





# Outcomes of bipolar TURP compared to monopolar TURP: A comprehensive literature review

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**Cite this article as:** Sinha MM, Pietropaolo A, Hameed BMZ, Gauhar V, Somani BK. Outcomes of bipolar TURP compared to monopolar TURP: A comprehensive literature review. *Turk J Urol.* 2022; 48(1): 1-10

## ABSTRACT

**Objective:** Transurethral resection of the prostate (TURP) is the commonest surgical procedure for the treatment of benign prostatic obstruction (BPO). Bipolar-TURP (BTURP) is being increasingly used as compared to the long-established Monopolar TURP (MTURP). In this systematic review, we compared the outcomes of BTURP vs MTURP.

**Material and methods:** A systematic review was conducted using PubMed, EMBASE, Scopus, Google Scholar, and the Cochrane library using relevant search terms from inception of databases till June 2020. Using PRISMA methodology, 18 randomized control trials were reviewed comparing MTURP vs BTURP with a total of 8,393 patients.

**Results:** A significant drop in serum sodium was seen in four studies in MTURP vs BTURP and while there was zero incidence of TUR syndrome in BTURP group, there were 1-16 episodes of TUR syndrome across studies in the MTURP group. A significant fall in hematocrit was seen in three of nine studies with MTURP and one with a significant difference in blood transfusion rates. There were no significant differences in the incidence of clot retention across the studies with 1-5 cases in BTURP group vs 2-12 cases in MTURP group. There were no significant differences related to the duration of catheterization, operative time, resection volume, length of stay, quality of life, postoperative urethral stricture, and sexual function.

**Conclusion:** Although both BTURP and MTURP improve urinary symptoms, BTURP is associated with less risk of hyponatremia, TUR syndrome, and blood loss compared to MTURP. There seems to be no significant difference in length of stay, urethral stricture, quality of life, and operative duration.

**Keywords:** Bipolar; BPH; LUTS; MIST; TURis; TURP.

## Introduction

Benign prostatic hyperplasia (BPH) is a common condition witnessed in men with increasing age. The incidence of lower urinary tract symptoms secondary (LUTS) to BPH affects about 3% of men between 45 and 49 years of age rising to above 30% in men over 80 years of age as found by Speakman et al<sup>1</sup> LUTS is often defined by International Prostate Symptom Score (IPSS) filled out by patients, wherein a score of 0 to 7 indicates mild symptoms, 8 to 19 indicates moderate symptoms, and 20 to 35 indicates severe symptoms.

As we make advances in medicine to help improve longevity and quality of life, we anticipate encountering more men with advancing age with troublesome LUTS owing to BPH. Transurethral resection of prostate (TURP) was first introduced in 1930s as an endoscopic advancement to aid in surgical management as compared to the more invasive open prostatic adenectomy that was the historical surgical option for the management of BPH. As we all now know, TURP is considered the mainstay for surgical management of BPH. Depending upon patient wishes, medical therapy is often offered to patients in the form

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**Submitted:**  
08.09.2021

**Accepted:**  
17.11.2021

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**Table 1. A Brief Overview of Papers Included and Their Details.**

Authors	Year	Journal	Country	Level of Evidence	N MTURP/ BTURP
Yoon et al <sup>2</sup>	2006	Yonsei Medical Journal	Korea	3	53/49
Chee Kong et al <sup>3</sup>	2009	Annals of Saudi Medicine	Malaysia	2	51/51
Autorino et al <sup>4</sup>	2009	European Urology	Italy	2	35/35
Chen et al <sup>5</sup>	2010	British Journal of Urology International	China	2	50/50
Skolarikos et al <sup>6</sup>	2010	The Journal of Urology	Greece, Germany, Netherlands and Italy	1	32/30
Fagerstrom et al <sup>7</sup>	2011	Journal of Endourology	Sweden	2	185 total
Fagerstrom et al <sup>7</sup>	2011	Journal of Endourology	Sweden	2	185 total
Méndez-Probst et al <sup>8</sup>	2011	Canadian Urological Association Journal	Canada	2	21/22
Sugihara et al <sup>9</sup>	2012	J Endourol	Japan	4	5155/1,531
Mamoulakis et al <sup>10</sup>	2013	British Journal of Urology International	Greece, Germany, Netherlands and Italy	1	120/135
Mamoulakis et al <sup>11</sup>	2013	European Urology	Greece, Germany, Netherlands and Italy	1	120/135
Komura et al <sup>12</sup>	2014	Prostatic disease and Male Voiding Function	Japan	2	67/69
Stucki et al <sup>13</sup>	2015	The Journal of Urology	Switzerland	2	67/70
Yee et al <sup>14</sup>	2015	Asian Journal of Endoscopic Surgery	Hong Kong	1	84/84
Sarma Madduri et al <sup>15</sup>	2016	Urology Annals	India	3	145/21
Karadeniz et al <sup>16</sup>	2016	Springerplus	Turkey	3	50/50
Demirdag et al <sup>17</sup>	2016	Prostatic disease and Male Voiding Function, Volume 98	Turkey	2	45/36
El-Assmy et al <sup>18</sup>	2018	International Urology and Nephrology	Egypt	2	122/1,244

