

## Original Research Article

# Role of preoperative assessment of serum sodium in transurethral resection of prostate to avoid transurethral resection of prostate syndrome: a comparative study

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### ABSTRACT

**Background:** Transurethral resection of prostate syndrome (TURP) syndrome is an iatrogenic complication caused by absorption of the irrigating fluid which is used to distend the bladder during surgery.

**Methods:** A total of 100 patients with benign prostatic hyperplasia (BPH) were taken for study. Study was done in tertiary care centre in Gujarat from January 2016 to December 2017. They were evaluated pre-operative and post-operative for sodium concentration.

**Results:** In this study most of the patients i.e. 32 were seen in age group 61- 65 years. 31% cases have developed hyponatremia out of 6% were having serum sodium level <125 mEq/l. 56% of cases were having prostate gland <40 cc. In 70% cases, TURP was completed within 60 minutes, while 30% cases required more than 60 minutes time. 13 were seen in age group 51 to 60 years, means 40.62% patients of this age group (13/32) and 12 patients were seen in age group 71-80 years, means 52.17% patients of this age group (12/23) were having post-operative hyponatremia. Out of 31 patients, 20 patients (64.52%) were having prostate size more than 60 cc and 11 patients (35.48%) were having prostate size between 46 to 60 cc.

**Conclusions:** From present study, it is concluded that electrolyte derangement occurs in older patients, with larger amount of tissue and longer time of resection and higher volume of irrigation fluid. It was also noticed that chances of electrolyte derangement are higher in patients with co-morbid conditions.

**Keywords:** BPH, Electrolyte imbalance, Endourology, Post-operative care, TURP syndrome

### INTRODUCTION

Benign prostatic hyperplasia (BPH) is a glandular, fibrous, and muscular proliferation of prostate tissue. Benign prostate hyperplasia (BPH) is a common disease in adult men and its incidence is age related. Prevalence of BPH is approximately 25% in men aged 40 to 49 years, 50% in men aged 50 to 59 years and 80% in men aged 70 to 79 years.<sup>1</sup> Between 1% and 8% of TURP procedures are complicated by TURP syndrome.

Transurethral resection of prostate is gold standard treatment modality for benign prostate hyperplasia.

Despite the more recent introduction of medical therapies for BPH, the high efficacy of TURP still makes it one of the most common surgical operations worldwide. However, this surgical technique is not without problems with per- and postoperative bleeding events and TUR syndromes being the most serious ones. Use of irrigation fluid is characteristic part of transurethral resection of prostate procedure, of which Transurethral resection of prostate syndrome is fatal complication in first 15 minutes to 24 hours post operatively.<sup>2</sup>

Transurethral resection of prostate (TURP) syndrome is an iatrogenic complication caused by absorption of the

irrigating fluid which is used to distend the bladder during surgery. Between 1% and 8% of TURP procedures are complicated by TURP syndrome. Complex shifts of water and electrolytes in the body accompany this absorption. TURP syndrome is characterized by systemic manifestations (cardiovascular, CNS changes and changes in metabolism). The clinical picture varies and is influenced by the type of irrigation fluid which is used, from the patient and surgical factors. Signs and symptoms are vague and variable, the sensations on the face and neck, lethargy, fear, fatigue, headache, dizziness, nausea, vomiting, dyspnea, arrhythmia, hypertension, bradycardia, restlessness, confusion. If not treated early symptoms, the clinical picture is exacerbated by the onset of cyanosis, hypotension, cardiac arrest and death.<sup>3</sup>

Almost at every TURP procedure is absorbed certain amounts of irrigation fluid through the prostatic venous sinuses (20 ml/minutes to several liters). Penetration of one liter irrigation fluid in circulation for a period of 1-hour match with an acute reduction in serum sodium concentration of 5-8 mmol/L, and it suggests that there is a risk of symptoms associated with absorption. Acute hyponatremia with serum concentration of sodium (115-120 mEq/L) is a potentially serious condition. Hyponatremia and plasma hypo-osmolality, may result in intravascular hemolysis leading to increase in serum potassium. Hyperkalemic cardio toxicity increases with hyponatremia and acidosis. Cardiovascular changes during TURP syndrome is due to a combination of Hyponatremia and hyperkalemia. Despite advanced surgical and anesthetic techniques which are used for prevention of TURP syndrome, as well as a better understanding of its pathophysiology, there is still a risk of occurrence of TURP syndrome, so the responsibility should be shared by the anesthesiologist and the urologist. The best prevention would be the adoption of proper surgical technique and preoperative evaluation, preparation of patients and to take the appropriate therapeutic measures.

