https://africanjournalofbiomedicalresearch.com/index.php/AJBR
Afr. J. Biomed. Res. Vol. 27 (September 2024); 78-82

Systematic Review

Clinical Profile and safety Outcomes of TURP Using Sterile Water as Irrigation Fluid": A Retrospective Observational Study.

Naveen HN[1], Roshni Devi Patil[2], Arpit Kumar[3], Shaik Hussain Saheb[4*].

[1,2,3]Dept of Urology, SSIMS&RC, Davanagere, India.*
[4]Department of Anatomy, GMC, Kadapa, Andhra Pradesh.

Abstract

Background: Transurethral resection of Prostate (TURP) is a surgical procedure for managing bladder outlet obstruction secondary to benign prostatic hyperplasia. The procedure requires continuous irrigation to maintain visibility, remove tissue debris, and prevent complications such as clot formation. Despite the entry of LASERs in prostate surgery, TURP is still a gold standard surgery practiced widely in the peripheral centers due to comparable results and affordable/less expensive. Glycine, sterile water, Normal saline, dextrose in water, mannitol, sorbitol are few of the irrigation fluids used during TURP (11,14).

During the surgical procedure, exposure of venous sinuses and injury to the prostatic capsule lead to systemic absorption of irrigation fluids, resulting in several complications including fluid overload, pulmonary edema, congestive heart failure, hyponatremia, and hypothermia. Glycine may have toxic effects on the heart and the kidneys as the absorbed glycine is metabolized to ammonia in the liver leading to hyperammonemia which may cause neurologic complications such as tremors and seizures. Massive absorption of sorbitol can also cause hyperglycemia and lactic acidosis and coagulopathy. Concerns and limitations including cost factors are associated with irrigation fluids.(13)

Emerging interest in sterile water as a potentially safer alternative is increasing due to similar safety profile and outcomes in the form reduced risk of TURP syndrome and systemic absorption issues and cost factors (3,4,6,8,12). The present study was conducted to evaluate the clinical profile and safety outcomes of using sterile water as an irrigation fluid in TURP procedures and to compare these outcomes with available literature which used other irrigation fluids.

Materials and Methods: This is a retrospective cohort study. 150 patients were included in the study. We have included the patients undergoing TURP procedures using sterile water as irrigation fluids. Information retrieved from Medical records department includes patient's socio-demographic data, investigation profile (Hb%, serum electrolytes, prostate size) intra-operative findings, the volume of irrigation fluid used, cost factor of irrigation fluid, post-operative complications including length of the hospital stay.

Results: Prostate volume ranges from 30 to 162 ml with a mean of 91 ml while resected prostate volume ranges from 6cc to 128 ml with a mean of 67 ml. Volume of the sterile water used as irrigation fluid ranged from 5.0 L to 90 .0 L with a mean of 47.5 L. Duration of resection ranged from 15 min to 80 min with mean of 47.5 min. Mean reduction in International Prostate Symptoms Score, improvement in Q-max and reduction in post-void residual urine were 20, 10.5 and 105 ml, respectively. Transfusion rate was 1.3 % while the duration of admission ranges from 2 to 6 days, with a mean of 2.5 days. The overall early complication rate was 6.6%. No statistically significant changes were reported in the serum sodium, blood urea nitrogen, creatinine, and hematocrit.

Conclusion: Sterile water as a irrigation fluid is safe and is and comparable to other expensive irrigation fluids like glycine in terms of safety profile, clinical outcome and render the treatment affordable. Future research, including randomized controlled trials to validate these findings are required.

Keywords: TURP, Prostate, Irrigation fluid, Prostatic Hyperplasia.

**Author for correspondence: Email: - anatomyshs@gmail.com*

Receiving date: 10/07/2024 Acceptance date: 20/08/2024

DOI: https://doi.org/10.53555/zn48zk61

INTRODUCTION

Transurethral resection of the prostate (TURP) is a common surgery that's used to treat bladder outlet obstructions secondary to benign enlargement of prostate. The prostate is an organ that functions as accessory male sexual organ and plays a role in male fertility. It provides prostatic secretions to the ejaculate, composed of an alkaline solution and prostate-specific antigen, which liquefies the ejaculate. These prostatic secretions make up approximately 30% of the ejaculate fluid. The prostate is derived from the urogenital sinus and are stimulated by androgens [1].

