CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2586066

Available online at: http://www.iajps.com ***Research Article***

CHANGES IN SODIUM LEVEL AFTER SURGICAL TREATMENT OF BENIGN ENLARGEMENT OF PROSTATE

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Abstract:

Objective: *To assess the changes in sodium level after surgical treatment of benign enlargement of prostate*

Study Design: *Descriptive case series*

Place and Duration: *Asian Institute of Medical Sciences from January 2018 to July 2018.*

Materials and Method: *Total 75 patients with BPH were included. Blood sample was obtained for baseline serum sodium level. Patients were undergoing TURP. After 24 hours of surgery, again blood sample was obtained for assessment of serum sodium level. Mean change in serum sodium was noted. Comparison for mean change was done by using t-test. Stratification was done. P-value ≤0.05 was considered as significant.*

Results: *The overall mean age was 59.58±7.02 years. Mean duration of symptoms was 6.94±1.18 months. Mean resected tissue weight was 44.26±8.01 grams. Mean sodium change was decrease to 1.21±2.04 meq/I. There was significant difference in mean serum sodium at baseline with after 24 hours.*

Conclusion: *There was significant mean change in serum sodium after 24 hours of TURP. So the need for monitoring electrolyte following TURP should be individualized.*

Keywords: *Mean Change, Serum Electrolyte, Benign Prostate Hyperplasia, Transurethral Resection Of The Prostate.*

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Please cite this article in press Imran Memon et al., ***Changes In Sodium Level After Surgical Treatment Of Benign Enlargement Of Prostate.,*** *Indo Am. J. P. Sci, 2019; 06(02).*

INTRODUCTION:

Benign prostatic hyperplasia (BPH) results from enlargement of prostate gland. [1] Approximately 80% hyperplastic growth of prostate begins in men at the age of 50 years and by age eighty, almost 90% of men have histologic evidence of BPH. The open prostatectomy and transurethral resection of prostate (TURP) have been the surgical options for men with obstructive symptoms. Nevertheless, TURP is considered by many as a simpler and safer procedure than open prostatectomy. [2]

TURP was first introduced in 1926 and popularized in 1930s. Research has demonstrated that TURP is clinically effective in improving the quality of life for patients with BPH. [3] TURP is considered the gold standard for the surgical treatment of BPH. Irrigant fluid absorption by the patient is a potentially serious complication of TURP and can lead to dilutional hyponatremia and TURP syndrome. [4]

Early complications include urinary tract infection, secondary haemorrhage, blood transfusion, prostatic capsule perforation, temporary urinary incontinence. [5] Other complications include hypervolemia and electrolyte imbalance called as TURP syndrome which results from absorption of large quantities of the irrigating fluid[6] and results in hyponatremia ,which can cause fatigue, irritability, nausea, headache, tightness in chest, shortness of breath, confusion, restlessness, abdominal pain ,bradycardia with hypertension, seizures and eventually coma. [6]

In a study, it has been reported that after TURP, mean decrease in serum sodium level was 2.29±0.15meq/l and mean increase in serum potassium level was 0.31±0.13meq/l in patients of BPH. [7] Another study has showed that after TURP, mean decrease in serum sodium level was only 1.85±0.49meq/l and mean increase in serum potassium level was 0.17±0.02meq/l in patients of BPH. [8]

Rationale of this study is to assess the mean change in serum electrolyte in patients of benign prostate hyperplasia after transurethral resection of the prostate. Literature has showed that after TURP, there is significant change in serum electrolytes in BPH cases. But one study stated above showed that there is only 1 unit decrease in serum sodium level while minor increase in potassium level.

So this creates a discrepancy in evidence. Moreover, there is no local evidence available which can help in resolving the dispute. So we want to conduct this study to find whether after TURP, serum sodium disturbance actually happens and required early rectification to prevent the patient from hazardous consequences. This will help to improve our practice as well as we will get local evidence and in future we will be able to implement guidelines for management of patients of BPH by using TURP without compromising health of patient.

