 100 mL of Balanced Salt Solution. Sodium hydroxide is used to alter the pH. The pH is 7.4 (6.5 to 8.0). A litre of water contains 140 milliequivalents of sodium, 5 milliequivalents of potassium, 3 milliequivalents of magnesium, 98 milliequivalents of chloride, 27 milliequivalents of acetate, and 23 milliequivalents of gluconate. The osmolarity of the solution is 294 mOsmol/L. The calorie content per litre is 21 kcal [3].

Ringer Lactate (RL) in each 100 ml contains Sodium Lactate 320 mg, Sodium Chloride 600mg, Potassium Chloride 40 mg and Calcium Chloride 27 mg. pH of RL is 6.5. One litre of fluid supplies Sodium 130 mEq, Potassium 4 mEq, Chloride 109 mEq, Calcium 3 mEq, Bicarbonate 28 mEq and Lactate 28 mEq. The osmolality is 273 mOsmol/L and caloric content is 9 kcal/L [4].

Since there are very few studies available on comparison between RL and Balanced Salt Solution, this study is conducted to elicit the effect of RL and Balanced Salt Solution on hemodynamic analysis and post-operative serum electrolytes in TURP surgeries.

## Material and Methods

It is a prospective study done in Department of Anaesthesia, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala for a period of 2 years (2019 - 2021) in 100 adult patients.

### Inclusion criteria

- ASA grade I, II
- Patient who gave written informed consent
- Age between 40 to 80 years
- TURP under spinal anaesthesia
- Elective surgery.

### Exclusion criteria

- Patient refusal
- ASA grade III, IV
- Liver disease
- Severe CHF
- Addison's disease
- Severe metabolic acidosis
- Vomiting or nasogastric aspiration (continuous)
- Patient with fluid overload - pulmonary edema, ascites
- Electrolyte imbalance
- CKD patient.

### Allocation of groups

The present study was carried out in hundred patients of the age group 40 - 80 years of both ASA I and ASA II grade undergoing elective TURP surgery under spinal anaesthesia. The study duration was two years.

The patients were divided into one of the two groups, with fifty patients in each group by random number chart. One of the scientists opened a sealed opaque envelope containing a random number to determine the research fluid to be administered. The operating surgeon and observing anaesthesiologist who collected the postoperative data was blinded to the study fluid. The study fluid was given to the investigators by a nonparticipating staff.

Patients were divided into 2 groups:

- Group I: 50 patients were given i/v RL.
- Group II: 50 patients were given i/v BSS.

## Methodology

Before surgery pre anaesthetic checkup was done. A thorough history was taken, as well as a physical examination that included HR, BP, breathing rate, and a systemic examination. Routine tests were performed, including haemoglobin (Hb), bleeding time (BT), clotting time (CT), liver function tests (LFT), renal function tests (RFT), comprehensive urine examination, random blood sugar (RBS), electrocardiography (ECG), and chest x-ray.

Both the study's conduct and the delivery of spinal anaesthesia required informed and valid written consent. All patients were fasted overnight and pre-medicated with Tablet (Tab) Alprazolam 0.25 mg and Tablet (Tab) Pantoprazole 40 mg with a sip of water the night before surgery and the morning of operation.

Routine monitoring begins once the patient is transferred to the operating room (ECG, pulse oximetry, non-invasive blood pressure) and baseline vital parameters like HR, BP, and $SpO_2$ were recorded. IV access was secured with 18G cannula. All patients were preloaded with 10 ml/kg Balanced Salt Solution and RL. In sitting position, a central neuraxial block was conducted aseptically using Quincke's needle 25G and Bupivacaine (H) 0.5 percent drug 3 ml injected at L2-3 or L3-4 intervertebral disc space, generating adequate analgesia to a dermatome level up to T10 without trouble. The TURP procedure was began with warm 1.5 percent glycine irrigation fluid, keeping the irrigation fluid column at a height of 60cm, measured from the level of the patient's pubic symphysis on the operating table. Total intravenous fluid was given at 4 ml/kg/hr. All patients were carefully observed for any side effects of TURP syndrome peri-operatively like restlessness, bradycardia and yawning.

