Factors influencing development of trans urethral resection of prostate (TURP) syndrome in benign prostatic hyperplasia patients with various co morbid medical illness: a prospective study

Narayanan K. J.1*, Kannan V. P.2

1Department of Urology, Thanjavur Medical College Hospital, Thanjavur, Tamil Nadu, India
2Department of Medicine, Thanjavur Medical College Hospital, Thanjavur, Tamil Nadu, India

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*Correspondence:
Dr. Narayanan K. J.,
E-mail: urologistjip@gmail.com

ABSTRACT

Background: The aim of this prospective study is to analyse the factors influencing development of trans urethral resection of prostate (TURP) syndrome in benign Prostatic hyperplasia patients with various co morbid medical illness in Thanjavur Medical College Hospital, from February 2015 to January 2017.

Methods: This prospective study was done among 38 benign hyperplasia prostate patients with various co morbid medical illness underwent TURP. Pre-operative and post-operative serum sodium levels correlated with signs and symptoms developed in various prostate gland sizes, resection times and volume of irrigation fluids.

Results: Sodium level has gone down to 14 meq/L, gone up to 2 meq/L post-operatively. Major fluctuations in serum sodium was seen in prostate size more than 50 grams, resection time more than 40 mints, irrigant volume more than 24 litres. Mean sodium decrease was increased when gland size was increased, resection time was increased, irrigant volume was increased.

Conclusions: In renal insufficiency patients, it is safe to complete the procedure within 40 minutes and restrict irrigant volume 15 litres, in coronary artery disease patients it is safe to restrict irrigant fluid volume less than 20 litres. In Diabetes Mellitus patients, it is safe to restrict irrigant fluid volume less than 24 litres. In hypertensive patients, it is safe to restrict the resection time less than 45 minutes. In patients with Diabetes and hypertension, it is safe to restrict the resection time less than 40 minutes and irrigant fluid less than 20 litres.

Keywords: BPH, Dilutional hyponatremia, TURP Syndrome

INTRODUCTION

The aim of this prospective study is to analyse the factors influencing development of trans urethral resection of prostate (TURP) syndrome in benign prostatic hyperplasia patients with various co morbid medical illness who underwent transurethral resection of prostate in Thanjavur Medical College hospital, from February 2015 to January 2017.

Trans urethral resection syndrome

Irrigating fluid is most frequently absorbed directly into the severed vascular system. On average during a TURP, approximately 20 mL of fluid per minute is absorbed, or approximately 1000-1200 mL in the first hour of resecting time. This may lead to dilutional hyponatremia. The most common signs and symptoms are nausea and arterial hypertension followed by vomiting and low urinary output, bradycardia and a marked increase in
systolic arterial pressure 50-70 mm Hg. Pulmonary oedema, depressed consciousness and coma might also develop late, indicating that serum sodium is <100 Meq/litre.1-4

**Hyponatremia**

Hyponatremia is defined as a decreased plasma sodium concentration <136 meq/L, manifests itself clinically as generalized weakness and mental confusion at values <120 meq/L, bulbar or pseudobulbar palsy at <110 Meq/L and severe mental impairment between 90 and 105 Meq/L.5,6

**METHODS**

The study was conducted among In-patients of Urology Department, Thanjavur Medical College hospital, Thanjavur, Tamil Nadu in between period from February 2015 to January 2017. A total of 38 benign prostatic hyperplasia patients with various co-morbid medical illnesses who underwent transurethral resection of prostate were selected.

**Inclusion criteria**

Benign Prostatic Hyperplasia with bothersome symptomatic / acute urinary retention patients, with co-morbid medical illness.

**Exclusion criteria**

Bladder neck hypertrophy, carcinoma of bladder, carcinoma of prostate, benign hyperplasia of prostate with bladder stones, benign hyperplasia of prostate with carcinoma bladder, recurrent benign hyperplasia of prostate, residual benign hyperplasia of prostate, benign prostatic hyperplasia patients who underwent tur of prostate and died of other than tur syndrome, patients with benign hyperplasia of prostate without any co morbid medical illnesses

A total of 38 bothersome symptomatic benign prostatic hyperplasia patients with various co morbid medical illnesses, those who underwent TURP were studied during this period, between the age groups of 48-95 yrs, the average age being 71.5 years.

All the above patients were evaluated for Benign prostatic hyperplasia. The following evaluations were done on these patients preoperatively: Symptoms assessment (IPSS- Score), urine culture and sensitivity, hemogram, blood urea, sugar, creatinine and electrolytes, ultrasonogram of kidney, ureter, bladder and prostate with post void residual urine volume, uroflowmetry, office urethroscopy,., cardiac evaluation, pulmonary evaluation if needed.

