ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Correlation between post-operative electrolyte changes to perioperative factors in Bipolar TURP

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Submission: 23-09-2022 Revision: 29-12-2022 Publication: 01-02-2023

ABSTRACT

Background: Transurethral resection of the prostate (TURP) is one of the best available treatments for benign hypertrophy of the prostate. Many of the complications in TURP are associated with the absorption of irrigation fluid. In BIPOLAR TURP, normal saline is used as an irrigant which is more physiological. **Aims and Objectives:** Our aim of the study is to evaluate the correlation between post-operative electrolyte changes to perioperative factors in bipolar TURP. **Materials and Methods:** One hundred and ten patients enrolled in this study who were admitted to Meenakshi Mission Hospital, Madurai, Tamil Nadu, India. **Results:** Mean age of the participants was 65.68 (±8.50) years with a median of 66 years. mean hemoglobin drop was 1.21 (±1.36) g/dl. The mean serum sodium drop was 1.55 (±3.01) mEq/L. The mean serum potassium change was 0.06 (±0.74) mEq/L. There was a significant positive association between operative time and serum sodium drop ($P<0.001$). There was no significant correlation between any of the other parameters prostate size, resection time, resected volume were noted, and post-operative electrolyte April 2019–March 2021. Patient pre-operative changes and hemoglobin drop is observed. Correlation is assessed with Spearman Rho. **Conclusion:** Our study concluded that as operative time increases sodium drop and hemoglobin drop significantly increases. Resected and pre-operative prostatic volumes do not affect electrolyte and hemoglobin levels.

Key words: Complication, Electrolyte, Prostate, Endoscopic Surgery, Operative Time

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v14i2.47370

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

In spite of many newer modalities, transurethral resection of the prostate (TURP) is still considered the gold standard for the surgical management of benign prostatic obstruction.[1] Irrigation fluid is required in TURP; which mainly dilates the mucosal spaces and ensures better vision. Irrigation fluid draws out the blood, clots, and resected chips from the bladder. Various types of irrigating fluids have been used during the TURP procedure.[2] Many complications in TURP are associated with the absorption of hypotonic irrigating fluid. Despite improvements in the current surgical and anesthetic management, 2.5–20% of patients undergoing TURP show one or more manifestations of TURP syndrome, and 0.5–5% of patients die perioperatively.[3]

Transurethral resection (TUR) syndrome is mainly described as dilutional hyponatremia due to the absorption of irrigation fluid through the resected prostatic bed. Features include mental confusion, bradycardia, hypotension/hypertension, nausea, vomiting, and visual disturbances associated with hyponatremia that is the most commonly observed symptoms.[4] These symptoms are mostly the result of brain edema caused by a hypervolemic hyponatremia state. Hyperkalemia can also occur after TURP attributable mainly to cell lysis and the release of intracellular potassium. Acute kidney injury secondary to obstruction or sepsis can also lead to hyperkalemia in some cases.[5]

TUR syndrome is decreasing nowadays. Several modifications have led to decreased incidence of this

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complication. Among these are the development of continuous flow resectoscopes, utilization of "non-hemolytic" solutions such as glycine, sorbitol, and mannitol, use of bipolar circuitry, and advances in training techniques.[6] A recent multicenter study found TUR syndrome in only 1% of patients.[7] Certain risk factors are known to be associated with an increased risk of TUR syndrome including volume and type of irrigant used, resection time, the weight of tissue resected, and use of monopolar diathermy.[8]

Monitoring of post-operative electrolytes level is usually not done in all centers. The majority of centers do not consider risk factors for the same also. Even there are no specific guidelines for whom to get post-TURP electrolyte monitoring. Routine electrolyte measurement in all post-TURP patients is not a cost-effective measure. It reflects an extra burden for patients and hospitals both. The aim of the study is to evaluate the correlation between postoperative electrolyte (sodium and potassium) change to perioperative risk factors (prostate volume, resection time, and resected volume).

Aims and objectives

The aim of the study was to evaluate the correlation between post-operative electrolyte (sodium, potassium) change and perioperative risk factors (prostate volume, resection time, and resected volume).

MATERIALS AND METHODS

This prospective, observational, and clinical study was performed at the Department of Nadu in the duration of April 2019–March 2021. In this study, 110 patients were included which is having confidence limit, of 95% and was comparable to Mamoulakis et al., study.[9] Our study is approved by the Local Ethical Committee (IEC approval number- DNB/CNS/CETSS/41159/13/OTHERS/1127721/9478).

