The Degree of Hyponatremia in Transurethral Resection of Prostate: A Prospective Study

Abdulaziz A. Alamri* Gamal Abdalla Mohamed Ejaimi** Abla Saab, MD*** Ali A. Alqahtani**** Mohammed Y. Assire****
Muneer Jan Bhat, MBBS, DA, DNB(MD)*****

ABSTRACT

Background: Systemic uptake of hypotonic fluid during irrigation performed at the time of Transurethral Resection of the Prostate (TURP) may cause electrolyte changes including sodium, potassium and calcium. The present study was aimed to assess the degree of sodium changes during Transurethral Resection of Prostate (TURP).

Methods: 50 males aged 54 to 86 years, presented for TURP, were enrolled in the study with ASA classification of I to IV grades. Glycine 1.5% was used with height of irrigation kept at 60 cm. One day preoperatively and one hour postoperative, levels of serum sodium were measured for all the patients.

Results: Spinal anaesthesia was given in 31 patients, whereas 19 patients were managed under general anaesthesia, with mean duration time being 72.42 ± 24.77min. The mean size of the resected prostate was 54.82 ± 25.04g. 58% patients developed mild hyponatremia, 4% had asymptomatic moderate hyponatremia and no patient developed severe hyponatremia or TURP Syndrome. The systemic diseases like hypertension, DM, or IHD found to be insignificant.

Conclusion: TURP was associated with a high incidence of asymptomatic mild hyponatremia. Duration of operation was one of the most important factors.

Keywords: Serum Sodium, Benign Prostatic Hyperplasia, Transurethral resection of prostate, Hyponatremia, TURP

INTRODUCTION

From past 60years, the benign prostatic hyperplasia (BPH) remains a common illness in men. This ailment is featured by presence of urinary incontinence, altered urinary frequency, urgency of urination, a weak and nocturnal urine flow[1,2]. BPH is characterized by increased prostate size (more than 20 g) with irritative and/or obstructive symptoms[3]. Surgical treatment of BPH involves the Transurethral resection of the prostate (TURP), which is a urological intervention, done under spinal or general anaesthesia using endoscopy. It is being advocated as the treatment of choice in 95% cases with simple prostatectomy, being more secure and effective than open prostatectomy[4-7].

After the surgical intervention, flushing and irrigation of the bladder is done using large triple lumen catheter[8]. Different irrigation solutions used are glycine, sorbitol, distilled water, and mannitol[9]. Besides irrigation, TURP procedure also involves the dilation of surface of mucosa, removing blood; and cleaning the resected pieces of prostatic tissue for visualizing the area properly.

A serious complication observed with TURP procedure is the uptake of hypotonic irrigation fluid systemically either directly in the vascular system via the prostatic venous plexus or indirectly into retroperitoneal or perivesical space[10]. This could be because of high irrigation fluid pressure that surpasses the venous pressure (1.5 kPa)[11].

In more than 20% of patients treated with TURP, TURP syndrome was observed with a complex pathophysiology requiring a multidisciplinary management[12,13]. TURP syndrome is a water intoxication that occurs iatrogenically because of augmented intake of fluid, causing hyponatremia within 15 min to 24 hours of resection[14]. Different types of signs and symptoms are reported in patients with TURP syndrome, involving fear, fatigue, lethargy, dizziness, confusion, headache, dyspnea, restlessness, nausea and vomiting, cardiovascular manifestations, arrhythmia, bradycardia and hypertension. If the condition is not detected and managed in time, TURP syndrome can manifest with exacerbated clinical symptoms like commencement of hypotension, cyanosis, cardiac arrest and death if not early detected and promptly treated[11].

In every TURP procedure, varying amount of irrigation fluids is absorbed through venous sinuses of prostrate (ranging from 20 ml/min to several litres). With diffusion of 1L of the irrigating fluid in circulation, in an hour, acute decline in the concentration of serum sodium levels (5–8 mmol/L) has been observed[15]. Acute hyponatremia is a serious condition that occurs with serum sodium concentration decreased to a level of 115–120 mEq/L[16]. It is often complicated by intravascular hemolysis and increase in serum potassium levels, increasing the risk of hyperkalemic cardiotoxicity[17]. In TURP syndrome, a combination of hyponatremia and hyperkalemia can give rise to cardiovascular complications[18].