**Constants in study**

Spinal anesthesia, sterile water as irrigant, placing the irrigating fluid drum at 60 cm above the operating table, 22 fr irrigant rubber tube, 24 fr non-continuous irrigation resectoscope sheath, resection without spc. done by equally skilled surgeons

**Variables observed in Study**

Patient age, gland size, immediate preoperative serum sodium value, immediate preoperative pulse rate, immediate preoperative blood pressure, resection time, irrigant volume, blood pressure immediately completing the procedure, pulse rate immediately completing the procedure, immediate post-operative serum sodium value, symptoms and signs in perioperative periods.

**Gland size measurement**

Gland size is measured by conventional ultrasound. the volume in cubic centimeters of prostate is comparable to weight in grams due to its specific gravity, which is 1.050.7

**Serum sodium measurement**

Blood samples 5cc in amount collected immediate pre- and post-operative periods. Serum sodium is measured in our hospital laboratory by Flame Emission Spectrophotometry.

**Resection time**

Resection time is the period in minutes between time of initiation of resection to the time at which last activation diathermy is done.

**Irrigant volume**

Irrigation volume is volume of Sterile Water in liters which is irrigated during the period of Resection time.

**Symptoms and signs in perioperative period**

Clinical Signs and symptoms observed in perioperative period were categorized as mild, moderate and severe.8-11

**RESULTS**

This study was conducted at Thanjavur Medical College hospital on 38 benign prostatic hyperplasia patients with various co morbid illness from February 2015 to January 2017. All the patients underwent transurethral resection of prostate.

Following observations are made in this study:
Among 38 patients suffers from co morbid medical illness. 16 patients were suffered from Hypertension, 13 patients suffered from Diabetes Mellitus, 9 patients suffered from chronic kidney disease. Patients suffered from coronary arterial disease, and 4 patients suffered from chronic obstructive or restrictive pulmonary diseases. 3 patients suffered from both Diabetes and Hypertension.

Degree of sodium change among this various age group of patients analyzed statistically by ANOVA followed by Turkey HSD test.

Degree of Sodium changes in patients with co morbid medical illness compared with normal patients. Sodium value gone down to 14 Meq/L and gone up to 1 Meq/L, which is compared with normal patients. Sodium change was higher in patient with co morbid medical illness than the normal patients. The P value is 0.0209, which is statistically significant.

Table 1: Co-morbid conditions.

<table>
<thead>
<tr>
<th>Co morbid conditions</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus (DM)</td>
<td>10</td>
</tr>
<tr>
<td>Hypertension (HT)</td>
<td>13</td>
</tr>
<tr>
<td>Coronary artery disease (CAD)</td>
<td>6</td>
</tr>
<tr>
<td>Chronic pulmonary disease (CPD)</td>
<td>4</td>
</tr>
<tr>
<td>Chronic kidney disease (CKD)</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2: Descriptive sodium difference in relation with co morbid conditions.

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error</th>
<th>95% Confidence interval for Mean</th>
<th>Minimum*</th>
<th>Maximum*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
<td>Upper Bound</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>6</td>
<td>4.42</td>
<td>2.889</td>
<td>0.367</td>
<td>3.69</td>
<td>5.15</td>
<td>-2</td>
</tr>
<tr>
<td>CAD</td>
<td>6</td>
<td>4.50</td>
<td>1.378</td>
<td>0.563</td>
<td>3.05</td>
<td>5.95</td>
<td>2</td>
</tr>
<tr>
<td>CPD</td>
<td>4</td>
<td>4.25</td>
<td>0.957</td>
<td>0.479</td>
<td>2.73</td>
<td>5.77</td>
<td>3</td>
</tr>
<tr>
<td>CKD</td>
<td>8</td>
<td>7.63</td>
<td>3.420</td>
<td>1.209</td>
<td>4.77</td>
<td>10.48</td>
<td>4</td>
</tr>
<tr>
<td>DM</td>
<td>7</td>
<td>2.43</td>
<td>1.902</td>
<td>0.719</td>
<td>0.67</td>
<td>4.19</td>
<td>-1</td>
</tr>
<tr>
<td>DM/HT</td>
<td>3</td>
<td>3.33</td>
<td>1.155</td>
<td>0.667</td>
<td>0.46</td>
<td>6.20</td>
<td>2</td>
</tr>
<tr>
<td>HT</td>
<td>10</td>
<td>4.30</td>
<td>2.058</td>
<td>0.651</td>
<td>2.83</td>
<td>5.77</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>4.49</td>
<td>2.805</td>
<td>0.281</td>
<td>3.93</td>
<td>5.05</td>
<td>-2</td>
</tr>
</tbody>
</table>

Different alphabet between age groups denotes significant risk at 5% level. *Values with negative symbol (-) denoted, sodium value more in post-operative than pre-operative sample. **Values with Positive side denoted, sodium value less in postoperative than pre-operative sample.

