


Incidence of Electrolyte Disturbance after TURP Procedure

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ABSTRACT

Introduction. Trans Urethral Resection of the Prostate (TURP) as a gold standard treatment for benign prostatic hyperplasia (BPH) is performed with fluid irrigation that may cause electrolyte disturbance due to excessive fluid absorption; and may lead to increased mortality. This study is to determine the incidence of electrolyte disturbances and risk factors in TURP procedure. **Materials & Methods.** A descriptive retrospective study was conducted at Bhayangkara Hospital Mataram in January 2014-January 2016. The subjects were all BPH patients who underwent TURP surgery. Data were retrieved from medical records. All TURP procedures used distilled water as irrigation fluid. Presurgery and postsurgery electrolyte level, digital rectal grading and weight of resection tissue were recorded. Deranged electrolyte was defined as presence of any or both serum sodium < 130 or > 145 mmol/L and serum potassium <3,5 or > 5,5 mmol/L. Student's T-test was applied to determine significant change between pre and post surgery variables. **Results.** Of 32 subjects, the mean age was 63.39 years and the mean weight of resected tissue was 63.03 grams. Sodium, potassium, chloride, and hemoglobin level were decreased post surgery (mean reduction 2.00, p = 0.000; 0.25, p = 0.000 ; 27.81, p = 0.021;1.050, p = 0.025, respectively). In 10 subjects, only significant decreased serum chloride and hemoglobin were found (mean reduction 4.5, p = 0.017; 1.46, p = 0.048, respectively). Sodium and potassium serum level were significantly decreased in non deranged electrolyte group (mean reduction 1.8, p = 0.01; 0.27, p = 0.00, respectively). No significant correlation between electrolyte imbalance with age and digital rectal examination grading. **Conclusion.** Electrolyte serum levels were significantly decreased after TURP procedure.

Keywords: BPH, electrolyte disturbance, TURP

ABSTRAK

Latar Belakang. *Trans Urethral Resection of the Prostate* (TURP) adalah suatu prosedur reseksi jaringan prostat, membutuhkan irigasi yang dapat menimbulkan gangguan elektrolit dan hemodinamika karena absorpsi cairan melalui vena selama irigasi. Gangguan elektrolit ini dapat meningkatkan morbiditas dan mortalitas. Tujuan penelitian ini adalah untuk mengetahui insidens perubahan elektrolit dan faktor risikonya. **Metode.** Penelitian deksriptif retrospektif di Rumah Sakit Bhayangkara Mataram dengan subjek semua pasien BPH yang menjalani prosedur TURP pada periode Januari 2014- Januari 2016. Data sekunder diambil dari rekam medis yaitu kadar elektrolit pra-bedah, kadar elektrolit pasca-bedah, tingkatan BPH berdasarkan colok dubur. Semua prosedur TURP menggunakan air distilasi sebagai cairan irigasi. Gangguan elektrolit didefinisikan sebagai kadar natrium <130 atau >145 mmol/L atau kadar kalium <3,5 atau >5,5 mmol/L. *Student's T-test* digunakan uji kemaknaan perubahan pasca-bedah. **Hasil.** Subjek sebanyak 32 pasien, rerata usia 63,39 tahun dan rerata berat jaringan reseksi 63,03 gram. Terdapat penurunan kadar natrium, kalium, klorida, dan hemoglobin pasca-bedah (rerata penurunan kadar serum Na 2,00, p = 0,000; serum K 0,25, p = 0,000; serum Cl 27,81, p = 0,021; dan serum Hb 1,050, p = 0,025). Terdapat 10 subjek dengan kategori gangguan elektrolit, klorida, dan Hb signifikan (rerata penurunan kadar serum Cl 4,5, p = 0,017; dan serum Hb 1,46, p = 0,048). Pada kategori non-gangguan elektrolit ditemukan penurunan natrium dan kalium yang signifikan (rerata penurunan kadar serum Na 1,8, p = 0,01; dan serum K 0,27, p = 0,00). Tidak ada korelasi dengan usia dan dengan tingkat penyakit berdasarkan colok dubur. **Simpulan.** Terdapat penurunan signifikan kadar elektrolit selama prosedur TURP. **Daniel Mahendra Krisna, Akhada Maulana. Kejadian Gangguan Elektrolit Serum Pasca-TURP**

Kata kunci: BPH, gangguan elektrolit, TURP

INTRODUCTION

Benign prostatic hyperplasia (BPH) is the disease in male elderly population. Trans Urethral Resection of the Prostate (TURP) has now been the gold standard for BPH, especially if the prostate volume range is 40-60 mL. TURP is performed by cutting or resecting the prostate tissue with electrocauter through urethra and use a cystoscope to visualize the prostate area.[1] Irrigation fluid is needed to distend the operative area and maintain the visibility.[2] Most complications are due to the continuous irrigation fluid is TURP syndrome, with symptoms of headache, anxiety, confusion, dyspnea, arrhythmia, hypotension,

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and seizures.[3] TURP syndrome is caused by the absorbtion of irrigation fluid into the vascular system through opened venous sinuses in prostatic tissue.[2,4] Electrolyte disturbances such as hyponatremia, hyperkalemia, and anemia often occurred during the TURP procedure.[1,3,5] These disturbances should be fully corrected because it leads to increased mortality rate. Pre- and post-surgery electrolyte monitoring should be done. This study is to determine the incidence of deranged electrolyte level and their risk factors in TURP procedure.