The average prostate is approximately 25-30 grams in size. It is composed of a capsule that surrounds the parenchyma, with three zones: central, peripheral, and transitional. The prostatic parenchyma is composed of stroma, ducts, and acini. The transition zone is typically where obstructive enlargement occurs in benign prostate hyperplasia (BPH). The prostate enlarges due to testosterone exposure, and it continues to grow with age. When the prostate enlarges, it is classified as benign prostatic hyperplasia (BPH), defined as an increase in the total number of prostatic stromal and epithelial cells causing nodular enlargement. About 70% of men in their 60's and 80% of men 70 years or older have some level of benign prostatic hyperplasia. Symptoms also vary with age, as 80% of men 80 years of age or more will have symptomatic BPH. When BPH causes urinary obstruction and either subjective or objective urinary difficulties, it may indicate the need for a TURP. The present study was conducted to evaluate the clinical profile and safety outcomes of using sterile water as an irrigation fluid in TURP procedures and to compare these outcomes with available literature which used other irrigation fluids [2].

Irrigation Fluids Used in TURP are. **1.5%Glycine:** Widely used due to its excellent visibility and thermal properties. However, glycine absorption can lead to TURP syndrome, characterized by electrolyte imbalances (hyperammonemia, hyperoxaluria) and fluid overload. **Saline** (bipolar TURP): saline has a lower risk of TURP syndrome but may still lead to electrolyte disturbances and fluid shifts cannot be used during monopolar turp. Other irrigants used are isotonic 5% dextrose, sorbitol, mannitol [3].

Rationale for Exploring Sterile Water as an Alternative Irrigation Fluid: Recent studies suggest that sterile water, which lacks electrolytes and additives, may offer a safer alternative as it is electrically inert, improves visibility and inexpensive and has similar outcomes comparable to other irrigation fluids. The use of sterile water might provide better visibility during surgery compared to traditional solutions, potentially leading to improved surgical precision and outcomes. Clear visualization can aid in more thorough resection of prostatic tissue, reducing the likelihood of residual tissue and need for reoperation. Sterile water is generally less expensive than some alternative irrigation fluids, which could lead to cost savings in healthcare settings [4]**.**

Materials and Methods:

The study is a retrospective cohort study of all the patients who had underwent monopolar TURP using sterile water as irrigant from June 2020 to June 2023 were included in the study. Total of 150 cases were included. Information retrieved from Medical records department includes patient's socio-demographic data, investigation profile (Hb%, serum electrolytes, prostate size) intra-operative findings, the volume of irrigation fluid used, cost of irrigation fluid, post-operative complications including length of the hospital stay.

Results:

Table No 1. Showing the Demographic Data

Patient age group(Years)	No of Patients
50-60	22
61-70	69
71-80	43
>81	16

Mean age: 69 y

Table No 2. Showing the Sizes of Prostate(gm) according to weight

Size of Prostate (g)	No of Patients
30-40	21
41-50	39
51-60	20
61-70	17
71-80	1
>80	34

Mean volume of prostate size was 91 g

Serum PSA ranged from 0.53 to 7.3 ng/dl

Table No 3. Showing the data of Key parameters Pre and Post TURP

	Pre TURP	**Mean**	**Post TURP**	**Mean**	**Mean reduction**
IPSS score	25-30	27.5	5-10	7.5	20
Post void residual urine/ml	100-160	130	10-40	25	115
Q Max/ml/sec (improvement	5-10	7.5	14-22	18	10.5
Volume of Prostate size	30g to 162g	96	4g to 50 g	27g	64
Hb	12g-16g	14	8g-15g	11.5	3.5
Serum electrolytes meq/l	136-145	140	125-140	136	4

Table No 4. Data showing intra and post-operative key parameters

Volume of the sterile water used	5.0 L to 90 .0 L	47 l (mean)
Duration of resection	15 min to 90 min	47.5 min
Duration of admission	2-6 days	3 days
Re TURP	0	

Cost of irrigation fluid used (approximately for 47 l mean) for sterile water ranged from 150 to 300 Rs, when compared to glycine/saline was 25000 Rs showing significant reduction in cost.

Perioperative Complications and Management

Table No 5. Comparison table showing our study using sterile water and other studies using other irrigation.

Complications	Numbers	Management
Bladder rupture	1	Laparotomy and repaired
Hypotension	2	Blood transfusion, vasopressors and fluid management
Hypertension	2	NTG drip/
Sepsis	3	Antibiotics
TUR syndrome	0	
Death	0	

Data from 150 patients were analyzed and presented. The age range was 50-88 years with a mean of 69 years. Prostate volume ranges from 30 to 162 ml with a mean of 91 ml while resected prostate volume ranges from 6cc to 128 ml with a mean of 67 ml. Volume of the sterile water used as irrigation fluid ranged from 5.0 L to 90 .0 L with a mean of 47.5 L. Duration of resection ranged from 15 min to 90 min with mean of 52.5 min. Mean reduction in International Prostate Symptoms Score, improvement in Q-max and reduction in post-void residual urine were 20, 10.5 and 105 ml, respectively. Transfusion rate was 1.3 % while the duration of admission ranges from 2 to 6 days, with a mean of 2.5 days. The overall early complication rate was 6.6%.