MATERIAL & METHODS:

It was a Descriptive case series conducted at Department of Urology, Asian Institute of Medical Sciences, Hyderabad, from January 2018 to July 2018. Total 75 number of cases were included through Non-probability consecutive sampling. Male patients aged 40-70years; presented with BPH undergone TURP with prostate volume 30-80mL, PSA<4ng/mL, IPSS≥20, Qmax≤10mL/s and failed medical therapy for >6 months, were included. Whereas those patients with previous unsuccessful surgery or recurrent strictures; patients with abnormal DRE or ultrasonography with suspicion of prostate cancer, history of prostate cancer, serum PSA ≥ 4ng/mL, previous urethral or prostate surgery, urethral stricture, neurogenic bladder, bladder calculi, and patients on anticoagulant therapy were excluded.
Informed consent and demographic detail [name, age, BMI (measured by weight in kgs/height in m^2) and duration of BPH] were obtained. Blood sample was obtained by using 3cc BD syringe under aseptic measures with the help of a staff nurse. Samples were sent to the laboratory of the hospital for assessment of baseline serum sodium level. All patients underwent TURP under spinal anesthesia. All procedures were performed by senior consultant urologist having at least 4 years' residency experience. After surgery, patients were shifted in urology wards and were followed-up there for 24 hours. After 24 hours, again blood sample was obtained and were sent to the laboratory of the hospital for assessment of post-surgical serum sodium level. Reports were assessed and mean changes in serum sodium were noted. All information was recorded on proforma.

All data were entered and analyzed in SPSS version 20.0. The quantitative variables i.e. age, BMI (measured by weight in kgs/height in m^2), duration of BPH, weight of resected tissue (measured by weighing machine), baseline, postoperative and change in serum sodium level were presented in the form of mean±standard deviation. Paired sample t-test was applied to compare mean change in serum sodium. Data were stratified for age, BMI, duration of BPH, weight of resected tissue and type of irrigant fluid used. Independent sample t-test was applied to compare stratified groups taking p-value ≤0.05 as significant.

RESULTS:

The overall mean age of study subjects was 59.58±7.02 years. The overall mean BMI of study subjects was 22.05±4.53 kg/m^2.The overall mean duration of symptoms was 6.94±1.18 months. The overall mean resected tissue weight was 44.26±8.01 grams.**Table-1**.

Table No 1

DESCRIPTIVE STATISTICS OF AGE (Years) (n=75)					
Mean ±SD	**95%CI (LB – UB)**	**Median (IQR)**	**Range**	**Minimum**	**Maximum**
59.58±7.02	57.97-61.20	62.00(10)	25	45	50
DESCRIPTIVE STATISTICS OF BMI (kg/m²) (n=75)					
22.05±4.53	21.00-23.09	20.10(3.10)	15.50	17	32.50
DESCRIPTIVE STATISTICS OF SYMPTOMS DURATION (months) (n=75)					
6.94±1.18	6.67-7.21	7.00(2)	4	5	9
DESCRIPTIVE STATISTICS OF RESECTED TISSUE WEIGHT (gram) (n=75)					
44.26±8.01	42.42-46.11	44.60(15.80)	27.50	30.20	57.70

It was observed that 1.5% glycine was used for all of 75 study subjects as irrigant fluid.

In our study, base line and after 24 hours sodium was 141.60±2.01 meq/I and 140.38±2.71 meq/I. Mean sodium change was decreased around 1.21±2.04 meq/I. The detailed descriptive statistics of sodium is presented in **Table-2**.