MATERIAL AND METHODS

A descriptive retrospective study was conducted at Bhayangkara Hospital, Mataram, Indonesia. The subjects were all BPH patient who underwent TURP surgery in the period January 2014-January 2016. Data were retrieved from medical records, including 1) Age, the age of patients at diagnosis, 2) Surgeon, there were 2 urologists who did TURP in this hospital 3) Hb pre-surgery: Hb serum level obtained before surgery, 4) Electrolyte pre-surgery: Sodium, Potassium, and Chloride serum levels before surgery, 5) Hb post-surgery: Hb serum level obtained after surgery, 6) Electrolyte post-surgery: Sodium, Potassium, and Chloride serum levels after surgery, 7) TURP complications, such as TURP Syndrome. All TURP procedure used distilled water as irrigation fluid. Digital rectal grading and the weight of resection tissue were recorded, but can not be analyzed due to too many incomplete medical record. We compared any electrolyte changes into two group, deranged electrolyte group and non-deranged electrolyte group. Deranged electrolyte was defined as presence of any : serum sodium level < 130 or > 145 mmol/L, serum potassium level <3,5 or > 5,5 mmol/L, or serum chloride level < 96 or >110 mmol/L. Non-deranged electrolyte was defined as any : sodium serum level between 130-145 mmol/L, potassium serum level between 3,5-5,5 mmol/L, chloride serum level between 96-110 mmol/L.

Statistical analysis used IBM SPSS Statistic 20 computer program. Results and baseline characteristics were described by mean and standard deviation for continuous variables. Frequency was described by categorical variables. Student's T-test was applied to determine significant change between pre- and post-surgery variables. The correlation between variables were analyzed with the logistic regression test. A *p* value less than 0,05 was considered statistically significant.

RESULTS

Of 92 subject included in the study, only 32 had complete medical record data. Mean age was 63.39 years. Mean resected tissue weight was 63.03 grams, but not all weight of resected tissue was recorded. Sodium, potassium, chloride serum level, and hemoglobin were decreased post-surgery; the only significant was chloride level decrease ($p < 0,05$) in 10 subjects (**Table 2**). In non-deranged electrolyte group there were significant decreased sodium and potassium serum level ($p < 0,05$) (**Table 3**).

DISCUSSION

TURP syndrome is the most fatal post-TURP complication due to irrigation fluid absorption, characterized by mental confusion, nausea, vomiting, hyper/hypotension, bradycardia, and visual disturbance.[6] Fluid is absorbed directly into the vascular system when the tissue has been resected and venous sinus opened.[6] Fluid pressure exceeds 2 kPa (15 mmHg) significantly increases volume absorption.[4,7] TURP incidence occurred in about 8% cases, though technical

Table 1a. Baseline subject characteristics

Variable	Frequency (N)	Mean Age (Years)	Mean Weight of Resected Tissue (Grams)
Total Subject	32	63.39	63.03
Deranged electrolyte	10	63.50	
Non-deranged electrolyte	22	64.14	

Table 1b. Baseline subject characteristics - electrolytes

Variable	Mean	SD	Mean of Reduction	*p* Value
Sodium Pre-TURP	134.87	93.559	2.00	0.000
Sodium Post-TURP	132.87	91.007		
Potassium Pre-TURP	4.228	0.4651	0.2500	0.000
Potassium Post-TURP	3.978	0.4956		
Chloride Pre-TURP	106.969	99.108	27.813	0.021
Chloride Post-TURP	104.188	117.293		
Hb Pre-TURP	12.875	2.3995	1.0500	0.025
Hb Post-TURP	11.825	1.5380		

Table 2. Deranged electrolyte subject characteristics

Variable	Mean	St Deviation	Mean of Reduction	*p* Value
Sodium Pre-TURP	133.900	11.1599	2.4000	0.70
Sodium Post-TURP	131.500	10.9265		
Potassium Pre-TURP	3.960	0.6769	0.3100	0.71
Potassium Post-TURP	3.650	0.6900		
Chloride Pre-TURP	108.500	12.3130	4.5000	0.017
Chloride Post-TURP	104.000	13.2413		
Hb Pre-TURP	11.360	0.7701	1.4600	0.048
Hb Post-TURP	9.900	1.4663		