of 5-alpha reductase inhibitors to reduce disease burden and/or alpha-1 antagonists to help with symptomatic management. With time, the benefit offered becomes limited, as physiological progression and surgical intervention are often required.

Bipolar TURP (BTURP) was introduced as an alternative to Monopolar TURP (MTURP). In this systematic review, we want to compare the outcomes of BTURP compared to MTURP.

### Main Points

- Both MTURP and BTURP offer good clinical outcomes.
- MTURP has a greater incidence of hyponatremia and TUR syndrome.
- MTURP has a higher incidence of fall in hematocrit and blood transfusion.
- There is no significant difference between MTURP and BTURP regarding length of stay, urethral stricture, quality of life, and operative duration.
- Findings from this review suggest that BTURP should be adopted as the standard of care.

## Material and Methods

### Search Strategy

Our review database was inclusive of PubMed, EMBASE, Scopus, Google Scholar, and the Cochrane library. The search terms included: “BPH,” “BPO,” “LUTS,” “MIST,” “Monopolar vs Bipolar,” “TURP,” “Monopolar TURP,” “Bipolar TURP,” and “Prostate.” The identified studies were examined to find any further potential studies for inclusion. Only papers published in English language that compared outcomes of both BTURP and MTURP have been included in this review (Table 1). The search period was from the inception of

**Table 2. Demonstrates Individual Inclusion and Exclusion Criteria for Different Studies.**

Authors	Inclusion Criteria	Exclusion Criteria
Yoon et al <sup>2</sup>	Age <50 with BPH symptoms	Abnormal DRE, high PSA, neurogenic bladder, urethral stricture, bladder stone/tumor, history of prostatic surgery
Chee Kong et al <sup>3</sup>	Moderate to severe LUTs, complications of BOO, catheter dependency	ASA > III, pacemaker, prostate carcinoma, bladder stone, previous bladder surgery
Autorino et al <sup>4</sup>	Age > 50, good performance status, urine retention, IPSS ≥ 18, max flow ≤ 15 mL/s	prostatic volume < 30 cc, prostate carcinoma, neurogenic bladder, bladder stone/ diverticulum, urethral stricture, maximum bladder capacity > 500
Chen et al <sup>5</sup>	Failed medical therapy	Severe pulmonary disease, ethylene alcohol allergy, prostate carcinoma, bladder stone, neurogenic bladder, history of prostatic surgery, urethral stricture, coagulopathy.
Skolarikos et al <sup>6</sup>	Prostatic volume >80 cc, IPSS >19/35	NA
Fagerstrom et al <sup>7</sup>	TRUSS 30-100, symptomatic BPH with failed medical therapy, urine retention, history of TURP.	<30/>100 mL prostatic volume, prostatic/bladder cancer, core biopsy in last 3 months, neurogenic bladder, stricture.
Fagerstrom et al <sup>7</sup>	TRUSS 30-100, symptomatic BPH with failed medical therapy, urine retention, history of TURP	<30/>100 mL prostatic volume, prostatic/bladder cancer, core biopsy in last 3 months, neurogenic bladder, urethral stricture.
Méndez-Probst et al <sup>8</sup>	LUTS with BPH, peak flow <12 mL/s, AUA >12, acute retention	Previous prostatic surgery, urethral stricture, medical therapy ongoing, future fertility, neurogenic bladder, UTI, ASA > III, anticoagulants, patient factor
Sugihara et al <sup>9</sup>	NA	Retrospective data analysis, they included all the available records
Mamoulakis et al <sup>10</sup>	Prostatic size >80 cc, IPSS >19/35	NA
Mamoulakis et al <sup>11</sup>	Prostatic size >80 cc, IPSS >19/35	NA
Komura et al <sup>12</sup>	Symptomatic BPH with failed medical therapy, urine retention	Prostatic carcinoma, bladder stone, previous prostatic surgery, patient on 5 alpha-reductase.
Stucki et al <sup>13</sup>	LUTS with BPH, BPH with IPSS-QoL, PVR > 100 mL with failed medical therapy, failed TWOC	Neurogenic bladder, prostate carcinoma, prostate/urethral surgery, bleeding disorders.
Yee et al <sup>14</sup>	Failed medical therapy for LUTS, urine retention	Patient on anticoagulants.
Sarma Madduri et al <sup>15</sup>	Age < 45 with BOO due to BPH, Qmax 15 mL/s, prostate volume > 20 g on TRUSS, failed medical management, recurrent hematuria	Neurovesical dysfunction, bladder calculus, prostate carcinoma, prostatic/urethral surgery, urethral stricture
Karadeniz et al <sup>16</sup>	Age: 50-90, ASA-II and III	Severe heart disease, respiratory failure, electrolyte imbalance, neoplasia, gastro-intestinal upset, bleeding, patient refusal
Demirdag et al <sup>17</sup>	>60 mL prostatic on TRUSS, LUTS, post void residual >100 mL, failed medical management	Prostate carcinoma, bladder stone, neurogenic bladder, previous prostatic surgery, urethral stricture
El-Assmy et al <sup>18</sup>	>50 years age, sexually active with same partner	Indwelling catheter >1 month, re-intervention in 12 months