Inclusion criteria

All patients admitted for bipolar TUR of the prostate in Meenakshi Mission Hospital and Research Center, Madurai, were enrolled in the study.

Exclusion criteria

1. Patients with prostate cancer at the time of presentation or operation or incidentally diagnosed by the procedure were excluded from the study
2. The patients present with stricture urethra and vesical calculus were not included in the study
3. Patients with already electrolyte imbalance were excluded from the study
4. Patients with chronic diseases such as chronic kidney disease, and chronic liver disease were excluded from the study.

Methods

All patients with BPH admitted for BIPOLAR TURP at MMHRC, Madurai, Tamil Nadu, from April 2019 to March 2022 were enrolled in the study.

All patients who were planned for BIPOLAR TURP; were admitted to MMHRC and all basic variables such as international prostate symptom score (IPSS), prostate-specific antigen (PSA), prostate size, hemoglobin, and electrolytes levels such as sodium and potassium were recorded. All operations were performed using a bipolar electrosurgical system (Coviden) and 26 French continuous irrigation Iglesias resectoscope (Olympus). Cutting and coagulation settings were 280 and 140 watts, respectively. Normal saline was used for intraoperative bladder irrigation and for post-operative irrigation. All operations were performed under spinal anesthesia by senior consultant urologists. Basic pre-operative patient data hemoglobin, electrolytes level, PSA, IPSS score, and prostate volume noted. While TURP intraoperative operative time, resected volume noted.

At the completion of the procedure, 20 French two-way Foleys along with eight French feeding tubes were kept for continuous bladder drainage and irrigation with normal saline. Post-operative electrolytes and hemoglobin were recorded on the 1st post-operative day morning if any drop is there, it is repeated every day, maximum drop has taken in count. Bladder irrigation stopped, and the catheter was removed on the 1st and 4th post-operative day, respectively, based on the department protocol, unless differently indicated.

RESULTS

Age distribution

The mean age of the participants was 65.68 (±8.50) years with a median of 66 years. The age ranged from 48 to 88 years.

Indication for surgery

Most common indication of TURP was acute urinary retention (50%) followed by bothersome urinary symptoms (49%) and 1% was chronic urinary retention.

Basic pre-operative characteristics

The mean IPSS score of the patients was 27.31 (±2.69). About 50% of the patients had acute urinary retention and 0.9% had chronic urinary retention. Mean serum PSA was 2.10 (±1.02) ng/ml. Mean prostate volume was 51.09 (±12.97) cc Table 1.

Operative characteristics

The mean operative time in the patients was 63.79 (±13.49) min. Mean resected volume was 26.07 (±11.05) cc Table 2.

Pre-operative laboratory values

Patients mean hemoglobin was 12.21±2.01, mean serum potassium was 4.11±0.48, mean serum sodium was 134.23±5.84, and mean serum creatinine was 1.22±0.71 (Table 3).

Post-operative change in laboratory parameters

The mean hemoglobin drop was 1.21 (±1.36) g/dl. The mean serum sodium drop was 1.55 (±3.01) mEq/L. The mean serum potassium change was 0.06 (±0.74) mEq/L (Table 4).

Correlation between operative parameters and post-operative laboratory parameters

There was a significant positive correlation between hemoglobin drop and prostate volume (cc), operative time (minutes), and resected volume (cc) (P=0.002, P=0.001, and P=0.014, respectively). There was a significant positive association between operative time and serum sodium drop (P<0.001). There was no significant correlation between any of the other parameters (Table 5).

DISCUSSION

TURP is a relatively safe procedure, which has been shown to have many benefits compared to open procedure; but it is not without complication. In our study, we have studied complication of bipolar TURP using MCG. Bipolar TURP in few studies considered safer than monopolar TURP.[10,11]

Bipolar TURP consider to be safe as irrigation fluid used is normal saline so post-operative electrolyte change considered to be less. We enrolled 110 cases in our study. Mean age of patients in our study was 65.68 (±8.50) which is comparable to 68.4 (±6.2) as per Mamoulakis et al.[9]

Table 1: Patient characteristics

Patient's factor	Mean	Median	SD	Minimum	Maximum
IPSS score	27.31	27.50	2.69	22	33
Serum PSA (ng/mL)	2.10	2.10	1.02	0.30	4.00
Prostate volume (cc)	51.09	49.00	12.97	28	90

IPSS: International prostate symptom score

Table 2: Operative characteristics

Operative factor	Mean	Median	SD	Minimum	Maximum
Operative time (minutes)	63.79	65.00	13.49	35	90
Resected volume (cc)	26.07	26.00	11.05	8	59