The results showed that there was significant difference in mean sodium at baseline with after 24 hours (p=0.000).The results also showed insignificant mean difference for sodium change with respect to age, BMI, duration of symptoms and weight of resected tissue. Detailed results of comparisons of means according to stratified groups for sodium are presented from

Table-3 & Table-4

TABLE – 2: DESCRIPTIVE STATISTICS OF SODIUM (meq/I)
(n=75)

	Baseline	After 24 hours	Change
Mean±SD	141.60±2.01	140.38±2.71	(-1.21)±(2.04)
95%CI	141.14–142.06	139.76–141.10	(-1.68) –(-0.74)
Median (IQR)	141.00 (2.20)	140.20 (3.40)	-2.30 (2.70)
Range	8.60	18.20	12.70
Minimum	137.30	128.30	-9.80
Maximum	145.90	146.50	2.90

Table no. 3

COMPARISON OF MEAN SODIUM AFTER 24 HOURS WITH BASELINE (n=75)			
	Mean	**SD**	**P-Valve**
Baseline	141.60	2.01	0.000*
After 24 hours	140.38	2.71	
COMPARISON OF MEAN SODIUM CHANGE ACCORDING TO AGE GROUP (n=75)			
≤60 years	-1.16	1.71	0.838**
>60 years	-1.26	2.33	
COMPARISON OF MEAN SODIUM CHANGE ACCORDING TO BMI GROUPS (n=75)			
<30 kg/m^2	-1.38	2.00	0.080**
≥30 kg/m^2	-0.21	2.08	
COMPARISON OF MEAN SODIUM CHANGE ACCORDING TO SYMPTOMS DURATION (n=75)			
≤6 months	-1.52	2.46	0.331**
>6 months	-1.04	1.77	

Dependent t-test was applied.
P-value ≤0.05 considered as Significant
*Significant at 0.05 levels.
**Insignificant at 0.05 levels.

TABLE – 4: COMPARISON OF MEAN SODIUM CHANGE ACCORDING TO RESECTED TISSUE WEIGHT GROUPS (n=75)

	Mean	SD	P-Value
≤50 grams	-1.35	2.13	0.396**
>50 grams	-0.91	1.83	

Independent t-test was applied.
P-value ≤0.05 considered as Significant
**Insignificant at 0.05 levels.

DISCUSSION:

Transurethral resection syndrome (TUR syndrome) is caused by fluid absorption from venous channels in prostatic bed in the presence of continuous irrigation. Absorption of this fluid leads to changes in serum electrolytes and potentially can lead to clinical TUR syndrome. In a study they found a decrease in serum concentration of both sodium and potassium postoperatively. Although the rate of fluid absorption during TURP depends upon a number of factors [9], the average rate is 20 mL/min. [10]
[985456] Aziz et al identified an overall decrease in the serum levels of both sodium and potassium, though the overall magnitude of this decrease is subtle (mean decrease of 3.13mEq/L for sodium and mean decrease of 0.082 for potassium). [9]

The local study of Muhammad et al. [11] presented the same results in his study. It is also similar with the study by Miyao et al. [12] Water intoxication with hyponatremia has been assumed as the main cause for the beginning of TURP syndrome. Another study conducted by Suhail et al. [13] reported that the mean serum sodium level difference was statistically significant between the groups (pre and post-operative treatment) the subject at P<0.01. While Bachmann et al. [14] also reported same results of sodium level. Gupta et al. [2] demonstrated the significant changes in serum sodium levels (hyponatremia) and the mean level of serum sodium showed statistically significant reduction (hyponatremia) post-operatively during surgical procedure. Present study also showed that significant hyperkalemia occurred after TURP procedure. [15]

Mean preoperative and postoperative hypochloremia was (2.82±0.5) mmol/L and (3.8±1.6) mmol/L (P>0.03) whereas mean preoperative and postoperative Hyperkalemia was (110±12.5) mmol/L and (106±9.5) mmol/L (P>0.04). Hahn et al. also found significant elevation of serum potassium. Whereas Gupta Kumar et al. also found similar results in his study. Norlen et al. [16] have reported significant changes in potassium levels (mainly in the form of dilutional hypokalemia) in the skeletal muscles post operatively when distilled water was used as irrigant.

