Original Article

Clinical experience with electrolyte flux after transurethral resection of the prostate (TURP) in selected private clinics in Port Harcourt Nigeria

Job Gogo Otokwala [1], Ochuko Otokunefor [2]

[1] Intensive Care Unit, Department of Anaesthesiology, University of Port Harcourt, Choba, Port Harcourt, Nigeria.
[2] Department of Chemical Pathology, University of Port Harcourt, Choba, Port Harcourt, Nigeria.

Abstract

Background: As men age towards the fifth decade, the prostate enlarges and occasionally could become a source of urinary tract obstruction requiring advanced technology with attendant risks to relieve obstruction.
Aim: To study the electrolyte changes in patients presenting for TURP.
Methods: A cross-sectional and descriptive design, conducted at selected private hospitals with standard endourology services in PortHarcourt between June 5, 2018, to June 30, 2024. Adult males aged ≥47 years with prostate volumes ≥ 80 grams, scheduled for monopolar Transurethral Resection of the Prostate (TURP) were recruited. Data were retrieved retrospectively from theatre register, patients' files, laboratory and ward registers. Demographic variables, preoperative and postoperative electrolyte values, resection time, total volume of water consumed were retrieved. A sample size of 246 patients was determined using the Cochrane formula for estimating a single population proportion. Data analysis was performed using IBM SPSS Statistics version 20.1.
Results: Two hundred and forty-six patient records were analysed with 165 having complete data representing 67.07%. The mean age was 69 ± 5.0 years. Range 47-92 years. The Mean volume of water used was 35± 2.3litres and the duration of resection was 90±3.4 mins. Hyponatremia was noticed in 30(18.2%) postoperatively and clinically presented as Nausea, vomiting, hypoxaemia and restlessness. Duration of resection, increased volume of irrigation fluid were risk factors. Managed with 3% sodium chloride, sodium bicarbonate and normal saline.
Conclusion: Hyponatremia is a common complication of TURP with monopolar resection using water or glycine. It is imperative to measure electrolyte level before and after TURP.

Keywords: Electrolyte flux, TURP, monopolar, resection, water, urology centers, Port Harcourt

Address for correspondence: Dr. Ochuko Otokunefor , Department of Chemical Pathology, University of Port Harcourt, Choba, Port Harcourt Nigeria.
Email: Ochuko.otokunefor@uniport.edu.ng
Phone: +2348037056312
Received: 12-12-2024, **Accepted:** 30-12-2024

Access this article online	
Quick Response Code:	**Website:** www.phmj.org.ng
	DOI: https://doi.org/10.60787/phmj.v18i3.184

How to cite this article: Otokwala JG, Otokunefor O. Clinical experience with electrolyte flux after transurethral resection of the prostate (TURP) in selected private clinics in Port Harcourt Nigeria. Port Harcourt Med J 2024;18(3):138-145.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a non-malignant, age-related enlargement of the prostate gland that commonly affects men over the age of 50 years.[1] As men advance in age, hormonal changes—particularly the imbalance between testosterone and estrogen—lead to cellular proliferation within the prostate, resulting in a gradual increase in gland size. [2,3] This anatomical alteration often causes obstruction of the bladder outlet, leading to a spectrum of lower urinary tract symptoms (LUTS) such as urinary frequency, hesitancy, weak stream, urgency, nocturia, and incomplete bladder emptying. These symptoms not only compromise quality of life but can also progress to serious complications such as urinary retention, recurrent urinary tract infections, and renal impairment if left untreated. [4]

When conservative medical management fails or the severity of obstruction necessitates surgical intervention, transurethral resection of the prostate (TURP) is often considered the treatment of choice.[5] TURP is a minimally invasive endoscopic procedure that involves the resection of hypertrophied prostatic tissue to relieve the obstruction. Despite its efficacy and widespread adoption, TURP is not without risks, especially when performed in resource-constrained environments. A critical aspect of TURP is the use of continuous bladder irrigation to clear blood clots and resected tissues from the surgical field, ensuring visibility and reducing the risk of clot retention.[6,7]

In high-income settings, isotonic or non-electrolyte-containing solutions such as glycine or saline are routinely used to minimize the risk of fluid overload and electrolyte disturbances.[8] However, in low-resource settings, where cost containment is a major consideration, more accessible and affordable alternatives like sterile water are often employed as irrigating fluids. While water is cost-effective, it is hypotonic and devoid of electrolytes. When absorbed into the systemic circulation through opened venous sinuses in the prostatic bed (a phenomenon referred to as intravesical fluid absorption or TUR syndrome) it can result in significant derangements in fluid and electrolyte homeostasis.[9,10]

