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Use of bipolar turp in saline to avoid hyponatremia and transurethral resection syndrome- A prospective study at a tertiary care centre

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Abstract

Objective: To compare serum sodium level changes and the incidence of transurethral resection (TUR) syndrome after monopolar transurethral resection of the prostate (TURP) and bipolar transurethral resection in saline (TURIS) for symptomatic benign prostatic hyperplasia.

Materials and Methods: Between January 2021 till June 2022, 60 patients with symptomatic benign prostate hyperplasia underwent TURP, by either a monopolar or bipolar technique. Preoperative and postoperative blood parameters were analyzed to compare preoperative and postoperative electrolyte concentrations.

Results: Over 18 month's period, 30 patients underwent a conventional monopolar TURP and 30 patients had a bipolar TURIS. Patient profiles were similar in both groups, regarding age, operation time. A drop in sodium of 6.2 mmol/l was seen in the conventional monopolar resection group. The decline of 4.4 mmol/l in the bipolar group was observed, which was statistically significant ($p < 0.05$). TUR syndromes were noted in the monopolar group, while none seen in the bipolar group.

Conclusion: Bipolar TURP in saline is a safe technique and reduces the risk of TUR syndrome. Bipolar TURP must be used more in teaching hospitals where students take more time to perform a TURP and bipolar TURP will be useful in such situation with less complications.

Keywords: Hyponatremia, Prostate, Transurethral resection, TUR syndrome.

Introduction

Monopolar transurethral resection of the prostate (TURP) is the gold standard in the operative management of benign prostatic hyperplasia (BPH) [1,2]. New techniques & approaches must be compared with the known efficacy of TURP [3]. The transurethral resection (TUR) syndrome is defined as a symptomatic dilutional hyponatremia due to fluid overload status, is a known complication of TURP which manifests with cardiovascular and neurological signs & symptoms.

Many methods have been suggested to reduce the risk of fluid absorption and overload status which include, shorter procedure, maintaining of low intravesical pressure by low inflow, continuous flow resection/ use of a suprapubic catheter. Despite following these, the incidence of TUR syndrome remains around 2% [4]. The technique of bipolar resection of the prostate is bit different from the conventional TURP. By using both the active and negative poles on the same electrode [4], a conductive medium (normal saline) is used for the resection, instead of the non-conductive irrigation fluid (glycine or mannitol).

Many randomized controlled trials (RCTs) have been done to evaluate the perioperative and postoperative morbidity and the final outcome of bipolar resections [5], which concluded that bipolar and monopolar TURP have almost same efficacy. No life-threatening hyponatremia and TUR syndrome were seen in several smaller RCTs (42–117 patients), leading to the conclusion that the bipolar resection is much safer compared to monopolar resection [5].

Material and Methods

A. Patient Data

Between January 2021 and June 2022, 60 men with bladder outlet obstruction due to BPH were taken in a single-center, unblinded study. Oral informed and written consent was taken. Voiding symptoms were graded according to the International Prostate Symptom Score (IPSS) [6]. The minimal criteria for entry were an IPSS of 13 or greater, and maximal urinary flow rates of less than 15 ml/s. Patients with known neurogenic bladder, prostate cancer was excluded.

The preoperative evaluation included a history, physical and digital rectal examination, urinalysis and urine culture, serum electrolytes, renal function tests, full blood count, prostate specific antigen determination, uroflowmetry and ultrasound measurement of postvoid residual urine volume.

A full blood count and serum electrolytes were measured on the blood samples obtained from the operation room. After initial cystoscopy and examination with the patient under anesthesia, the patients were randomized to conventional monopolar TURP or bipolar TURIS. The two procedures were performed with intermittent glycine 1.5% or saline 0.9% irrigation and using general or spinal anesthesia. At the end of the procedure a 22 Fr three-way Foley catheter was inserted. All patients were treated postoperatively with continuous saline bladder irrigation until bleeding stopped. The full blood count and serum electrolytes were determined post procedure in the recovery room. The patients were checked for symptoms, by an anesthesiologist and a trained nurse, over a 2-hour period.

Criteria for TUR syndrome

TUR syndrome is characterized by a dilutional hyponatremia (serum sodium < 125 mmol/l) with one or more circulatory and/or neurological symptoms. Possible circulatory complications include chest pain, hypertension, bradycardia, decreased urine output and hypotension. Neurological symptoms include blurred vision, nausea, vomiting, uneasiness, tiredness, disorientation and mild to severe headache.

Equipment

A standard resect scope and electrical current generator was used for TURP and TURIS. TURP was done with a standard 25 Fr resect scope and standard loops using 175 W cutting power and 75 W coagulation power. TURIS was performed using a 25 Fr resect scope with bipolar electrodes set at 200 W for cutting and 150 W for coagulation.