Discussion:

TURP is still a common standard procedure for the treatment of BPH which has taken advantage over open prostatectomy due to less morbidity and excellent results [5]. Various minimally invasive surgical therapies were developed to treat benign prostatic hyperplasia (BPH). An ideal irrigant fluid for transurethral resection should be easily available, non-conductive, good visibility, isotonic, and has less side effects when absorbed [6]. Glycine is an endogenous amino acid with osmolality of 230 mosm/l. It is cheap, transparent, and does not cause any allergy. Excess glycine absorption of glycine can cause encephalopathy, metabolic acidosis, and TURP syndrome. As variable amounts of irrigation fluid are absorbed during TUR of the prostate (TURP). Sterile water is used with clear visibility and is easily available [7,8,9]. Its disadvantage is hypo-osmolality, which can cause intravascular hemolysis, dilution hyponatremia, and renal failure [10,11].

In study of Reza S M[8] reports the results of a wide range of patients who were candidates for TURP. In this case study they used sterile water as irrigational fluid in TURP. According to this study, smaller absorbed volumes may elicit milder forms of the syndrome. According to the results of this study, there were no statistically significant changes in the serum Na, BUN, Cr, and Hct. This finding is probably achieved due to the small amount of irrigating fluid absorbed.

Nilam D V et al [13] study with 30 patients undergoing bipolar TURP using saline as an irrigation fluid under 60.67 (±14.167) minutes, 23.73 (±4.770) L, respectively. Most of the patients had gland sizes between 31 to 50 cc. A mean fall in pH by 0.03 (p-value=0.02), an increase in serum sodium from 139±3.65 meq/L to 142.2±3.60 meq/L (p-value=0.01), an association between amount of irrigation fluid used and changes in serum sodium levels (p-value=0.047) was found. In our present study we used sterile water as irrigation fluid and there was not much significant changes in the serum electrolytes

MT Pasha et al [12] study of post-operative dilutional hyponatremia was observed in 13 (15.3%) patients in Group A and in 10 (11.8%) patients in group-B. The difference between both the groups being nonsignificant (p-value=0.501). Frequency of postoperative urinary tract infection on 15th postoperative day in group-A was 23(27.1%) while in group-B it was 16 (18.8%), the difference among both the groups being insignificant (p-value=0.202) their conclusion was Although the frequency of postoperative complications like UTI and dilutional hyponatremia was less with sterile distilled water, yet, the difference was statistically not significant. Some of the previous studies have shown the higher amount of absorbed fluid to be accompanied with more frequent complications and more severe changes in electrolytes and Hct. Absorption of the fluid used for bladder irrigation during TURP may disturb the circulatory system and lead to clinical symptoms, known as the transurethral resection syndrome. The prevalence of the syndrome varies in different studies, which might be related to factors including the type of chemical fluid used for irrigation, like sterile water, mannitol, glycine, etc. The osmotic characteristic of the irrigating fluid, the patient's condition, and the amount of fluid absorbed [13].

Trepanier CA [14] stated that ``Large volumes of irrigation fluids are commonly used for distension and irrigation of the bladder during transurethral resection of the prostate (TURP). During the surgical procedure, exposure of venous sinuses and injury to the prostatic capsule lead to systemic absorption of irrigation fluids, resulting in several complications including fluid overload, pulmonary edema, congestive heart failure, hyponatremia, and hypothermia. Furthermore, specific additives such as glycine and sorbitol have adverse effects. Glycine has toxic effects on the heart, eyes, brain and the kidneys. The absorbed glycine is metabolized to ammonia in the liver. The hyperammonemia may cause neurologic complications such as tremors and seizures. Massive absorption of sorbitol can also cause hyperglycemia and lactic acidosis``.

Transurethral resection of the prostate (TURP) syndrome describes the symptomatic absorption of hypotonic irrigation fluid used during a TURP procedure, the culmination of which could possibly lead to death. Through direct communication with the prostatic circulatory system, rapid absorption of irrigation solution can occur. Compared with bipolar and laser resectoscopes which allow the use of isotonic irrigation solution, which is expensive, monopolar resectoscopes require the use of an electrolyte-free irrigation solution to prevent electricity scatter. We did not have a single TUR syndrome in our study

Conclusion:

Sterile water offers a similar advantage over traditional fluids like glycine and saline by potentially increasing the visibility, being inexpensive and comparable safety. Using sterile water may contribute to comparable improvement in perioperative and postoperative outcomes, including shorter hospital stays and faster recovery times. Considering sterile water as an irrigation fluid in TURP procedures holds promise for improving patient outcomes and safety and ultimately benefiting patient care and healthcare practices at large.