Absorption of large volumes of hypotonic irrigation fluid can lead to hyponatremia, a potentially life-threatening condition characterised by reduced serum sodium levels. Clinical manifestations range from mild confusion and headache to severe neurological impairment, seizures, and coma.[11] Similarly, disturbances in serum potassium levels may occur, affecting cardiac rhythm and neuromuscular function. These changes are particularly concerning in elderly patients who may already have compromised renal function or multiple comorbidities, reducing their physiological reserve.[12]

Given these risks, there is a growing need to understand the extent of electrolyte changes associated with TURP, particularly in settings where water is used as an irrigation medium. Preoperative and postoperative evaluation of serum electrolytes and renal function provides essential insight into the patient's physiological response to the procedure and can guide perioperative care to mitigate complications. [13,14] While no incidence rate of TURP Syndrome has been reported in Port Harcourt, a few studies have reported figures ranging from 0% in a military hospital [15] to 1.03% in a teaching hospital both in Enugu state [16] and 2.2% in Jos, Nigeria. [17] Jeje et al in Lagos established that water was as safe to use as glycine and saline.[18]

This study aimed to investigate the electrolyte changes in patients undergoing TURP by assessing electrolyte function---specifically serum sodium and potassium levels—before and after the procedure.[19]

METHODOLOGY

This study adopted a cross-sectional, and descriptive design and was conducted in selected private hospitals in Port Harcourt, Nigeria, equipped with standard endourology services. The investigation spanned a six-year period, from June 5, 2018, to June 30, 2024. Ethical approval for the study was obtained from the Research and Ethics Committee of the State Ministry of Health prior to data collection. Ethical clearance ensured that the study adhered strictly to the principles outlined in the Declaration of Helsinki for research

involving human subjects. Participation was entirely voluntary, and written informed consent was obtained from all eligible patients before their data was included in the study. Patient confidentiality and data anonymity were rigorously maintained throughout the research process.

The study population comprised male adults aged 47 years and above who presented with symptomatic benign prostatic hyperplasia (BPH), with prostate volumes exceeding 80 grams, and were scheduled for monopolar transurethral resection of the prostate (TURP). Inclusion was limited to patients who had provided informed consent and had complete clinical and laboratory records. Exclusion criteria included incomplete data, a history of chronic renal disease, and the use of medications known to alter electrolyte balance. Blood samples were collected shortly before preloading for spinal anaesthesia and again within one hour after the completion of the TURP procedure. Data were retrieved retrospectively from medical records, laboratory registers, and ward registers. The variables obtained included demographic details, preoperative and postoperative electrolyte values, resection time, type of irrigation fluid used, and the total volume of irrigation fluid consumed. In all cases, water was used as the irrigation fluid.

The sample size of 246 patients was determined using the Cochran formula for estimating a single proportion. This calculation was based on an assumed 20% incidence of postoperative hyponatremia, a 95% confidence level, and a 5% margin of error, where Z is the Z-score corresponding to the desired confidence level (1.96), p is the estimated proportion (0.20), and d is the margin of error (0.05). Data analysis was performed using IBM SPSS Statistics version 20.1, developed by IBM Corporation, Armonk, New York, USA. Descriptive statistics were used to summarize demographic and clinical variables. Paired sample t-tests were applied to compare electrolyte levels before and after the TURP procedure. Statistical significance was determined at a 95% confidence level, with a p-value of 0.05 or less considered significant.

RESULTS

A total of 246 patients were initially analyzed, with 165 patients (67.07%) having complete data. A total of one hundred and sixty-five patient records were therefore used for this study. The mean age of the patients was 69 ± 5.0 years, with an age range of 47 to 92 years. The majority of patients analysed in this study were within the 61–70 years age group, indicating a higher prevalence of the condition necessitating transurethral resection of the prostate (TURP) in this age bracket. This group was followed by patients in the 71–80 and 51–60 years categories. Fewer patients were observed in the younger (41–50 years) and older (81–92 years) age groups as shown in Table 1.

The average volume of irrigation fluid used during the procedure was 35±2.3 litres, and the mean duration of resection was 90 ± 3.4minutes. Postoperatively, 30 patients (18.2%) developed hyponatremia, which presented clinically with symptoms such as vomiting, hypoxaemia, and restlessness as shown in Table 2. The study identified the duration of resection and the increased volume of irrigation fluid as significant risk factors for hyponatremia. Management of these cases involved the administration of 3% sodium chloride, sodium bicarbonate, and normal saline. None of the patients required admission to the intensive care unit (ICU).