ASA, American Society of Anesthesia classification; BOO, bladder outflow obstruction; TRUSS, trans-rectal ultrasound; DRE, digital rectal examination; PSA, prostate-specific antigen; NA, not available; TWOC, trial without catheter; IPSS, International Prostate Symptom Score; UTI, urinary tract infection; AUA, American Urological Association.

databases till June 2020. The inclusion and exclusion criteria for the papers are included in Table 2.

#### *Inclusion criteria in studies*

- Age >50 years.
- Troublesome LUTS assessed by IPSS.

- Sexual dysfunction assessed by International Index of Erectile Function (IIEF).
- Failed medical therapy.

#### *Exclusion criteria in studies*

- Prostate or bladder cancer.
- Previous prostate or urethral surgery.

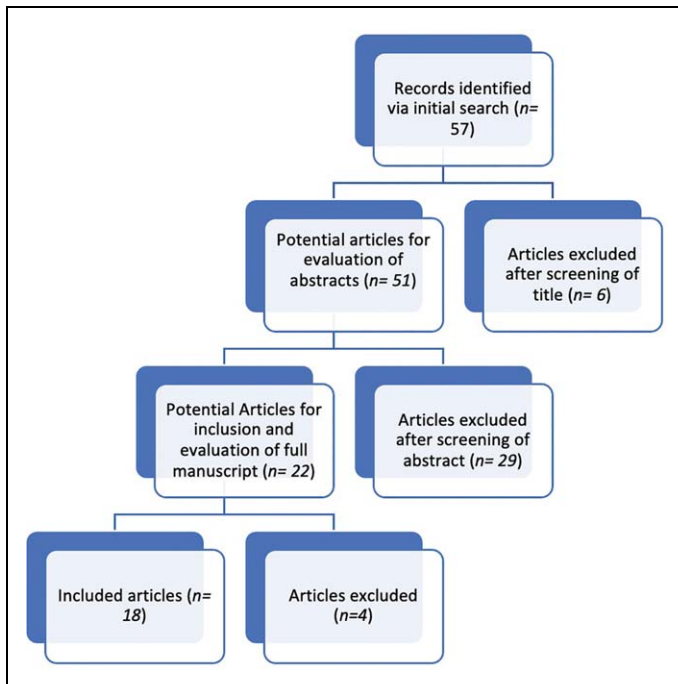


Figure 1. PRISMA flowchart of the included studies.

- Neurogenic bladder.
- Bladder stones.

In total, 18 papers were included<sup>2-18</sup> based on the selection criteria (Figure 1).

## Data Collection

Following variables were extrapolated from the 18 included studies. Author, year of publication, country of study, study type and randomized/nonrandomized trial as level of evidence, number of patients included, inclusion and exclusion criteria, and clinical outcomes with and without significance. The above were collected on Microsoft excel and the outcomes have been summarized in a narrative fashion. Table 1 includes all the included papers. As the data were heterogeneous with various studies comparing different outcomes, the outcomes have been represented in a narrative and tabular fashion.

## Results

A total of 18 were selected based on our inclusion criteria as per the PRISMA checklist. Of the 18 studies, 14 studies demonstrate an advantage of bipolar BTURP compared to MTURP. The following results pertain to our findings from the review.