MATERIALS AND METHOD

This prospective study was conducted in Aseer Central Hospital (ACH), Abha, Kingdom of Saudi Arabia (KSA), from May 2016 to April 2017. Ethical approval was obtained from the ACH Ethics and Internal Review Board (IBR) committee. 50 male patients aged 54 – 86 years presented for TURP were enrolled in the study with American Society of Anesthesiologists (ASA) classification of grade I and IV. Informed and written consent was obtained from all study subjects.

Following the fasting regimen protocol for each patient, preoperative assessment and evaluation was done after routine investigations. Patients with the history of electrolytes imbalance, impaired renal or hepatic function, heart failure, and patients undergoing treatment with diuretics were excluded from the study. Monitoring of hemodynamic parameters was carried out as per ASA standard monitoring. Systolic blood pressure (SBP), diastolic blood pressure (DBP), Heart rate

* Consultant of Urology, Head of the Department of Surgery, King Khalid University, Abha, Saudi Arabia., E-mail: aaazizamri@gmail.com
** Consultant of Anaesthesia and Intensive Care, Department of Anesthesia and Intensive Care, Taiba Hospital, Kuwait.
*** Lecturer of Anesthesia and Intensive Care, Ain Shams University, Cairo, Egypt.
**** Aseer Central Hospital, Department of Urology, Saudi Arabia.
***** Assistant Professor Anaesthesia, Department of Surgery, King Khalid University, Abha, Saudi Arabia.

(HR), oxygen saturation and respiratory rate (RR) was recorded during and after procedure. 1.5% glycine was used as irrigation fluid at 60cm height. Preoperative serum sodium was measured one day preoperatively and one hour from the end of the procedure.

Data was entered and analyzed using the Statistical Package for Social Sciences (SPSS version 21.0). The statistical significance was significant at p-value < 0.05.

RESULTS

The mean of all study subjects was reported to be 71.58 ± 7.76 years. The majority of the patients had grade I or III. Spinal anaesthesia was given to 31 patients (62%) and 19 (38%) patients were subjected to general anaesthesia. The mean duration of procedure was 72.42 ± 24.77min. The mean size of the resected prostate was 54.82 ± 25.04g with the minimum and maximum size being 21.4 g and 131 g. Blood transfusion was done in only 5 patients (10%) (Table 1).

19 patients (38%) were reported with normal range of serum sodium, 29 (58%) had mild hyponatremia and 2 patients (4%) had an asymptomatic moderate hyponatremia, with an insignificant difference (p-value>0.05) statistically. No patient developed severe hyponatremia or TURP Syndrome (Table 2).

The intergroup comparison was done between normal with mild; and normal with moderate hyponatremia for various parameters like hypertension, DM, IHD, size of resected segment, type of anaesthesia and duration of surgery. It was observed that both intergroup comparisons showed an insignificant difference statistically except for duration of surgery (Table 3).

DISCUSSION

TURP is a common surgical intervention being done in males aged above 60 years. At this age, males are commonly reported with various comorbidities. It has been observed that diuretics are commonly used in this age group that can result in dehydration and deficiency of essential electrolytes such as potassium, sodium, and calcium. During Endourology surgery, absorption of intravesical irrigation fluid systemically is one of the serious intraoperative complications.

Table 1: General characteristics

Variables	Mean	SD	Minimum	Maximum
Age (Yrs)	71.58	7.76	54	86
ASA I II III IV	 11 (22%) 24 (48%) 13 (26%) 02 (4%)			
Types of Anesthesia General Anesthesia Spinal Anesthesia	 19 (38%) 31 (62%)			
Size of Prostate ≤ 60 g ≥ 60 g	54.82 39 (78%) 11 (22%)	25.04	21.4	131
Blood transfusion Yes No	 5 (10%) 45			
Duration of Surgery Duration ≤ 60 minutes ≥ 60 minutes	72.42 22 (44%) 28 (56%)		30	120

Table 2: Grades of hyponatremia

Variables	N (%)
Normal (135 – 145)	19 (38%)
Mild (134 – 130)	29 (58%)
Moderate (129 – 125)	2 (4%)
Severe (≤ 124)	0

Table 3: HTN, DM, IHD, size of prostate, type of anesthesia and duration of the procedure