Table 3 presents the mean and standard deviation (SD) of serum potassium (K^+) and sodium (Na^+) levels measured before and after Transurethral Resection of the Prostate (TURP). There was a slight increase in potassium levels postoperatively and a notable decrease in sodium levels, possibly attributed to the absorption of hypotonic irrigation fluid during the procedure. The analysis of electrolyte changes following TURP revealed notable alterations in serum potassium (K^+) and sodium (Na^+) levels before and after the procedure. The mean preoperative potassium level was 3.55 ± 0.27 mmol/L, and the postoperative level increased slightly to 3.66 ± 0.32 mmol/L. However, this

change was not statistically significant (t = -1.86, p = 0.066). In contrast, sodium levels showed a significant postoperative reduction. The mean preoperative sodium level was 134.77 ± 1.89 mmol/L, which decreased to 130.60 ± 7.93 mmol/L after the procedure. The paired t-test analysis confirmed this decrease to be statistically significant (t = 5.33, p < 0.000001). These findings suggest that while potassium levels remained relatively stable, TURP was associated with a significant reduction in serum sodium, highlighting a potential risk of dilutional hyponatremia.

Table 1: Age distribution of patients

Age range (Years)	Frequency	Percentage (%)
41- 50	15	9.1
51- 60	30	18.2
61- 70	65	39.4
71- 80	40	24.2
81- 92	15	9.1
Total	**165**	**100**

Table 2: Summary of results from patient analysis

Parameter	Value/Observation
Total number of patients analysed	246
Patients with complete data	165 (67.07%)
Mean age	69 ± 5.0 years
Age range	47–92 years
Mean volume of irrigation fluid used	35±2.3 litres
Mean duration of resection	90 ± 3.4minutes
Incidence of postoperative hyponatremia	30 patients (18.2%)
Clinical manifestations of hyponatremia	Vomiting, hypoxaemia, restlessness
Risk factors for hyponatremia	i. Resection time 105± 5.2 minutes ii. irrigation fluid 42± 2.1 litres
Management of hyponatremia	i. 3% Sodium chloride ii. Sodium bicarbonate iii. Normal saline
ICU admissions	None

Table 3: Electrolyte changes in patients undergoing TURP

Electrolyte	Preoperative (Mean ± SD)	Postoperative (Mean ± SD)
Potassium (K^+)	3.55 ± 0.27 mmol/L	3.66 ± 0.32 mmol/L
Sodium (Na^+)	134.77 ± 1.89 mmol/L	130.60 ± 7.93 mmol/L

DISCUSSION

Transurethral resection syndrome (TUR syndrome) remains a well-documented complication of transurethral resection of the prostate (TURP), primarily resulting from the absorption of irrigation fluid into the venous sinuses of the prostatic bed. This absorption can cause electrolyte flux resulting in hyponatremia, and presenting clinically as TURP syndrome. In this study, we observed a significant reduction in serum sodium levels postoperatively, with a mean decrease of 3.13 mEq/L. Although potassium levels exhibited a mild postoperative increase, this change was not statistically significant. These findings highlight the association between TURP and dilutional hyponatremia, even when clinical symptoms remain mild in most patients. Hyponatremia during TURP is common and although TURP is routing offered in PortHarcourt Nigeria, no study has highlighted its prevalence. It is clinically either classified as mild, moderate, or severe. The mean postoperative sodium level in this study fell within the mild range (130–134 mEq/L). Patients with mild hyponatremia are often asymptomatic; when symptoms do occur, they are typically nonspecific—such as nausea, vomiting, and delayed recovery from anaesthesia—consistent with our findings. [20] We identified longer resection durations and greater irrigation fluid volumes as risk factors for the development of hyponatremia. Management involved administration of hypertonic saline (3% sodium chloride), sodium bicarbonate, and normal saline, with no ICU admissions required, as summarised in Table 2.

Regarding potassium levels, we observed postoperative slight increases which were not statistically significant. In contrast, sodium levels showed a significant postoperative reduction which correlates with the known association between TURP and postoperative hyponatremia, as shown in Table 3.