Table 3. Non-deranged electrolyte subject characteristics

Variable	Mean	St Deviation	Mean of Reduction	*p* Value
Sodium Pre-TURP	135.318	8.6706	1.8182	0.01
Sodium Post-TURP	133.500	8.3538		
Potassium Pre-TURP	4.350	0.2704	0.2227	0.00
Potassium Post-TURP	4.127	0.2898		
Chloride Pre-TURP	106.273	8.8543	2.0000	0.195
Chloride Post-TURP	104.273	11.3103		
Hb Pre-TURP	13.250	2.6050	0.9222	0.123
Hb Post-TURP	12.328	1.1478		

Table 4. Logistic regression analysis of predictor electrolyte derangement

	Exp (*B*)	S.E	*p* Value
Age	0.108	0.192	0.603
Grade	0.070	5.774	0.991


improvements have decreased morbidity and mortality.[8]

Electrolyte imbalance such as hyponatremia, hypo/hyperkalemia, and hypochloremia often occurred when excessive fluid was absorbed during TURP procedure.[4,6] Presurgery electrolyte monitoring should be a priority. In this study, both normal and deranged electrolyte groups have decreased sodium, potassium, chloride, and Hb value during the TURP procedure. It is similar with Altaf, *et al*,[1] they found 38% BPH subject that underwent TURP had electrolyte disturbances.

Some factors can influence the electrolyte disturbances; such as weight of resected tissue, intravenous fluids, irrigation fluids, irrigation volume, age, and the time spent in surgery.[5] Nakahira, *et al*,[9] found that the incidence of TURP syndrome was higher in the elderly (p = 0,115), resected mass more than 45 g (p< 0,001), continuous irrigation (p<0,001), plasma substitute more than 500 mL (p< 0,001), and duration of operation more than 1,5 hours (p< 0,001).

New techniques such as bipolar resection minimize TURP syndrome incidence; the positive and negative poles are on the same axis and isolated from each other in the bipolar TURP so the energy dose not travel through the body.[10,11] Energy from the loop is transmitted to saline solution. Bipolar technique could decrease operating time.[10] Despite monopolar technique as the gold standard, irrigation fluid used in monopolar technique such as glycine or mannitol could lead to TURP syndrome.[11]

Karadeniz, *et al*,[12] compared serum sodium level in the patient who underwent bipolar (with 5% mannitol as irrigation fluid) and monopolar (with 0,9% sodium chloride as irrigation fluid) TURP; bipolar group had higher sodium level at 45 minute of surgery and post surgery. Pasha, *et al*,[13] suggested that sterile distilled water was safer than 1,5 % glycine as irrigation fluid.

Our study could not find the correlation between resected tissue weight and electrolyte disturbance due to lack of data, but we try to correlate it with digital rectal examination grading to predict the volume of the prostate.[14] In the past, DRE grading was used to estimate prostate volume when TRUS cannot be done.[14] Barnes, *et al*, suggested that 1-2 cm encroachment into the rectum was grade I, 2-3 cm is grade II, 3-4 cm is grade III, and more than 4 cm is grade IV.[15] DRE grading may provide rough estimate of prostate volume.[14] DRE grading used as prostate volume measurement may not predict accurately the weight of resected tissue. We found no correlation between them; it may due to small sample size and small range of age group.

Our study has similar results with Gupta, *et al*,[4] who found higher incidence of hyponatremia; may be caused by irrigation. Distilled water used as irrigation fluid may be less effective and safe compared to glysin or mannitol-sorbitol.[2,4,13]

Hyponatremia does not generate symptoms until sodium concentration is below 120 mmol/L.[3] Severe hyponatremia could happen when sodium serum levels are below 100 mmol/L, which lead to acute intravascular hemolysis, renal failure, respiratory compromise, electrocardiogram changes, cardiovascular depression, coma, and death.[1] No sodium serum levels below 120 mmol/L was found in this study.

Interestingly, one subject from the non-deranged group had TURP syndrome. The electrolyte range or limit that may cause TURP syndrome should be evaluated.[9] Moorthy, *et al*,[16] found various electrolyte value that could precipitate TURP syndrome; there is no fixed electrolyte value that may indicate a TURP syndrome.[16] Some research is needed to find which electrolyte component that can act as an indicator and their value range. Moreover, other factors such as resected tissue weight, intravenous fluids, irrigation fluids, irrigation volume, age, and the duration of procedure have been important factors to prevent TURP syndrome. In case of TURP syndrome or severe hyponatremia, the procedure must be stopped; furosemide injection with hypertonic sodium chloride are given by intravenous access.[6]

CONCLUSION

Electrolyte levels were significantly decreased during TURP procedure. Pre- and post-surgery electrolyte should be fully monitored to prevent TURP complication.

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