This study analyzed the changes in electrolyte status with TURP, which indirectly reveals absorption of the irrigation fluid in the systemic circulation, and early diagnosis and development of TURP syndrome. Serum sodium concentration during TURP is common practice and is effective for assessing intravascular absorption. So, early detection of hyponatremia and timely intervention can prevent transurethral resection of prostate syndrome. So our study is to focus on evaluation of concentration of serum sodium level in operated patients of transurethral resection of prostate.

**METHODS**

Study was started after getting approval from scientific review committee and ethical committee of the institute and conducted at Department of General Surgery in Tertiary care health care Hospital in Gujarat State from January 2016 to December 2017. Randomly first 100 cases were taken into study.

The present study was randomized, prospective, observational and longitudinal. Protocol of trial procedure was formed along with Performa, Patient Information Sheet and Informed Consent. 100 male patients undergoing transurethral resection of prostate were evaluated pre-operative and post-operative for sodium concentration.

**Inclusion criteria**

Patients willing to give informed and written consent and patients of presenting with benign prostatic hyperplasia willing for transurethral resection of prostate.

**Exclusion criteria**

Those with pre-existing heart, lung disease or renal disease; those who have renal disease, diuretics therapy, diarrhea, vomiting and severe electrolyte disorder; patients with high serum prostate specific antigen level.

100 male patients undergoing transurethral resection of prostate were evaluated pre-operative and post-operative for sodium concentration. A detailed history of each patient for pre-operative and post-operative history and examination was done to rule out post-operative complications of TURP.

**RESULTS**

This study included 100 male patients planned for elective TURP. The level of serum electrolyte-serum sodium level was determined by taking venous blood sample pre-operative and post-operatively. The amount of used irrigation fluid, the weight of prostate and duration of surgery were also followed.

**Table 1: Distribution according to age.**

Age group	No. of patients
41-50 years	15
51-60 years	24
61-70 years	32
71-80 years	23
>80 years	6

In this study most of the patients i.e. 32 were seen in age group 61-65 years whereas 24 patients were ranged from 51 to 60 years, 23 were observed in the age group 71 to 80 years, 15 patients from 41 to 50 years and only 6 were seen in the age group >80 years.

**Table 2: Patients having post-operative hyponatremia.**

Serum sodium level (mEq/l)	No. of patients
135-145	69
125-135	25
<125	06

Patients with sodium derangement-post operative hyponatremia were compared with prostate size, duration of surgery and amount of used irrigation fluid.

**Table 3: Size of prostate in present study.**

Size of prostate	No. of patients
<45 cc	56
45-60 cc	24
>60 cc	20

Out of 100 patients 56 were having prostate size <45 cc, while 24 cases were having size between 45-60 cc. Only 20 patients were having size more than 64 cc.

**Table 4: Duration of surgery.**

Duration	No. of patients
30-60 minutes	70
>60 minutes	30

According to duration of surgery patient were divided into two groups: patients with duration of surgery between 30 to 60 minutes and patient with duration of more than 60 minutes. Out of 100 patients 71 patients had duration of surgery less than 60 minutes and 30 patients had duration of surgery more than 60 minutes.

**Table 5: Correlation of sodium derangement with age group.**

Age group (in years)	Total number of patients	Post op hyponatremia
41-50	15	0
51-60	24	2
61-70	32	13
71-80	23	12
>80	23	4

In this study, out of 100 patients, 31 had hyponatremia. Most of the patients i.e. 13 were seen in age group 51 to 60 years, means 40.62% patients of this age group (13 out of 32) were having post-operative hyponatremia. 12 patients were seen in age group 71-80 years, means 52.17% patients of this age group (12 out of 23) were having post-operative hyponatremia. In the age group of >80 years, maximum patients i.e. 66.66% (means 4 out of 6 patients of this age group) were seen with post-operative hyponatremia. Small number of patients i.e. 2 out of 24 patients were seen in age group 51-60 years and in age group 41-50 years, no one was found with complication of hyponatremia. So, post-operative hyponatremia was higher in older patients.