### Comparison of Fluid Re-Absorption and Serum Sodium with Associated Transurethral Resection (TUR) Syndrome

The studies discussing fluid reabsorption and postoperative serum sodium levels also looked at evidence of TUR syndrome, which was increasingly rare (Figure 1, Table 3). The pathophysiology behind TUR syndrome is the absorption of irrigation fluid through peri-prostatic channels created intraoperatively during resection. This could be attributed to the surgeon's awareness, gland volume, and resection time.

Several studies have been performed to quantify and compare the significance of fluid reabsorption in association with serum sodium levels and the concurrent occurrence of TUR syndrome. Most of these studies have demonstrated a minimal incidence of TUR syndrome.<sup>2-18</sup> A significant drop in serum sodium was seen in four studies in MTURP arm compared to BTURP<sup>5,6,12,15</sup> while there was a zero incidence of TUR syndrome in the BTURP group, there were 1-16 episodes of TUR syndrome mentioned across studies in the MTURP group.<sup>6,8,9,13,14,17</sup>

Karadeniz et al<sup>16</sup> used mannitol in MTURP and 0.9% NaCl in BTURP, the favorable point toward normal saline is that it is a physiological fluid which may contribute to fewer cases of TUR syndrome. MTURP had statistically significant hyponatremia which was not found in BTURP. Two cases of MTURP had TUR syndrome with the lowest serum sodium of 111 and 119 mmol/L. Statistically significant serum sodium drop in MTURP did not always translate to statistically significant incidence of TUR syndrome as shown in the paper by Chee Kong et al<sup>3</sup> Sarma Madduri et al<sup>15</sup> commented that BTURP reduces TUR syndrome incidence by a relative risk of 0.17.

Fagerstrom et al<sup>7</sup> added ethanol in irrigation fluid for accuracy in measurement of re-absorption and this was assessed by routine intraoperative breath analysis. The procedures were terminated when uptake was detected in two and four patients in BTURP and MTURP, respectively. Three patients from MTURP arm developed TUR syndrome with symptoms of arterial pressure drop, abdominal pain, and headache. Chen et al<sup>5</sup> did not demonstrate any TUR syndrome despite a more pronounced fall in serum sodium in MTURP reflecting more fluid re-absorption. This was also noticed in Stucki et al<sup>13</sup> where 6 of 67 and 2 of 70 procedures of MTURP and BTURP, respectively, were terminated due to fluid uptake measured by breath analysis of ethanol. Demirdag et al<sup>17</sup> demonstrated a significant fall in serum sodium in MTURP, but not in BTURP, and two patients in MTURP arm went on to develop TUR syndrome, while none had it in the BTURP group.

**Table 3. Data From Papers Regarding the Incidence of TUR Syndrome (Serum Sodium Fall Postoperatively and Fluid Reabsorption as and Where Quantified).**

	Authors	TUR Syndrome n (%)	Sig	Mean Change in Sodium Level (SD)	Sig	Fluid Absorption, mL (SD)	Sig	Comment
MTURP	Yoon et al <sup>2</sup>	NA	NA	0.64 mEq/L (3.56)	NS	NA	NA	BTURP better but not significant
BTURP		NA		0.06 mEq/L (0.62)		NA		
MTURP	Chen et al <sup>5</sup>	NA	NA	3.4 mmol/L (1.4)	S	208 (344)	S	BTURP was Significantly better
BTURP		NA		6.3 mmol/L (2.9)		512 (706)		
MTURP	Skolarikos et al <sup>6</sup>	1 (3.1)	NS	4.2 mmol/L (7.5)	S	NA	NA	BTURP better but not significant
BTURP		0 (0)		0.7 mmol/L (2.9)		NA		
MTURP	Méndez-Probst et al <sup>8</sup>	0 (0)	NS	NA	NA	NA	NA	No difference in arms except for asymptomatic hyponatremia
BTURP		0 (0)		NA		NA		
MTURP	Sugihara et al <sup>9</sup>	16 (0.3)	NS	NA	NA	NA	NA	BTURP better but not significant
BTURP		0 (0)		NA		NA		
MTURP	Komura et al <sup>12</sup>	NA	NA	3.6 mmol/L	S	NA	NA	BTURP was Significantly better
BTURP		NA		0.5 mmol/L		NA		
MTURP	Stucki et al <sup>13</sup>	1 (1.4)	NA	NA	NA	NA	NA	BTURP better but not significant
BTURP		0 (0)		NA		NA		
MTURP	Yee et al <sup>14</sup>	2 (2.4)	NS	NA	NA	NA	NA	BTURP better but not significant
BTURP		0 (0)		NA		NA		
MTURP	Sarma Madduri et al <sup>15</sup>	3 (2.06)	NA	3.6 mEq/L (2.89)	S	NA	NA	BTURP was Significantly better
BTURP		0 (0)		0.99 mEq/L (0.76)		NA		
MTURP	Demirdag et al <sup>17</sup>	2 (4.4)	NS	NA	NA	NA	NA	BTURP better but not significant
BTURP		0 (0)		NA		NA		

n, total number; SD, standard deviation; Sig, significance; S, statistically significant; NS, statistically nonsignificant; NA, not available.