In summary, while the use of sterile water as an irrigation fluid in TURP shows promise in comparable results with other irrigation fluids further research and guideline development are necessary to fully integrate this practice into routine clinical care. Further research is needed, particularly prospective studies and comparative effectiveness research, to establish conclusive evidence and refine recommendations for improving patient outcomes and healthcare efficiency.

Limitations of the Study and Potential Biases: Retrospective Design, Confounding Factors includes only a single experienced urologist operating the case. Recommendations for Further Research and Clinical Practice: Prospective randomized controlled trials are needed to further validate these findings and need longer follow-up periods to assess long-term safety and efficacy.

References

A Memon , N P Buchholz, S Salahuddin Arch. Water as an irrigant in transurethral resection of the prostate: a cost-effective alternative. Ital Urol Androl. 1999 Jun;71(3):131-4.

Aaron L, Franco OE, Hayward SW. Review of Prostate Anatomy and Embryology and the Etiology of Benign Prostatic Hyperplasia. Urol Clin North Am. 2016 Aug;43(3):279-88.

Aghamir SM, Alizadeh F, Meysamie A, Assefi Rad S, Edrisi L. Sterile water versus isotonic saline solution as irrigation fluid in percutaneous nephrolithotomy. Urol J. 2009 Fall;6(4):249-53. PMID: 20027552.

Aziz W, Ather MH. Frequency of Electrolyte Derangement after Transurethral Resection of Prostate: Need for Postoperative Electrolyte Monitoring. Adv Urol. 2015; 2015:415735. doi: 10.1155/2015/415735. Epub 2015 May 18. PMID: 26089874; PMCID: PMC4450210.

Collin S. Brown. Dilutional hyponatremia in a community hospital setting: Case report. Intensive and Critical Care Nursing. 2014;30(1):1-5.

Emmanuel A Jeje , Taiwo O Alabi, Rufus W Ojewola, Moses A Ogunjimi, Kehinde H Tijani, Gabriel K Asiyanbi. Monopolar transurethral resection of the prostate using water as the irrigation fluid: Our initial experience. Niger Postgrad Med J. 2021 Jul-Sep;28(3):175-180.

Gupta K, Rastogi B, Jain M, Gupta PK, Sharma D. Electrolyte changes: An indirect method to assess irrigation fluid absorption complications during transurethral resection of prostate: A prospective study. Saudi J Anaesth. 2010 Sep;4(3):142-6. doi: 10.4103/1658-354X.71505. PMID: 21189849; PMCID: PMC2980658.

H Norlen , L G Allgén, E Vinnars, A Wiklund, Plasma haemoglobin concentrations and other influx variables in blood in connection with transurethral resection of the prostate using distilled water as an irrigating fluid. Scand J Urol Nephrol . 1987; 21(3):161-8.

Leslie SW, Chargui S, Stormont G. Transurethral Resection of the Prostate. [Updated 2023 Pearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560884/

Nilam Dharma Virkar , Aparna Ashay Nerurkar, Geeta Anant Patkar. Effect of Saline Irrigation for Transurethral Resection of Prostate on Acid Base and Electrolyte Status-A Prospective Cohort Study. Journal of Clinical and Diagnostic Research. 2022;16(1): UC01-UC04. DOI: 10.7860/JCDR/2022/51582.15809.

Reich O, Gratzke C, Bachmann A, et al. Morbidity, mortality and early outcome of transurethral resection of the prostate: a prospective multicenter evaluation of 10,654 patients. J Urol. 2008;180(1):246-249.

Reza Shariat Moharari, Mohammad Reza Khajavi, Peyman Khademhosseini, Seyed Reza Hosseini, and Atabak Najafi. Sterile Water as an Irrigating Fluid for Transurethral Resection of the Prostate: Aesthetical View of the Records of 1600 Cases. Southern Medical Journal. 2008; 101:4.

Stephen W. Leslie; Soumaya Chargui; Gavin Stormont. Transurethral Resection of the Prostate. Transurethral Resection of the Prostate - StatPearls - NCBI Bookshelf (nih.gov).

Thasinas Dissayabutraa Wattanachai Ungjaroenwathanab , Chanatee Bunyaratavejc , Kriengsak Prasopsantic, Piyaratana Tosukhowong. Irrigation with water during transurethral resection of the prostate (TURP) induces intravascular hemolysis. Asian Biomedicine.2013;7(6):795-802.

Trépanier CA, Lessard MR, Brochu J, Turcotte G. Another feature of TURP syndrome: hyperglycaemia and lactic acidosis caused by massive absorption of sorbitol. Br J Anaesth. 2001; 87:316–9.