After 1 hr post- operatively, serum levels of sodium, potassium and chloride were also measured. The values of pre and post-operative serum sodium, potassium and chloride levels were compared and significance of the difference in values were assessed.

## Results:

- The study participants were in the age group 40 - 80 years with maximum number of patients in the age group of 60 - 70 years.
- ASA grade of patients were comparable in both the groups.
- There was no significant change in HR, SBP, DBP, MAP observed throughout the perioperative period.
- There was no statistically significant difference in serum Na level postoperatively in both the groups.
- There was no statistically significant difference in serum K level postoperatively in both the groups.
- There was no statistically significant difference in serum Cl level postoperatively in both the groups.

**Analysis is as follows**

| | | Groups | | | | Chi-Square | p-value |
|---|---|---|---|---|---|---|---|
| | I | | II | | | | |
| Age | 40-50 | 7 | 14.0% | 5 | 10.0% | 2.719 | 0.437 |
| | 51-60 | 17 | 34.0% | 11 | 22.0% | | |
| | 61-70 | 17 | 34.0% | 23 | 46.0% | | |
| | >70 | 9 | 18.0% | 11 | 22.0% | | |
| | Total | 50 | 100.0% | 50 | 100.0% | | |

***Table 1:*** *Distribution of patients according to age group.*

| | | Groups | | | | Chi-Square | p-value |
|---|---|---|---|---|---|---|---|
| | I | | II | | | | |
| ASA | I | 18 | 36.0% | 20 | 40.0% | .170 | .680 |
| | II | 32 | 64.0% | 30 | 60.0% | | |
| | Total | 50 | 100.0% | 50 | 100.0% | | |

***Table 2:*** *Distribution of ASA grade in both the groups.*

| | Groups | | | | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | I | | | II | | | | |
| | N | Mean | SD | N | Mean | SD | | |
| HR at | 50 | 81.96 | 11.28 | 50 | 84.44 | 11.72 | 1.078 | .284 |
| 5 min | 50 | 78.22 | 10.50 | 50 | 79.60 | 11.47 | .628 | .532 |
| 10 min | 50 | 78.12 | 10.03 | 50 | 75.82 | 10.22 | 2.123 | .056 |
| 20 min | 50 | 78.20 | 9.28 | 50 | 74.66 | 10.52 | 1.785 | .077 |
| 30 min | 50 | 79.26 | 9.32 | 50 | 75.42 | 10.57 | 1.927 | .057 |
| 40 min | 34 | 77.62 | 8.68 | 42 | 75.81 | 10.32 | .814 | .418 |
| 50 min | 4 | 81.50 | 5.57 | 7 | 70.00 | 12.45 | 1.721 | .119 |

***Table 3:*** *Comparison of heart rate among both the groups.*

| | Groups | | | | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | I | | | II | | | | |
| | N | Mean | SD | N | Mean | SD | | |
| SBP at | 50 | 119.52 | 13.99 | 50 | 118.48 | 11.74 | .403 | .688 |
| 5 min | 50 | 108.56 | 12.96 | 50 | 108.80 | 11.42 | .098 | .922 |
| 10 min | 50 | 107.44 | 10.47 | 50 | 108.24 | 9.84 | .394 | .695 |
| 20 min | 50 | 107.44 | 9.91 | 50 | 109.76 | 9.09 | .373 | .058 |
| 30 min | 50 | 113.00 | 10.70 | 50 | 115.44 | 9.60 | 1.200 | .233 |
| 40 min | 34 | 113.41 | 9.89 | 42 | 113.52 | 9.41 | .050 | .960 |
| 50 min | 4 | 110.00 | 12.33 | 7 | 112.86 | 5.98 | .528 | .610 |