Relationships between fluid absorption, volume of irrigation fluid used, and resection duration, are well documented in literature.[20,21] Prolonged resection time and higher irrigant volumes increase the risk of fluid absorption due to sustained exposure of open venous sinuses. It is estimated that irrigation fluid is absorbed at a rate of approximately 20 mL/min, which accumulates significantly with extended surgical time and larger fluid volumes. Our findings support this trend, with higher rates of hyponatremia observed in patients with longer surgeries and greater irrigation fluid use, aligning with studies conducted in India that identified similar risks.[22,23]

The absence of significant postoperative changes in potassium levels may be attributed to the type of irrigant used, which is less likely to cause haemolysis—a potential source of elevated serum potassium. Additionally, the dilutional effect from fluid absorption may have offset minor increases in potassium concentration. This observation aligns with the findings of Singhania et al., who reported no significant postoperative potassium elevations with specific irrigation techniques.[13]

Though not directly supported by the presented data, age is widely acknowledged in literature as a major risk factor for electrolyte disturbances during TURP. Elderly patients have reduced cardiovascular and renal reserves, decreased vascular compliance, and impaired fluid regulation, all of which limit their ability to compensate for rapid fluid shifts.[22,24] These physiological changes increase the likelihood of electrolyte imbalances when fluid is absorbed during surgery. Moreover, the potential for venous sinuses to remain open longer may be greater in older patients, further heightening this risk. However, in our study, no direct correlation was established between age and postoperative electrolyte changes.[18]

A notable observation was that patients who developed electrolyte disturbances had a greater mean weight of prostatic tissue resected[16]. This implies that a larger number of venous sinuses were exposed during surgery, increasing the risk of fluid absorption. This finding reinforces the importance of considering prostate size in surgical planning. For patients with significantly enlarged prostates, alternative techniques such as open prostatectomy or holmium laser enucleation may offer safer outcomes.[18]

Increased resection time is a recognized risk factor for fluid absorption and electrolyte disturbance during TURP, primarily due to the prolonged exposure of venous channels.[12] Although this association was not statistically confirmed in our dataset, the observed trend supports the established clinical recommendation to limit resection duration—preferably to less than 60 minutes—to reduce the risk of fluid overload. Similarly, while we did not demonstrate a statistically significant correlation between the volume of irrigation fluid and postoperative electrolyte derangements, the physiological rationale remains valid.[19]

Hypertension also emerged as a potential risk factor for postoperative electrolyte imbalance. Although not statistically significant in this study, hypertensive patients are commonly prescribed medications such as ACE inhibitors and diuretics, which can influence sodium balance and fluid regulation.[1,3] The low number of patients using diuretics in our study may have limited our ability to detect a significant relationship. Furthermore, logistic regression analysis suggested that higher preoperative sodium levels were associated with a reduced likelihood of postoperative electrolyte disturbances.[22,23] While this association did not reach strong statistical significance, it aligns with clinical knowledge that patients with lower normal sodium levels

have a reduced physiological buffer and are more vulnerable to developing dilutional hyponatremia.[25,26]

Finally, findings from Takure's recent study conducted in indigenous communities across sub-Saharan Africa provide valuable insight into the broader applicability of TURP in low-resource settings.[27] The study documented a steady rise in TURP utilisation, with annual procedure numbers increasing from 4 to 20. This growing access to TURP highlights the importance of continued surveillance and improvement of perioperative practices, particularly in resource-constrained environments.

Limitations of the study: The data was collated retrospectively and the risk of introduction of selection bias from the existing records which in some cases were incomplete was obvious and it might result in unnecessary generalizations. Secondly, two different surgeons with varying learning curves in TURP could have influenced the outcome. A well-defined prospective study is preferred.

CONCLUSION

The incidence of post-surgical (TURP) hyponatremia was 18.2%. Duration of time for the surgery, volume and the use of low solute-based solutions for irrigation all play a role to contribute to the incidence of hyponatremia. Electrolyte levels should be closely monitored in all patients undergoing TURP.

Recommendations: The risk of clinically significant hyponatremia during TURP with monopolar resection using water is reduced with the adoption of the following strategies: Limiting resection time to reduce absorption of irrigation fluids, use of alternative surgical strategies for larger prostates, use of lower irrigation pressures and the need to closely monitor electrolyte fluxes before and after the procedures and for the team to have a low threshold to recognize signs of hyponatremia and to introduce treatment early.

Financial support and sponsorship
Nil

Conflicts of interest
There are no conflicts of interest

REFERENCES

1. Lourenco T, Pickard R, Vale L, Grant A, Fraser C, MacLennan G, et al. Minimally invasive treatments for benign prostatic enlargement: systematic review of randomised controlled trials. BMJ 2008;337: a1662.

2. Mamoulakis C, Ubbink DT, de la Rosette JJ. Bipolar versus monopolar transurethral resection of the prostate: a systematic review and meta-analysis of randomized controlled trials. Eur Urol 2009 ;56(5):798–809.

3. Ather MH, Faruqui N, Abid F. Optimization of low pre-operative hemoglobin reduces transfusion requirement in patients undergoing transurethral resection of prostate. J Pak Med Assoc 2003 ;53(4): 170. Erratum in: J Pak Med Assoc 2003 ;53(4):170.