Komura et al<sup>12</sup> also showed lack of any TUR syndromes in both arms despite a significant fall in serum sodium in MTURP as compared to BTURP. Méndez-Probst et al<sup>8</sup> showed asymptomatic hyponatremia in 19% and 4.5% patients in MTURP and BTURP arm respectively, but this was not statistically significant.

### Fall in Hematocrit and Blood Transfusions

Hemorrhage is a known complication of TURP. The hypothesis behind BTURP causing less intra/postoperative hemorrhage is that it has a local “cut and seal” mechanism rather than the current passing through the patient’s body. This in turn should be reducing the need for blood transfusion. Studies analyzed these with the outcome pointing toward BTURP having a reduced need for blood transfusion as compared to MTURP (Figure 1).

Of the 11 studies, one<sup>7</sup> showed a significantly higher blood transfusion with MTURP.<sup>2,3,6-9,12-15,17</sup> A significant fall in

hematocrit was seen in three<sup>3,5,7</sup> of the nine studies with MTURP.<sup>2,3,5-8,12,14,15</sup> Although there were no significant differences in the incidence of clot retention across the two groups,<sup>5,12,13,17</sup> between 1-5 cases were recorded in BTURP group and between 2-12 cases were recorded in MTURP group across studies. Table 4 shows in a tabular manner the findings from all the papers.

Alexander et al<sup>19</sup> from their study suggest that there is a possibility of reduced need for blood transfusion with a risk ratio of 0.42, 95% confidence interval 0.30-0.59. Fagerstrom et al<sup>7</sup> found a statistically significant reduction in total blood loss with a *P* value of <.001 with mean blood loss of 855 mL and 472 mL in MTURP and BTURP, respectively. Yoon et al<sup>2</sup> found that 3.8% and 2% patients of MTURP and BTURP, respectively, needed re-surgery due to ongoing hemorrhage, but statistical significance was not available for this.

**Table 4. Data From Papers Regarding the Need for Blood Transfusion, Drop in Hemoglobin (Hb) and Postoperative Clot Retention.**

	Authors	Blood Transfusion, n (%)	Sig	Mean Fall in Hb (SD)	Sig	Postop Clot Retention, n (%)	Sig	Comment
MTURP	Yoon et al <sup>2</sup>	1 (1.9)	NS	0.62 g/dL (0.78)	NS	NA	NA	BTURP better but not significant
BTURP		0 (0)		0.67 g/dL (0.62)		NA		
MTURP	Chee Kong et al <sup>3</sup>	2 (3.9)	NA	1.8 g/dL (1.41)	S	NA	NA	BTURP was Significantly better
BTURP		0 (0)		0.6 g/dL (1.48)		NA		
MTURP	Chen et al <sup>5</sup>	NA	NA	1.1 g/dL (0.6)	S	NA	NA	BTURP was Significantly better
BTURP		NA		1.6 g/dL (0.7)		NA		
MTURP	Skolarikos et al <sup>6</sup>	2 (6.3)	NS	1.1 mmol/L (0.9)	NS	2 (6.3)	NA	No significance or obvious disparity
BTURP		4 (13.4)		0.9 mmol/L (0.7)		3 (10.0)		
MTURP	Fagerstrom et al <sup>7</sup>	10 (11)	S	9.59 g/dL (16.88-5.51)*	S	NA	NA	BTURP was significantly better for total blood loss, mentioned in text
BTURP		4 (4)		5.54 g/dL (9.91-2.43)*		NA		
MTURP	Méndez-Probst et al <sup>8</sup>	0 (0)	NA	9.10	NS	NA	NA	More loss in BTURP than MTURP, but not significant
BTURP		0 (0)		12.57		NA		
MTURP	Sugihara et al <sup>9</sup>	118 (2.2)	NA	NA	NA	NA	NA	BTURP better but significance NA
BTURP		20 (1.3)		NA		NA		
MTURP	Komura et al <sup>12</sup>	4 (7.0)	NS	1.5 g/dL (1.1)	NS	7 (11.3)	NS	BTURP better but not significant
BTURP		1 (1.6)		1.5 g/dL (1.0)		1 (1.6)		
MTURP	Stucki et al <sup>13</sup>	1.5 %	NS	NA	NA	13.4%	NS	BTURP better but not significant
BTURP		1.4%		NA		5.7%		
MTURP	Yee et al <sup>14</sup>	1 (1.2)	NS	0.78 g/dL (0.99)	NS	NA	NA	BTURP better but not significant
BTURP		0 (0)		0.61 g/dL (0.72)		NA		
MTURP	Sarma Madduri et al <sup>15</sup>	10 (6.89)	NS	1.57 g/dL (0.71)	NS	NA	NA	BTURP better but not significant
BTURP		2 (9.5)		1.75 g/dL (0.77)		NA		
MTURP	Demirdag et al <sup>17</sup>	8 (17.8)	NS	NA	NA	12 (26.6)	NS	BTURP better but not significant
BTURP		4 (14.8)		NA		5 (13.9)		