Table 3: ANOVA. Significance of sodium difference.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between groups</td>
<td>113.2873</td>
<td>6</td>
<td>18.8812</td>
<td>2.6377</td>
<td>0.0209*</td>
</tr>
<tr>
<td>Within groups</td>
<td>665.7027</td>
<td>93</td>
<td>7.1581</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>778.9900</td>
<td>99</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This P value denotes significant at 5% level

Table 4: Chronic kidney disease (CKD).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficients</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland size</td>
<td>0.6729</td>
<td>0.012</td>
<td>Yes</td>
</tr>
<tr>
<td>Irritant volume</td>
<td>0.8541</td>
<td>0.007</td>
<td>Yes</td>
</tr>
<tr>
<td>Resection time</td>
<td>0.8844</td>
<td>0.004</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Patients with co morbid medical illness, sodium difference was compared with gland size, irrigant volume and resection time by finding correlation coefficients with P value.

This much of hyponatremia was not seen in other groups. minimal sodium decrease was 4 meq/l. All patients with CKD showed hyponatremia of 4 meq/l at least.

Table 5: Coronary artery disease (CAD).

<table>
<thead>
<tr>
<th></th>
<th>Correlation Coefficients</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland size</td>
<td>0.7644</td>
<td>0.077</td>
<td>Not</td>
</tr>
<tr>
<td>Irritant volume</td>
<td>0.8226</td>
<td>0.044</td>
<td>Yes</td>
</tr>
<tr>
<td>Resection time</td>
<td>0.7736</td>
<td>0.071</td>
<td>Not</td>
</tr>
</tbody>
</table>

Table 4, compares sodium difference in CRF patients with gland size, resection time and irrigant volume. Which shows that all the three factors are statistically significant. So, in CRF patients with larger gland, prolonged resection time, and large irrigant volume showed high degree of hyponatremia. Patients with CKD
underwent resection in less than 40 minutes did not develop TUR syndrome, in less than 15 liters of irritant volumes did not develop TUR syndrome, and less than 40 grams did not develop TUR syndrome.

Patients with CAD, sodium value gone down to 6 meq/l. All patients with cad showed hyponatremia of 2 meq/l at least (Table 5), compares sodium difference in CAD patients with gland size, resection time and irrigant volume. Which shows irrigant volume was statistically significant. So, in CAD patients with large irrigant volume showed high degree of hyponatremia. In less than 20 litres of irrigant volumes did not develop TUR syndrome.

### Table 6: Chronic pulmonary disease (CPD).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficients</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland size</td>
<td>0.4264</td>
<td>0.574</td>
<td>Not</td>
</tr>
<tr>
<td>Irritant volume</td>
<td>- 0.1974</td>
<td>0.803</td>
<td>Not</td>
</tr>
<tr>
<td>Resection time</td>
<td>- 0.2818</td>
<td>0.718</td>
<td>Not</td>
</tr>
</tbody>
</table>

Patients with CPD, sodium value gone down in the range of 3 to 5 meq/l (Table 6), compares sodium difference in CPD patients with gland size, resection time and irrigant volume, which shows all the three factors are statistically Insignificant.

### Table 7: Diabetes mellitus (DM).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficients</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland size</td>
<td>0.7422</td>
<td>0.056</td>
<td>Not</td>
</tr>
<tr>
<td>Irritant volume</td>
<td>0.4424</td>
<td>0.320</td>
<td>Yes</td>
</tr>
<tr>
<td>Resection time</td>
<td>0.7085</td>
<td>0.075</td>
<td>Not</td>
</tr>
</tbody>
</table>

Patients with DM, sodium value gone down to 4 meq/l and gone up to 1 meq/l (Table 7), compares sodium difference in DM patients with gland size, resection time and irrigant volume.

Which shows irrigant volume was statistically significant. So, in DM patients with large irrigant volume > 24 liters showed high degree of hyponatremia. In less than 24 liters of irrigant volumes did not develop TUR syndrome.