Statistics

All statistical tests performed with 5% level of significance. For the continuous variables the two groups were compared using the independent t test. Complications such as TUR syndrome were tested using the Pearson chi-square test. SPSS version 26.0 was used to perform the hypothesis tests.

Results

During 18 months, 60 patients with symptomatic benign prostate hyperplasia were treated surgically by endoscopic resection: 30 by conventional TURP and 30 patients by TURIS. Patient and operation characteristics of both groups are reported in Table 1.

Table 1: Characteristics of the two groups.

Variables	Monopolar TURP	Bipolar TURIS
Age (years)	66.67 +/- 6.97	67.27+/- 4.86
Operative time (min)	41.67+/- 5.65	45.73+/- 4.41

Data are shown as mean ± SD. TURP = transurethral resection of the prostate; TURIS = transurethral resection in saline.

Men in the TURP group were 50–80 years old (mean age ± SD 66.67 ± 6.97). The patients treated by TURIS were 55–83 years old (mean age ± SD 67.27 ± 4.86). Both the groups underwent resection under spinal anesthesia. The mean operation time was not significantly different: 41.67 ± 5.65 min in the TURP group and 45.73 ± 4.41 min in the TURIS group.

Our policy is to keep resection time as short as possible, preferably not exceeding 60 min. The maximal duration was 55 min for conventional monopolar resections and 57 min for bipolar resections in saline.

Table 2 lists the mean values for hemoglobin, sodium, potassium and chloride before and immediately after surgery in both groups.

Variable		Preop	Postop	Difference
Hemoglobin in (mg/dl)	Monopolar	12.27 ± 0.96	11.57 ± 0.96	–0.7
Sodium (mmol/l)		139.57 ± 3.12	133.4 ± 3.51	–6.2
Hemoglobin in (mg/dl)	Bipolar	12.04 ± 1.27	11.43 ± 1.25	–0.6
Sodium (mmol/l)		139.56 ± 3.26	135.1 ± 3.5	–4.4

Data are shown as mean ± SD. TURP = transurethral resection of the prostate; TURIS = transurethral resection in saline.

In the conventional monopolar TURP group, serum sodium declined by 6.2 mmol/l. This is statistically significantly different ($p < 0.05$) from the drop of 4.4 mmol/l in the bipolar arm (Table 3).

Table 3: Chemical and hematological parameters of all surgical procedures.

Variable	Monopolar TURP	Bipolar TURIS	p
Hemoglobin (mg/dl)	t-value 0.4489		0.655
Sodium (mmol/l)	t-value -2.1207		0.038

The electrolyte changes were seen with drop in serum sodium was more important in the monopolar group (–1.8 mmol/l) ($p < 0.05$).

Two cases of TUR syndrome in the monopolar TURP group and none in the bipolar TURIS group was noted. One 70 years old patient during resection under spinal anesthesia due to extensive perioperative bleeding with drop of serum sodium of 15 mmol/l was seen (135 to 120 mmol/l). Second 75-year-old patient, due to intraoperative bleeding with drop in serum sodium of 20 mmol/l (142 to 122 mmol/l) was seen.

Discussion

In present times both medically and surgically efficient treatments are available to treat voiding difficulties due to BPH. Medical treatment is reserved for mild and moderate voiding symptoms. TURP is still the gold standard to treat moderate and severe bladder outlet obstruction surgically. Over the past few decades, new techniques and technologies have been developed, including bipolar resection, bipolar vaporization and laser treatment.

Endoscopic surgical procedures cannot be done without an irrigation fluid. The ideal irrigation fluid for monopolar TURs is a non-conducting medium that does not interfere with diathermy, has a high translucency and has an osmolality similar to that of serum with minimal side-effects when absorbed.

Monopolar TURP is usually performed with hypo-osmolar irrigating fluid such as glycine, sorbitol or mannitol. During the resection, large volumes are used in the bladder, a closed system. Variable amounts of fluid can be absorbed, either directly into vascular system through prostatic veins provoking a dilutional hyponatremia [7]. A small amount of fluid is normally absorbed in about 1–8% of patients [8–12]. This causes mild TUR syndrome [13–15]. Absorption of large amounts is a rare, that may lead to a severe condition requiring hospitalization [16].

A TUR syndrome is characterized by a dilutional hyponatremia (serum sodium < 125 mmol/l) with one or more circulatory and/or neurological symptoms. Such neurological symptoms include blurred vision, confusion, nausea, vomiting, uneasiness, tiredness, decreased consciousness and mild to severe headache. Circulatory symptoms are hypertension, bradycardia, chest pain, decreased urine output and hypotension.

Hahn et al. stated mannitol 3% to causes fewer symptoms than glycine 1.5% [15]. Inman et al. found no significant difference between 2.7% sorbitol–0.5% mannitol and glycine 1.5% [17]. The incidence of TUR syndrome has decreased significantly, from 7% to < 1%, during the past few decades [18].