n, number of incidents; NA, not available; Sig, significance; S, statistically significant; NS, statistically not significant.

\*Findings in median and within brackets represent range.

### Indwelling Catheter Duration, Length of Stay (LOS), and Cost Effectiveness

The catheter time in essence implicates a prolonged length of stay (LOS) in hospital if requiring irrigation or TURP associated morbidity. However, globally LOS is very dependent on insurance policies and healthcare terms.

Sugihara et al<sup>9</sup> on a retrospective analysis found a longer LOS associated with indwelling catheter as the health insurance included hospital stay, and in 2007, Okamura et al<sup>20</sup> docu-

mented that Japanese patients preferred being inpatients while having an indwelling catheter. And they acknowledged this as a bias in their paper. Their mean costs of MTURP was \$6,103 (SD 2,100) vs \$6,062 (SD 2,020) ( $P = .48$ ), therefore rendering it insignificant.

Skolarikos et al<sup>6</sup> found the two patients with failed TWOC (trial without catheter) required re-intervention in the form of re-TURP or Intermittent self catheterisation (ISC) (as per patient preference). But whether these patients were from

MTURP arm or BTURP arm was not specified. Komura et al<sup>12</sup> found a statistically significant reduction in indwelling catheter duration in BTURP arm as compared to MTURP with 20.6 hours (SD 8.8) vs 35.8 hours (SD 54.6) ( $P = .042$ ), with a significant reduction in length of stay (3.4 days vs 2.4 days,  $P = .045$ ). Yee et al<sup>14</sup> compared LOS against age, prostate volume, preoperative foley catheter, and surgical intervention, and only the surgical group had significance with an odds ratio of 3.13 with a confidence interval of 95% and  $P = .002$ . These three studies<sup>6,12,14</sup> found a statistically significant shorter LOS for BTURP patients as compared to MTURP patients. Méndez-Probst et al<sup>8</sup> found that seven patients from the BTURP arm were discharged on the same date of surgery as compared to three in MTURP arm, but this was not statistically significant.

It is difficult to comment on the global cost-effectiveness of the two technologies due to differing health services in different countries as is acknowledged above.

#### Urethral Strictures and Bladder Neck Stenosis

Tefekli et al<sup>21</sup> suggested the possibility of BTURP causing higher stricture incidence in comparison to MTURP, but this was not supported in the current review. Hueber et al<sup>22</sup> compared the outcomes in 43 men 6 months postoperatively and stated that they did not find any significant difference between the two groups. Mamoulakis et al<sup>11</sup> found that 12 of 121 patients (9.9%) from MTURP arm vs 20 of 135 (14.8%) from BTURP required re-intervention ( $P = .32$ ) in short-term follow-up. Of the nine papers that mention postoperative urethral stricture and bladder neck stenosis (BNS), only one<sup>13</sup> had a significant rise in urethral structure in BTURP group ( $P = .002$ ).

#### IPSS score and QoL (Quality of Life) Assessment

The effect of BPH is measured via IPSS score which the patients fill out along with a QoL assessment. These help guide the clinicians toward the need for intervention and assess postoperative quality of intervention. Eight studies focused on the IPSS, Qmax, Uroflow, and PVR outcomes post TURP surgery and compared the findings between MTURP and BTURP. This differed between 3-6 weeks, 3, 6, 12, 24, 36, and 48 months in various studies.

Of the studies included, there was only some significant difference in early IPSS scores, Qmax, Uroflow, and PVR lasting 3-6 weeks, but this was not statistically significant according to Skolarikos et al<sup>6</sup> Beyond this, there was not any significance in difference of improvement in symptoms for patients in both arms. Fagerstrom et al<sup>7</sup> showed that recovery occurred quicker in BTURP as compared to MTURP when compared at

3 and 6 weeks, ( $P < .05$ ). But at 18 months, they canceled each other out and the outcomes were equivocal. Stucki et al<sup>13</sup> mention no significant difference in IPSS score improvement in MTURP and BTURP arms with both arms showing individual improvement in IPSS scores on a follow-up at 3 and 12 months. The longest follow-up was at 48 months in Autorino et al<sup>4</sup> but this showed no difference in improvement, and therefore, there does not seem to be the need for longer follow-up to assess the difference in improvement between the two available options.