***Table 4:*** *Comparison of systolic blood pressure among both the groups.*

| | Groups | | | | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | I | | | II | | | | |
| | N | Mean | SD | N | Mean | SD | | |
| DBP at | 50 | 78.00 | 7.70 | 50 | 81.60 | 11.32 | 1.860 | .066 |
| 5 min | 50 | 72.72 | 8.76 | 50 | 74.40 | 11.18 | 1.330 | .220 |
| 10 min | 50 | 70.64 | 8.43 | 50 | 72.60 | 11.10 | 1.023 | .066 |
| 20 min | 50 | 70.64 | 8.11 | 50 | 73.16 | 10.72 | 1.378 | .190 |
| 30 min | 50 | 69.40 | 7.98 | 50 | 71.20 | 10.89 | 1.514 | .051 |
| 40 min | 34 | 70.82 | 8.97 | 42 | 73.24 | 11.20 | 1.019 | .311 |
| 50 min | 4 | 63.50 | 7.90 | 7 | 74.57 | 13.79 | 1.454 | .180 |

***Table 5:*** *Comparison of diastolic blood pressure among both the groups.*

| | Groups | | | | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | I | | | II | | | | |
| | N | Mean | SD | N | Mean | SD | | |
| MAP at | 50 | 90.48 | 9.86 | 50 | 93.89 | 11.40 | 1.601 | .113 |
| 5 min | 50 | 84.51 | 9.52 | 50 | 87.87 | 11.13 | 1.622 | .108 |
| 10 min | 50 | 84.91 | 8.59 | 50 | 87.15 | 10.43 | 2.219 | .069 |
| 20 min | 50 | 85.91 | 8.17 | 50 | 87.36 | 9.86 | 2.458 | .056 |
| 30 min | 50 | 84.76 | 8.45 | 50 | 88.59 | 10.13 | 2.051 | .073 |
| 40 min | 50 | 67.81 | 4.67 | 50 | 72.80 | 3.42 | 2.013 | .077 |
| 50 min | 4 | 79.00 | 7.51 | 7 | 87.33 | 11.16 | 1.318 | .220 |

***Table 6:*** *Comparison of mean arterial pressure among both the groups.*

| Pre OP S.Electrolyte | RL | | | BSS | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD | | |
| S.Na | 50 | 139.60 | 3.06 | 50 | 139.66 | 2.97 | 0.099 | 0.921 |
| S.K | 50 | 4.67 | 0.26 | 50 | 4.63 | 0.16 | 0.876 | 0.383 |
| S. Cl | 50 | 99.62 | 2.93 | 50 | 99.94 | 2.78 | 0.560 | 0.577 |

***Table 7:*** *Comparison of pre-operative serum electrolytes (S. Na, K, Cl) among both the groups.*

| Post OP S. Electrolyte | RL | | | BSS | | | t-value | p-value |
|---|---|---|---|---|---|---|---|---|
| | N | Mean | SD | N | Mean | SD | | |
| S.Na | 50 | 133.06 | 3.16 | 50 | 133.66 | 3.25 | 0.930 | 0.350 |
| S.K | 50 | 4.53 | 0.29 | 50 | 4.50 | 0.18 | 0.622 | 0.535 |
| S.Cl | 50 | 97.64 | 2.64 | 50 | 98.08 | 2.51 | 0.853 | 0.395 |