Other methods to prevent fluid absorption are decreasing operation times, lowering position of the fluid bag and low-pressure irrigation. It is accepted that fluid absorption is more likely to happen with longer procedures and added with more operative bleeding [19]. Blandy stated that “Time alone is no more relevant to endoscopic than to any other kind of surgery, and if you can make a better job of the operation by taking 61 minutes, it is illogical to call a halt at 59” [20].

According to Madsen and Naber [21], not exceeding 60 cm as height of the fluid bag, except for a short time when there is excessive bleeding, may also help to prevent fluid absorption. Hahn and Ekengren [22] and van Renen et al. [23] failed to demonstrate a correlation between the height of the fluid bag and the risk of fluid absorption during TURP.

Another method is use of low-pressure irrigation is the use of a continuous-flow resectoscope [24]. Spinal anesthesia is not characterized by a reduced fluid absorption [25], but has the advantage that it allows earlier detection of changes in the mental status of the patient.

Bipolar resection uses a safer irrigation fluid which may offer effective protection against the TUR syndrome. Bipolar resection systems, Gyrus, Vista and TURIS Olympus, Karl Storz, were studied in randomized controlled trials. The use of NaCl 0.9% as irrigating fluid has particularly advantage. This solution can be given intravenously with minimal known side effects. The risk of developing symptoms of volume overload is present with saline 0.9% [26,27]. Grove et al. reported [28] that an isotonic distension fluid carries the risk of rapid absorption and pulmonary oedema, but with less chance of electrolyte imbalance. Most RCTs on bipolar technology do not reveal longer operation times (Table 4).

Table 4: Operation time in randomized controlled trials with bipolar technique.

Study	Monopolar Operative time (min)	Bipolar Operative time (min)	p
Yang et al. [35]	55	46	0.080
Tefekli et al. [32]	57.8	40.3	0.000
Singh et al. [31]	36.9	39.3	0.961
Seckiner et al. [37]	52.9	52.9	0.835
Akçayöz et al. [38]	44	45	0.852
Abascal Junquera et al. [39]	42.7	39.7	0.383
Patankar et al. [40]	57.8	49.9	0.013
Nuhoglu et al. [36]	52	55	0.337
Erturhan et al. [33]	57	36	0.000
Ho et al. [30]	58	59	0.769
Rose et al. [34]	35	55	0.005
Iori et al. [41]	31.7	39.1	0.437
Bhansali et al. [42]	NA	NA	NA
Autorino et al. [43]	53	49	0.070
Michielsen et al.	50.2	52.0	0.357

NA= Not Available

Tefekli et al. [32] and Erturhan et al. [33] reported statistically significant lower operation time with Gyrus. Only Rose et al. [34] and Michielsen et al. [29] reported a longer operation time with TURIS. In larger clinical study, no statistically significant difference in operation times was observed (p = 0.532).

Electrolyte changes are reported in all RCTs. Except for the study of Yang et al. [35], all other studies show a larger drop in sodium after monopolar resections with glycine 1.5% than with NaCl 0.9%.

The present study's demonstration of a statistically significant difference in the decrease of serum sodium between the two resection techniques was confirmed in three other studies [30, 31, 36]. More important is the non-occurrence of TUR syndrome after bipolar resection in all RCTs (Table 5).

Table 5: TUR syndrome in randomized controlled trials with bipolar technique

Study	Monopolar		Bipolar		p
	n	TUR-S	n	TUR-S	
Yang et al. [35]	59	1	58	0	1.000
Singh et al. [31]	30	0	30	0	1.000
Seckiner et al. [37]	24	2	24	0	0.489
Akçayöz et al. [38]	21	0	21	0	1.000
Patankar et al. [40]	51	2	52	0	0.243
Nuhoglu et al. [36]	30	0	27	0	1.000
de Sio et al. [44]	35	0	35	0	1.000
Erturhan et al. [33]	120	2	120	0	0.498
Ho et al. [30]	52	2	48	0	0.268
Iori et al. [42]	26	0	27	0	1.000
Bhansali et al. [42]	34	4	33	0	0.114
Michielsen et al.	265	2	285	0	0.232
Total	747	15	760	0	0.000

TUR-S = transurethral resection syndrome.

In 747 patients operated conventionally with the monopolar technique, 15 cases of TUR syndrome were reported (2%), which is better when compared with the < 1 to 3% reported by Rassweiler et al. [3]. In the bipolar study there were no cases after 760 resections. A limited and clinical acceptable decrease in serum sodium was also observed in the surgical interventions with TURIS lasting for more than 1hr.

Conclusions

In conclusion, bipolar TURP is a safe and efficient method for resolving bladder outlet obstruction using saline to dilate and irrigate the operation field significantly helps to reduce the risk of dilutional hyponatremia and TUR syndrome. Repeated postoperative serum analysis may be restricted to patients with notable clinical changes in their neurological, respiratory and/or circulatory parameters.

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