#### Sexual Function Improvement Postop

Sexual function is often quantified by IIEF-15 score which contains five domains (with scores ranging from 0-30). This includes Erectile Function (EF) (1-30), Orgasmic Function (OF) (0-10), Sexual Desire (SD)(2-10), Intercourse satisfaction (IS) (0-15), and Overall satisfaction (OS) (2-10). We only found three studies that compared the sexual function using IIEF scores in patients.

El-Assmy et al<sup>18</sup> (from Egypt) used the Ejaculatory domain of Male Sexual-Health questionnaire Ej-MSQH instead to quantify the same which includes seven questions (Ejaculatory frequency, Latency, Volume, Force, Pain, Pleasure, and Dry ejaculate). They did not find any significant difference in improvement in sexual function when compared between the two arms. Demirdag et al<sup>17</sup> found a significant improvement at 6 months using IIEF score, but no comments have been made about FU thereafter. Mamoulakis et al<sup>10</sup> also used IIEF to assess postoperative improvement in sexual function at 12 months and found no statistical difference in improvement between the two arms.

#### Operative Time and Resection Volume

The operative time was found to be longer in BTURP as compared to MTURP. This can be attributed to the smaller loop caliber of the BTURP device. Four out of the 14<sup>9,12,14,15</sup> studies found that BTURP takes a longer operative duration as compared to MTURP. But this did not reflect in postoperative morbidity in any observable form. No significant benefit in resection volume even with the increased operative duration was found when BTURP was compared against MTURP. Twelve studies compared this and found no significant difference.

#### Other Complications

Fagerstrom et al<sup>7</sup> demonstrated a significance in re-admission after MTURP as compared to BTURP with 14 vs 5 with a  $P$  value of  $<.001$ , but no other significant findings to support