4. Reich O, Gratzke C, Bachmann A, Stief CG, Schlenker B, Hermanek P, 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.

5. Mamoulakis C, Efthimiou I, Kazoulis S, Christoulakis I, Sofras F. The modified Clavien classification system: a standardized platform for reporting complications in transurethral resection of the prostate. World J Urol 2011;29(2):205–210.

6. Muhammad AT, Shaikh AA, Devrajani BR, Shah SZ, Das T, Singh D. Serum sodium level in transurethral resection of the prostate (TURP): a cross-sectional descriptive study at two hospitals. Med Channel 2010;16(2):318–320.

7. Hakeem AR, Sairam K, Plail RO. The value of blood tests following transurethral

resection of the prostate. UroToday Int J 2009;2(2): Article 5.

8. 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.

9. Suhail MA, Pirzada AJ, Khaskheli MS. Comparison of effectiveness of irrigation fluid mannitol 5% with that of glycine 1.5% in preventing post TURP hyponatremia. Med Channel 2010;6(2):321–325.

10. Mamoulakis C, Skolarikos A, Schulze M, Scoffone CM, Rassweiler JJ, Alivizatos G, et al. Results from an international multicentre double-blind randomized controlled trial on the perioperative efficacy and safety of bipolar vs monopolar transurethral resection of the prostate. BJU Int 2012;109(2):240–248.

11. Moorthy HK, Philip S. TURP syndrome—current concepts in the pathophysiology and management. Indian J Urol 2001;17(2):97–102.

12. Moorthy HK, Philip S. Serum electrolytes in TURP syndrome—is the role of potassium under-estimated? Indian J Anaesth 2002;46(6):441–444.

13. Singhania P, Nandini D, Sarita F, Hemant P, Hemalata I. Transurethral resection of prostate: a comparison of standard monopolar versus bipolar saline resection. Int Braz J Urol 2010;36(2):183–189.

14. Uchida T, Ohori M, Soh S, Sato T, Iwamura M, Ao T, et al. Factors influencing morbidity in patients undergoing transurethral resection of the prostate. Urology 1999;53(1):98–105.

15. Amu OC, Affusim EA, Nnadozie UU, Nwachukwu CD. Outcome of transurethral resection of the prostate (TURP) using 5% dextrose water as irrigant. Niger J Clin Pract 2023;26(10):1568–1574.

16. Mbaeri TU, Abiahu JA, Obiesie EA, Odo C, Oranusi KC, Nwofor AME, et al. Assessment of complications of transurethral resection of the prostate using Clavien-Dindo classification in South Eastern Nigeria. Niger J Surg 2020; 26(2):142–146.

17. Ofoha CG, Dakum NK, Akhaine J, Sambo NM. Monopolar transurethral resection of the prostate; experience in a tertiary centre in Nigeria. J Adv Med Med Res 2021;33(14):59–65.

18. Jeje EA, Alabi TO, Ojewola RW, Ogunjimi MA, Tijani KH, Asiyanbi GK. Monopolar transurethral resection of the prostate using water as the irrigation fluid: our initial experience. Niger Postgrad Med J 2021;28(3):175–180.

19. Vijayan S. TURP syndrome. Trends Anaesth Crit Care 2011;1(1):46–50.

20. Attri B, Kumar V, Kant V. Serum sodium and potassium changes during transurethral resection of prostate gland in patients under subarachnoid block. Int J Med Anesthesiol 2023;6(3):100-103.

21. Goh KP. Management of hyponatremia. Am Fam Physician 2004;69(10):2387–2394.

22. Hurlbert BJ, Wingard DW. Water intoxication after 15 minutes of transurethral resection of the prostate. Anesthesiology 1979;50(4):355–356.

23. Madsen PO, Naber KG. The importance of the pressure in the prostatic fossa and absorption of irrigating fluid during transurethral resection of the prostate. J Urol 1973;109(3):446–452.

24. Gupta K, Rastogi B, Jain M, Gupta P, 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;4(3):142–146.

25. Chakithandy S, Evans R, Vyakarnam P. Acute severe hyponatraemia and seizures associated with postoperative enalapril

administration. Anaesth Intensive Care 2009;37(4):673–674.

26. Shah J, Nethercliffe J. Is routine post-operative haemoglobin measurement required after transurethral resection of the prostate? Transfus Med 2004;14(5):343–346.
27. Takure AO. Transurethral resection of the prostate in community outreach: what are the lessons? Ann Ib Postgrad Med 2024;22(2):26–30.