Moorthy et al. showed significant hyperkalemia occurred in patients undergoing TURP. Hyperkalemic cardiotoxicity is increased by hyponatremia and acidosis. Hyperkalemia following TURP is partly explained by cell lysis as happened during resection of tissue. Absorption of fluid into circulation is an alternate mechanism that can cause hyperkalemia after TURP. [17] When patients with deranged electrolytes were compared with those having no electrolyte derangement, a number of important findings were noted. First, patients with electrolyte derangement were significantly older than those without electrolyte derangement. Uchida et al. found age of the patient undergoing TURP as a significant risk factor for perioperative blood transfusion and attributed it to more rigid vasculature in elderly, which allows for persistent opening of venous channels. [18]

The same mechanism can account for increased fluid absorption and electrolyte derangement in elderly patients. Second, mean weight of tissue resected was found to be higher in those patients undergoing TURP. The amount of fluid absorption depends mainly on the number and size of venous sinuses opened. The weight of tissue resected serves as a surrogate marker for the number of venous sinuses opened in prostatic bed. [19]

Provided that the irrigation fluid column is kept at a constant height, a constant volume of fluid is obtained per minute during resection. However, the amount of fluid absorption not only depends on the duration of exposure of the exposed venous sinuses to the irrigating fluid but also upon the number of prostatic venous sinuses opened and hydrostatic pressure at the prostatic bed. Madsen and Naber demonstrated that hydrostatic pressure at the prostatic bed is an important factor determining fluid absorption during TURP. This hydrostatic pressure depends upon the height of irrigating fluid column and pressure inside bladder during surgery. [20] Fourth, volume of irrigant used was found to be significantly higher in patients with deranged electrolytes. We used 1.5% glycine in all patients undergoing TURP. So, the type of irrigant used is not a factor in determining fluid absorption in our patients. Volume of irrigant used is consistently found to correlate with the risk of postoperative electrolyte derangement in previous studies. [21]

Finally, hypertensive patients were found to be at higher risk of developing postoperative electrolyte derangement. Some antihypertensives, for example, angiotensin converting enzyme inhibitors, are known to inhibit normal regulation of fluid balance and may even cause hyponatremia. [22] The significance of mild hyponatremia after TURP is unknown. It may contribute to postoperative nausea, vomiting, and delayed recovery from general anesthesia in at least some patients.[9]

Several strategies have been proposed to reduce the risk of fluid absorption during TURP, but none is capable of eliminating this complication altogether. It has been suggested to keep resection time below 60 min to minimize fluid absorption; TURP syndrome has been reported after a resection time of only 15min. [23]

Monitoring the extent of fluid absorption during surgery has been suggested to control fluid balance in every patient. The most viable methods to monitor fluid absorption are ethanol monitoring and gravimetric weighing. [24] Newer techniques, such as bipolar resectoscopes and vaporizing the tissue instead of resecting tissue, have reduced fluid absorption and its consequent electrolyte derangement, so routine monitoring of fluid absorption has been largely abandoned outside a study setting. However there is no consensus on routine monitoring of postoperative electrolytes. It has been suggested that with improvements in technology and use of isotonic, nonhemolytic solutions; electrolyte derangement is rare. Particularly with the use of isotonic saline and bipolar resection TURP syndrome is of historical interest only. [25] Electrolyte monitoring should be considered in patients having risk factors for increased fluid absorption.

CONCLUSION:

Electrolyte derangement after TURP is not uncommon. The results of the study showed that the mean change in serum sodium was found significant after 24 hour of TURP. The need for monitoring electrolyte following TURP should be individualized, taking into account the weight of resected tissue, volume of irrigation used, and increasing age. Low normal values of serum sodium should alert the surgeon to the possibility of postoperative electrolyte derangement.

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