Total 31 patients were found with altered post-operative serum sodium level. Out of 31 patients 20 patient (64.52%) were having prostate size more than 60 cc and 11 patients (35.48%) were having prostate size between 46 to 60 cc. patients with prostate size less than 45 cc did

not show hyponatremia. So it was noticed that post-operative hyponatremia was higher with larger size of prostate.

**Table 6: Correlation of post-operative hyponatremia with size of prostate.**

Size of prostate	No. of patients with altered sodium level	Percentage
<45 cc	0	0
46 to 60 cc	11	35.48
>60 cc	20	64.52

**Table 7: Correlation of sodium deranged with duration of surgery.**

Duration of surgery	Total no. of patients	No of patient with altered sodium level
30 to 60 minutes	69	0
>60 minutes	31	31

Total 31 patients were found with altered post-operative serum sodium level. All the patients were having duration of surgery more than 60 minutes. That means post-operative hyponatremia was found with duration of surgery more than 60 minutes.

**Table 8: Correlation with volume of used irrigation fluid.**

Volume of irrigation fluid	No. of patients	No. of patients with electrolyte derangement
<18 l	69	00
>18 l	31	31

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. For this study we set the irrigation fluid at height of 60 cm from patient heart level. In all 31 patients who were found with electrolyte derangement, the volume of irrigation fluid was more than 18 liters. In compare to patients electrolyte derangement the volume of irrigation fluid was higher. Volume of irrigation fluid in patients without electrolyte derangement was less than 18 liters.

**Table 9: Patient with post-operative complication.**

Complication	No. of patients
Restlessness with anxiety	4
Bradycardia	3

Overall 31/100 patients had post-operative hyponatremia after TURP in our study. None of the patients had clinical TUR syndrome. In 7 patient anxiety and bradycardia appeared when the duration of surgery exceeded 60 minutes, which corresponds to reduction of serum sodium level. It was noticed that post-operative serum sodium level was less than 125 mEq/l. So in our study,

statistically significant reduction of serum was directly proportional to the volume of the used irrigation fluid, the duration of procedure and size of prostate as well as found to be higher in older patients and hypertensive patients.

## **DISCUSSION**

TURP is one of the most common urological procedures performed. Despite introduction of several minimally invasive options like holmium laser enucleation and holmium laser ablation, TURP is still considered the gold standard for surgical management of benign prostatic obstruction (BPO).

Complications after TURP are frequent. Early complications of TURP include bleeding, sepsis, TUR syndrome, incontinence, and urinary retention. The incidence of early complications of TURP has decreased considerably over the past few decades. This is largely attributable to standardization of the procedure, better perioperative management, and better anesthetic techniques. Bleeding requiring transfusion, acute kidney injury, and transurethral resection syndrome are the complications of TURP in early postoperative period that greatly influence morbidity of the procedure and may even lead to mortality.

Electrolyte imbalance is one of the most worrisome complications of TURP especially due to risk of developing overt TUR syndrome. Pathophysiological mechanism of TURP syndrome consists of pharmacological and volume effects of irrigation fluid, and serum electrolyte changes, so it is difficult to avoid occurrence of complications. The best preventive method is selecting the proper surgical technique and optimizes the condition of patients preoperative.

### ***Age incidence***

Patients with electrolyte derangement were significantly older than those without electrolyte derangement. In these study patients of age group 41-50 years, no one was found with post-operative hyponatremia. Only 8.33% patients of age group 51-60 were found with post-operative hyponatremia. But in age group 61-70 years 40.60%, 52.17% patient of age group 71-80 years and 66.66% patients of age group >80 years were found with post-operative hyponatremia.

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.<sup>4</sup> The same mechanism can account for increased fluid absorption and electrolyte derangement in elderly patients.

Aziz et al in their study also found that incidence of electrolyte derangement is more in elder patients. 280

patients who underwent TURP were studied. Mean age of patient was 69.98 years. When patients with electrolyte derangement were compared with those having no electrolyte derangement, the former group was found to be significantly higher than those with no electrolyte derangement.<sup>5</sup> Altaf et al also found that age of patient undergoing TURP is significant risk factor for post-operative electrolyte imbalance.<sup>6</sup> So it was concluded that elder patients are more prone to electrolyte derangement-post-operative hyponatremia.