Table 3: Pre-operative laboratory parameters

Laboratory parameter	Mean	Median	SD	Minimum	Maximum
Hemoglobin (pre-operative) (g/dL)	12.21	12.40	2.01	1.1	17.0
Serum potassium (pre-operative) (mEq/L)	4.11	4.10	0.48	2.9	5.8
Serum sodium (preoperative) (mEq/L)	134.23	136.00	5.84	113	146
Serum creatinine (pre-operative) (mg/dL)	1.22	1.05	0.71	0.6	5.1

Table 4: Hematological parameters

Blood parameter	Mean	Median	SD	Minimum	Maximum
Hemoglobin drop (g/dL)	1.21	0.90	1.36	0.0	8.2
Serum sodium drop (mEq/L)	1.55	0.00	3.01	0	18
Serum potassium alteration (mEq/L)	0.06	0.10	0.74	−5.0	2.5

Table 5: Correlation between operative parameters and outcome measures

Parameter	Prostate volume (cc)		Operative time (minutes)		Resected volume (cc)	
	Spearman's rho	P-value	Spearman's rho	P-value	Spearman's rho	P-value
Hemoglobin drop (g/dL)	0.287	0.002	0.302	0.001	0.234	0.014
Serum sodium drop (mEq/L)	0.076	0.431	0.390	<0.001	0.083	0.391
Serum potassium imbalance (mEq/L)	−0.129	0.179	−0.049	0.611	−0.091	0.347
Hospital stay (days)	0.062	0.517	−0.008	0.933	0.114	0.234

In our study, most common indication of TURP was acute urinary retention, which we found in 55 cases (50%), second most common was bothersome symptoms in 50 cases (49%) and in one case chronic urinary retention (1%). AUR as an indication was higher than Mamoulakis et al., (19.5%)[9] and Stroman et al., (12.5%).[12] This can be explained as we have catheterized few patients, who was willing for catheterization because of severe LUTS.

Mean IPSS score of our patients who presented with bothersome symptoms was 27.31 (±2.69), Mamoulakis et al.,[9] reported mean IPSS 22±2.6. In our study, mean serum PSA was 2.10 (±1.02) ng/ml with median 2.10 and mean prostate volume 51.09 (±12.97) cc. Mamoulakis et al.,[9] reported mean prostate volume 54cc and mean serum PSA 3.0 (1.7–3.9), similarly Sarma et al.,[11] reported prostate volume 66.4±22.9 cc and mean serum PSA 0.3±3.1 ng/dl.

Our average operative time was.79 (±13.49) min and mean resected volume was 26.07 (±11.05) cc. Madduri et al.,[11] reported mean operative time 82.1±29.6 min with resected volume 22.4 (±8.6)cc.

In our patients, mean pre-operative Hb was 12.2±2.01 g/dl, mean serum potassium was 4.11±0.48 meq/dl, mean serum sodium was 134.23±5.84 meq/dl, and mean serum creatinine 1.22±0.71 meq/dl which is comparable to Karadeniz et al.[10]

Post-operative laboratory parameters to access blood loss and fluid absorption were Hb drop, sodium drop, and potassium alteration in serum. In our study, mean hemoglobin drop was 1.21 (±1.36) g/dl (median 0.90 g/dl); mean serum sodium drop was 1.55 (±3.01) mEq/L. The mean serum potassium alteration was 0.06 (±0.74) meq/L; which was comparable to other studies Karadeniz et al.[10]

In our study, mean hospital stay was 7.71 (±1.65) days. Madduri et al., reported a mean hospital stay of 3.90±0.8 days; which is much less than our study because of our institutional protocol of catheter removal at post-operative day 4.[11]

In our study, we found statistically significant positive correlation between hemoglobin drop and prostate volume (cc), operative time (minutes), and resected volume (cc) (P=0.002, P=0.001, and P=0.014, respectively) (correlation coefficient 0.287, 0.302, and 0.234, respectively). There was a significant positive association between operative time and serum sodium drop (P<0.001). There was no significant correlation between any of the other parameters. Kirollos et al., reported correlation coefficient between Hb drop and resected prostate volume 0.347.[13] Zhu et al., reported hemoglobin drop relation to operative time and pre-operative prostatic volume.[14] Operative time and sodium drop correlation also reported by Aziz and Ather.[15] Serum potassium alteration and hospital stay not correlated significantly to either of prostate volume, resected volume, or operative time.

Limitations of the study

The study is not multicentered. The study is not comparative study, so it can not be compared with monopolar TURP. We have studied three perioperative factors, other factors like, irrigation fluid used, volume of fluid, height of fluid can also be compared.