### Table 8: Hypertension (HT).

<table>
<thead>
<tr>
<th></th>
<th>Correlation coefficients</th>
<th>P value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gland size</td>
<td>0.7252</td>
<td>0.018</td>
<td>Yes</td>
</tr>
<tr>
<td>Irritant volume</td>
<td>0.5473</td>
<td>0.102</td>
<td>Not</td>
</tr>
<tr>
<td>Resection time</td>
<td>0.7494</td>
<td>0.013</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Patients with DM/HT, sodium value gone down in the range of 2 to 4 meq/l. Table 9, compares sodium difference in DM/HT patients with gland size, resection time and irrigant volume. Which shows gland size and resection time and irrigant volume were statistically significant. So, in DM/HT patients with larger gland >50 grams, prolonged resection time >40 mins and using larger irrigation fluid >20 liters showed high degree of hyponatremia.

### DISCUSSION

The results of the present study were analyzed and compared with other studies. There is rapid accumulation of fluid in intravascular space occurs during Transurethral Resection of prostate surgery, in this situation effective renal function is very important factor to clear this excess load. Effective renal function is impaired in condition like aged patients, renal failure patients. These patients are unable to distribute the excess fluid as rapidly as it is accumulated. This leads to “Dilutional Hyponatremia”, which is responsible for Transurethral Resection Syndrome.

**Co morbid illness and sodium dynamics**

In this study co morbid medical illness; coronary arterial diseases, both diabetes mellitus and hypertension and chronic kidney disease are significant factors which affects serum post-operative sodium values.

**Coronary arterial disease**

In patients with Coronary Arterial Disease Irritant volume was a statistically significant factor in my study. In CAD Patients >20 liters of irrigant fluid volume patient developed TURP syndrome. In Cardiac Patient fluid over load is the significant factor decides morbidity and mortality. Richard H. Harrison III et al has shown in his study that cardiac disease patient is the candidate for the TURP syndrome, due to low salt diet, digitalis, diuretics, and reduced exercise.
**Diabetes mellitus**

In patients with Diabetes Mellitus, large irrigant volume > 24 liters was a statistically significant factor in my study. Harrison RH III et al, has shown in his study that chronic illness like diabetes mellitus have markedly reduced total body water, electrolytes and blood volume, they are more prone for the Transurethral Resection reaction.⁸

**Hypertension**

In patients with hypertension, gland size and resection time were significant factor in this study. HT patients with larger gland >50 grams, prolonged resection time >45 minutes showed high degree of hyponatremia. Harrison RH III et al, has shown in his study that hypertension have markedly reduced total body water, electrolytes and blood volume, they are more prone for the Transurethral Resection reaction.⁸

**Diabetes mellitus and hypertension**

in patients with diabetes mellitus and hypertension, gland size, irrigant volume and resection time were significant factor in the present study. In DM/HT patients with larger gland >50 grams, prolonged resection time >40 minutes and using larger irrigation fluid >20 liters showed high degree of hyponatremia. Harrison RH III et al, has shown in his study that chronic illness like diabetes mellitus and hypertension have markedly reduced total body water, electrolytes and blood volume, they are more prone for the Transurethral Resection reaction.⁸

**Chronic kidney disease (CKD)**

Among this, CKD is the most significant co morbid illness. In the present study patients with CKD did not develop TURP syndrome, if gland size was <40 grams, resection time was < 40 minutes, and irrigant volume was <15 liters. Holtgrewe H and Valk W et al, have concluded Azotemia patients had TURP syndrome 1.7% than normal patients 0.7%.¹² The activity of healthy kidney to eliminate intra operative fluid load is thus a factor attaining statistical significance.¹² The patients who display nitrogen retention on admission experience ill effects from a prolonged operative procedure.¹²

**CONCLUSION**

In Renal insufficiency patients, it is safe to complete the procedure within 40 minutes or restrict irrigant volume 15 liters, whichever is earlier. In coronary artery disease patients, it is safe to restrict irrigant fluid volume less than 20 liters. In Diabetes mellitus patients, it is safe to restrict irrigant fluid volume less than 24 liters. In Hypertensive patients, it is safe to restrict the resection time less than 45 minutes. In patients with diabetes and hypertension, it is better to complete procedure as quick as with low volume irrigation. It is safe to restrict the resection time less than 40 minutes or irrigant fluid less than 20 liters, whichever is earlier.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

**REFERENCES**