***Table 8:*** *Comparison of post operative serum electrolytes (S. Na, K, Cl) among both the groups.*

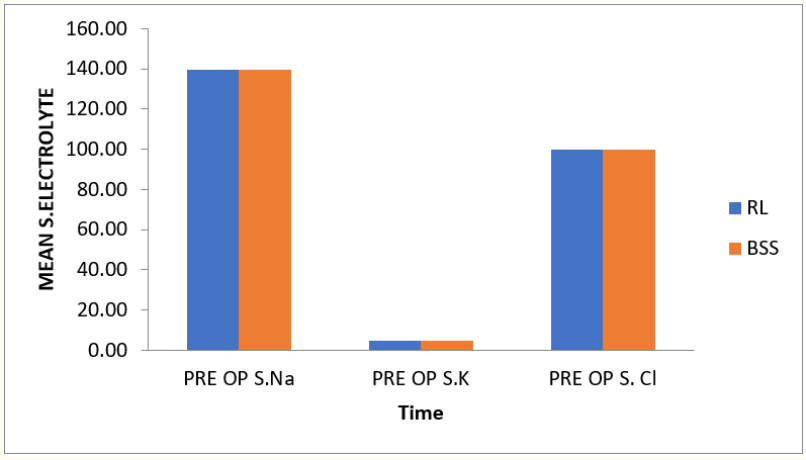


***Figure 1:*** *Comparison of pre-operative serum electrolytes (S. Na, K, Cl) among both the groups.*

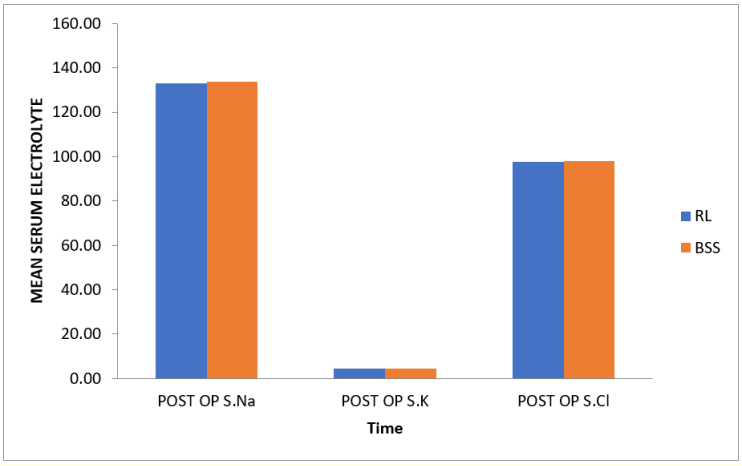


***Figure 2:*** *Comparison of post operative serum electrolytes (S. Na, K, Cl) among both the groups.*

## Discussion

This was a prospective study conducted in rural settings over a period of 2 years in MMIMSR Mullana Ambala Haryana in 100 patients who are undergoing TURP surgery. Patients were randomly divided into 2 groups:

- Group I: 50 patients were given i/v RL.
- Group II: 50 patients were given i/v BSS.

In our present study, in both the groups all variables i.e. mean age and ASA grading were comparable at baseline which is in concordance with the comparative randomized study of BSS and RL fluid administration in plasma electrolyte in cardiac surgery by Syed Saqib Naqvi [5] in 2020.

In our study we found that difference in heart rate was not significant among both groups at time intervals 5, 10, 20, 30, 40, 50 minutes. The result of our study is in concordance with Anne Kiran Kumar., *et al*. [6] and Syed Saqib Naqvi [5].

In our study there was no significant change in mean arterial pressure among both the groups at time intervals 5, 10, 20, 30, 40, 50 minutes as p value > 0.05. This finding was similar to previous study by Chaussard M., *et al*. [7], Anne Kiran Kumar., *et al*. [6] and Syed Saqib Naqvi [5].

In our present study mean post-operative serum Na level of RL group was 133 ± 3.16 mEq/L and mean post-operative serum Na level of BSS group was 133.66 ± 3.25 mEq/L, there were no significant changes in serum sodium level seen with either of the two solutions postoperatively (p value = 0.351). Hakan Hasman., *et al*. [8], Syed Saqib Naqvi [5], Liu C., *et al*. [9] and Rajamani S., *et al*. [10] found similar results in his study.

In our present study mean post-operative serum K level of RL group was 4.53 ± 0.29 mEq/L and mean post-operative serum K level of BSS group was 4.50 ± 0.18 mEq/L, there were no significant changes in serum potassium level seen with either of the two solutions postoperatively (p value = 0.535). This observation matched that of a study done by Hakan Hasman., *et al*. [8], Hadimioglu N., *et al*. [11], Liu C., *et al*. [9] and Rajamani S., *et al* [10].

In the current study, mean post-operative serum Cl level of RL group was 97.64 ± 2.64 mEq/L and mean post-operative serum K level of BSS group was 98.08 ± 2.51 mEq/L, there were no significant changes in serum chloride level seen with either of the two solutions postoperatively (p value = 0.395). This finding was similar to previous study by Hakan Hasman., *et al*. [8], L Weinberg., *et al*. [12], Hadimioglu N., *et al*. [11], Liu C., *et al*. [9] and Rajamani S., *et al* [10].

## Conclusion

Hence we conclude that both i/v RL and i/v BSS can be used as intravenous fluid perioperatively in TURP surgeries using glycine 1.5% as an irrigating fluid as both have no significant effect on serum electrolytes post-operatively.

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