### ***Size of prostate***

Weight of prostate was found to be higher in those patients undergoing TURP. In this study total 31 patients were found with altered post-operative serum sodium level. Out of 31 patients 20 (64.52%) were having prostate size more than 60 cc and 11 patients (35.48%) were having prostate size between 46 to 60 cc. Patients with prostate size less than 45 cc did not show hyponatremia.

Petrusheva et al in his study observed that weight of prostate more than 60 gram are more prone to post-operative hyponatremia and post-operative complications.<sup>7</sup> Aziz et al also found significant correlation between weight of resected tissue and post-operative electrolyte derangement. So, it was concluded that post-operative electrolyte imbalance is higher with larger size of prostate. 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.

### ***Duration of surgery- resection time***

Increased resection time correlates with electrolyte derangement in our study. Out of 31 patients with altered post-operative serum sodium level, 30 patients (96.77%) were having duration of surgery more than 60 minutes and only 1 patient had duration of surgery less than 60 minutes. It suggests that the duration of surgery >60 minutes causes electrolyte derangement.

Moorthy et al in their study found that duration of surgery had better correlation with changes in serum electrolyte than weight of gland resected, volume of irrigation fluid and height of fluid column.<sup>8</sup> Aziz et al had concluded that patients with electrolyte derangement had a longer mean resection time. Mean resection time was longer i.e. 42.5 minutes in patients with electrolyte in compare to patients without electrolyte derangement in which mean resection time was 28.34 minutes.

### ***Volume of irrigation fluid***

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 irrigation fluid was more than 20 liters in patients with deranged electrolyte.

Aziz et al in their study found that volume of irrigant used were significantly higher in patients with deranged electrolyte.<sup>5</sup> Mean volume of irrigant in patients with electrolyte derangement was  $23.55 \pm 15.20$  liters in compare to patients without deranged electrolyte which was  $12.81 \pm 7.57$  liters. Petrusheva et al also found that significant reduction of serum sodium was directly proportional to the volume of the used irrigation fluid.<sup>7</sup>

Volume of irrigant used is consistently found to correlate with the risk of postoperative electrolyte derangement in the study Gupta et al.<sup>9</sup>

### **Co-morbid conditions**

In this study patients with pre-existing heart disease, lung disease and renal disease were excluded. Other than these conditions, hypertensive patients were found to be at higher risk of developing postoperative electrolyte derangement. Diabetes mellitus was not found to be associated with post-operative derangement.

Aziz et al, in their study found that hypertensive patients had a higher proportion of electrolyte derangement compare to normotensive.<sup>5</sup> Comorbid conditions including ischemic heart disease (IHD), congestive cardiac failure (CCF), and diabetes mellitus (DM) were not found to be associated with post-operative electrolyte derangement. Chakithandy et al found that some anti-hypertensive, for example, angiotensin converting enzyme inhibitors, are known to inhibit normal regulation of fluid balance and may even cause hyponatremia.<sup>10</sup>

### **Post-operative complications**

Clinical manifestation of fully developed TURP syndrome did not occur in any patient due to the taken precautions intraoperatively. In 7 patient anxiety and bradycardia appeared when the duration of surgery exceeded 60 minutes, which corresponds to reduction of serum sodium level. It was noticed that post-operative serum sodium level was less than 125 mEq/L.<sup>11</sup>

### **CONCLUSION**

As the pathophysiological mechanism of TURP syndrome consists of pharmacological and volume effects of irrigation fluid, and serum electrolyte changes, it is difficult to avoid occurrence of complications. The best preventive method is selecting the proper surgical technique and optimizes the condition of patients preoperative. Therefore, our study emphasized the need for evaluation of serum sodium level preoperative at patients scheduled for TURP procedure as well as post-operative serum sodium level to prevent serious complications.

Electrolyte derangement after TURP is not uncommon. The need for monitoring electrolyte following TURP should be individualized, taking into account the weight of resected tissue, volume of irrigation used, resection time, increasing age, and hypertension. Low normal values of serum sodium should alert the surgeon to the possibility of postoperative electrolyte derangement. Evaluation of changes in serum electrolyte during TURP is simple and economical method for the indirect estimation of irrigation fluid absorption into the systemic circulation during TURP and opportunity for early identification of TURP syndrome. The only limitation of our study is a single center small cases study. The same study can be more helpful with multicentre data with more number of cases.

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