Variables	Normal hypona-tremia (n = 19)	Mild hypona-tremia (n = 29)	P-Value	Normal hypona-tremia (n = 19)	Moderate hypona-tremia (n = 31)	P-Value
HTN No Yes	 11 8	 23 6	0.110	 11 8	 24 7	0.144
DM No Yes	 13 6	 24 5	0.245	 13 6	 25 6	0.326
IHD No Yes	 16 3	 24 5	0.895	 16 3	 26 5	0.975
Size of resected Prostate ≤ 60 g (38) ≥ 60 g (12)	 16 3	 20 9	0.233	 16 3	 21 10	0.196
Type of Anesthesia Spinal General	 11 8	 18 11	0.772	 11 8	 20 11	0.640
Duration of Surgery ≤ 60 minutes (46%) ≥ 60 minutes (54%)	 13 6	 10 19	0.021*	 13 6	 10 21	0.013*

In 1990, Han et al. demonstrated that the primary reason of pathogenesis of TURP syndrome is water intoxication and hyponatremia[19]. Changes in intravascular and plasma osmolar volume are characteristics of TURP syndrome. The dilutional hyponatremia has also been reported as a result from the absorption of small amounts of fluid.

But, in our study, we observed that patients develop mild to moderate hyponatremia, but no patient had developed severe hyponatremia or TURP Syndrome.

Symptoms noticed with hyponatremia are dizziness, headache, nausea, dyspnea, weakness, muscle spasms and seizures. More severe symptoms are observed when level of absorption increases more than 3 liters. In 1973, Madsen et al. conducted a study and revealed that different important factors that determine the rate of absorption of irrigants: hydrostatic pressure in the prostate area, dependence on the quantity of irrigation cylindrical vessel and the pressure developed inside the bladder during the operation[21]. Similar to our study, Petrusheva AP *et al*. in 2015 observed significant changes in serum sodium levels by changing the sterile water volume, the procedure duration and the resected prostate volume[22].

We observed a transient increase in serum potassium that could be due to intracellular absorption. A study done by Han et al. observed a significant increase in levels of serum potassium during the absorption of sterile water intraoperatively[16,20].

In our study, we observed no significant difference in level of hyponatremia with anaesthetic techniques. It has been found in various studies that to detect early signs of TURP syndrome, regional anaesthesia is preferred over general anaesthesia. Regional anaesthesia not only decreases the chances of venous thrombosis postoperatively, but also no significant difference is observed with general anaesthesia, in relation to cognitive function, mortality and blood loss postoperatively[23].

Although water gives better visualization for hemolysis, but acute water intoxication is a major difficulty of significant assimilation.

Thus, in our study, we used 1.5% of glycine for irrigation. It was preferred being less costly, and has less chances to cause renal failure and hemolysis. Glycine in concentration of 2.2% is also being used in many studies. But it has more side effects than 1.5% glycine as irrigant. Transient blindness is observed with high concentration of glycine, because it is an inhibitory neurotransmitter in the retina[24].

The other commonly used irrigants is the combination of 2.7% sorbitol and 0.54% mannitol. The solutions that are less frequently used are 2.5–4% dextrose, 3% mannitol, 3.3% sorbitol, and 1% urea. These solutions are hypotonic, thus a sufficient amount of water absorption can take place, especially when irrigation is done under pressure. These solutions were reported to cause hyperglycemia and increase the intravascular volume as compared to 1.5% glycine[10].

Our study showed a significant change in serum sodium (hyponatremia) related to the duration of the operation. Procedure more than 1 hour is associated with higher level of hyponatremia. With more than 90 minutes duration of TURP, higher morbidity and mortality was observed[25,26].

Different methods are suggested to reduce the hazard of liquid absorption, but nothing is totally effective in eliminating problems. The degree of absorption of fluid (using ethanol monitoring and gravimetric measurement) is monitored while operation allowing the better control over the fluid balances[27]. Newer techniques like bipolar resectoscope and vaporization of tissue are effective in reducing the fluid absorption and its consequences[28].

CONCLUSION

Our study revealed that hyponatremia is a common finding in patients undergoing TURP. We observed that duration of operation is one of the deciding factors to determine the level of hyponatremia. We advocate that sodium levels should be assessed as a mandatory investigation during long TURP procedure for early detection and management of hyponatremia.

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