CONCLUSION

Multiple factors are an important guide for surgeons to be careful while doing TURP and can guide in whom post-operative electrolyte monitoring should be done. Our study concluded that electrolyte change (sodium drop) and hemoglobin drop are significantly associated only with operative time. Resected volume and pre-operative prostatic volume are not associated with post-operative electrolyte change and hemoglobin drop.

ACKNOWLEDGMENT

We are grateful to the patients for their cooperation in the study. Beside this the entire team of Department of Urology helped a lot in this research work.

REFERENCES

1. Akpayak IC, Shuaibu SI, Onowa VE, Nabasu LE and Galam ZZ. Monopolar transurethral resection of the prostate for benign prostatic hyperplasia: What are the outcomes and complications in our patients? Niger J Med. 2017;26(2):173-177.
   https://doi.org/10.4103/1115-2613.278291
2. Oesterling JE. Benign prostatic hyperplasia: Medical and minimally invasive treatment options. N Engl J Med. 1995;332(2):99-109.
   https://doi.org/10.1056/NEJM199501123320207
3. Desai A, Patil SB, Kundargi V, Patil B, Patil N and Ranka K. Electrolyte changes in monopolar and bipolar transurethral resection of prostate (TURP)-a prospective randomized study. RGUHS J Med Sci. 2017;7(4):151-155.
   https://doi.org/10.1186/isrctn16583435
4. Muhammad A, Shaikh A, Devrajani BR, Shah Z, Das T and 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):218-220.
5. Hakeem AR, Sairam K and Plail RO. The value of blood tests following transurethral resection of the prostate. *UroToday Int J*. 2009;2(2):96-105.
   https://doi.org/10.3834/uij.1944-5784.2009.04.05
6. Hawary A, Mukhtar K, Sinclair A and Pearce I. Transurethral resection of the prostate syndrome: Almost gone but not

forgotten. J Endourol. 2009;23(12):2013-2020.

https://doi.org/10.1089/end.2009.0129

7. Suhail M, Pirzada A and Khaskheli M. Comparison of effectiveness of irrigation fluid mannitol 5% with that of glycine 1.5% in preventing post TURP hyponatremia. MedChannel. 2010;6(2):321-325.
8. 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.

   https://doi.org/10.1111/j.1464-410X.2011.10222.x
9. Mamoulakis C, Efthimiou I, Kazoulis S, Christoulakis I and 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.

   https://doi.org/10.1007/s00345-010-0566-y
10. Karadeniz MS, Bayazit E, Aksoy O, Salviz EA, Tefik T, Sanli O, et al. Bipolar versus monopolar resection of benign prostate hyperplasia: A comparison of plasma electrolytes, hemoglobin and TUR syndrome. Springerplus. 2016;5(1):1739.

    https://doi.org/10.1186/s40064-016-3407-7
11. Madduri VK, Bera MK and Pal DK. Monopolar versus bipolar transurethral resection of prostate for benign prostatic hyperplasia: Operative outcomes and surgeon preferences, a real-world scenario. Urol Ann. 2016;8(3):291-296.

    https://doi.org/10.4103/0974-7796.184900
12. Stroman L, Ellis D, Toomey R and Mazaris E. An 18-month audit of TURP complications using the Clavien-Dindo classification system. Austin J Urol. 2014;1(3):3.
13. Kirollos MM and Campbell N. Factors influencing blood loss in transurethral resection of the prostate (TURP): Auditing TURP. Br J Urol. 1997;80(1):111-115.

    https://doi.org/10.1046/j.1464-410x.1997.00253.x
14. Zhu YP, Dai B, Zhang HL, Shi GH and Ye DW. Impact of preoperative 5α-reductase inhibitors on perioperative blood loss in patients with benign prostatic hyperplasia: A meta-analysis of randomized controlled trials BMC Urol. 2015;15:47.

    https://doi.org/10.1186/s12894-015-0043-4
15. Aziz W and Ather MH. Frequency of electrolyte derangement after transurethral resection of prostate: Need for postoperative electrolyte monitoring. Adv Urol. 2015;2015:415735.

    https://doi.org/10.1155/2015/415735

Authors' Contributions:
AD- Concept and design of the study and prepared first draft of manuscript; **SST**- Interpreted the results, reviewed the literature, and manuscript preparation; and **SK** and **PDV**- Concept, coordination, statistical analysis and interpretation, preparation of manuscript, and revision of the manuscript.

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Source of Support: Nil, **Conflicts of Interest:** None declared.