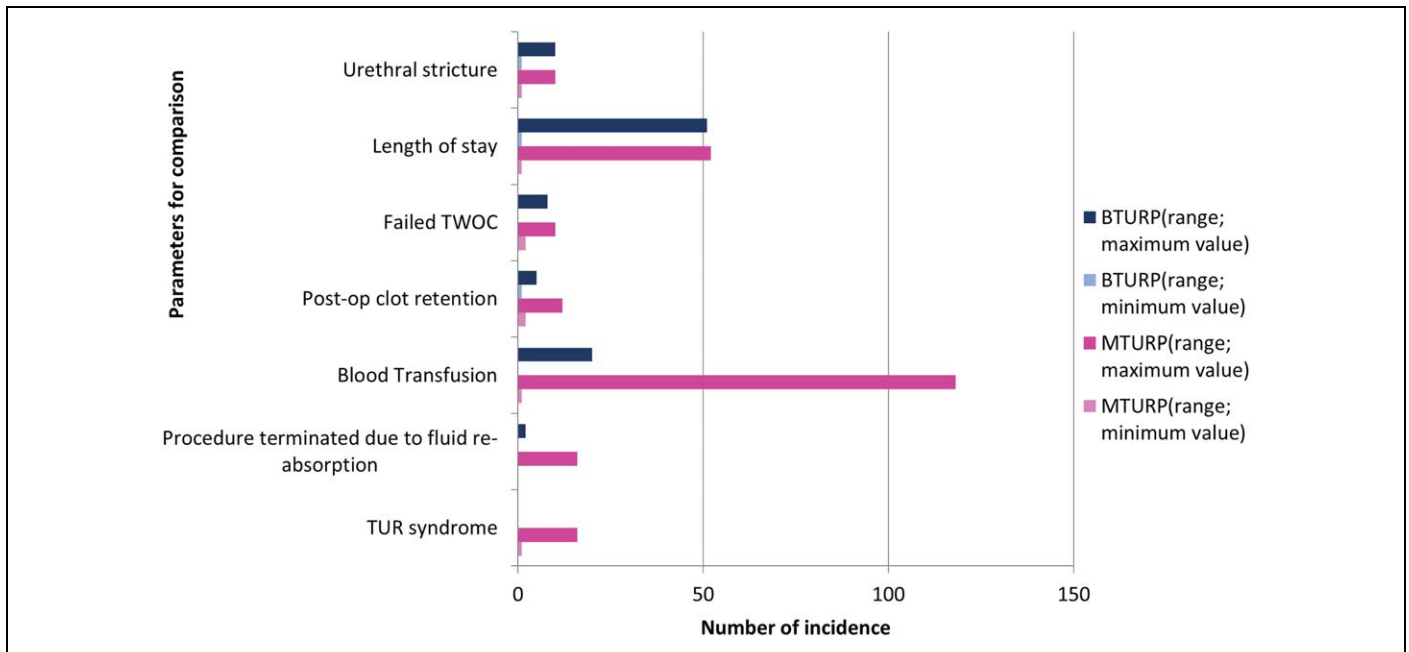


Figure 2. Comparison between number of incidence between different parameters as found in studies included for BTURP vs MTURP.

BTURP over MTURP were found. No difference in capsular perforation was seen.<sup>6,11,16</sup>

## Discussion

We found that BTURP has significantly less reduction in serum sodium postoperatively when compared to MTURP. Various theories have been postulated for this, one of which is that 0.9% Sodium Chloride is a physiological fluid and therefore causes less tissue toxicity and also helps with replacing any fluid losses as stated by El-Assmy et al<sup>18</sup> Also, the “cut and seal” mechanism offered by BTURP which leads to non-passage of current through patient’s body and rather through the loop could cause lesser interaction between irrigating fluid and the microvascular channels created intraoperatively. This could also be attributed to a wider knowledge of TUR syndrome and therefore surgeons being more aware of time restrictions for MTURP.

We also did not find a significant drop in Hematocrit post BTURP, which could also possibly be attributed to the cut and seal mechanism as it helps coagulate while resecting. The concomitant vaporization and hemostasis are also postulated to help improve intraoperative vision as stated by Ene et al<sup>23</sup>

There have been concerns about BTURP causing more thermal injury and therefore causing a higher risk of urethral strictures.

Abdelwahab et al<sup>24</sup> found an incidence of 11% in their randomized prospective trial with BTURP. Méndez-Probst et al<sup>8</sup> compared tissue with thermal injury and classified it as degree of thermal artifact in resected tissue as: grade I: 0% injury, grade II: <25% injury, grade III: 25%-50% injury, grade IV: 50%-75% injury, and grade V: >75%. They compared BTURP with MTURP in a randomized prospective trial and found no significant difference in thermal injury in both the arms. We did not find any significant increase in urethral strictures or bladder neck injury between the two arms in our review.

Komura et al<sup>12</sup> used only one surgeon for all their cases to remove surgeon bias and found an increase in operative time with BTURP, but this again did not translate into any significant drop in hemoglobin, serum sodium levels, or need for peri-operative transfusions. Although our study found an increase in operative time with BTRUP as compared to MTURP, it did not reflect in any of the postoperative outcomes and so the increased time did not make a difference in the post-operative outcome.

BTURP offers certain advantages when compared to MTURP with regard to drop in serum sodium and fall in hematocrit, although it did not always translate to a difference in clinical outcomes. It seems that perhaps more needs to be done to assess the cost-effectiveness, reimbursement, and quality of life considering it is different across various parts of the world.



Although the paper includes randomized control trials comparing both BTURP And MTURP, there are certain limitations of the paper. A formal risk of bias assessment was not carried out and some papers had a certain aspect of outcomes missing with a degree of heterogeneity of the included study endpoints. There is global variation regarding length of stay, reimbursements, and personal practices with regard to the duration of indwelling catheter which have not been looked at in the paper. As with any comparative study on technology assessment, there will also be an inherent publication bias which has not been appraised in the paper. The heterogeneity of the included study endpoints

In conclusion, both BTURP and MTURP improve urinary symptoms, although BTURP is associated with less risk of hyponatremia, TUR syndrome, and blood loss compared to MTURP, Figure 2 gives a summary of these findings. There does not seem to be any significant difference in length of stay, urethral stricture, quality of life, and operative duration between these two procedures.

**Ethics Committee Approval:** N/A

**Informed Consent:** N/A

**Peer-review:** This manuscript was prepared by the invitation of the Editorial Board and its scientific evaluation was carried out by the Editorial Board.

**Author Contributions:** Concept - M.M.S.; Design - M.M.S.; Supervision - B.K.S.; Data Collection and/or Processing - M.M.S., A.P.; Analysis and/or Interpretation - M.M.S.; Literature Search - M.M.S., A.P.; Writing Manuscript - M.M.S., B.K.S.; Critical Review - B.M.Z.H., V.G.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

**Financial Disclosure:** The authors declared that this study has received no financial support.

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