



# Pattern of Complications and Their Predictors Following Transurethral Resection of the Prostate Using the Modified Clavien Classification System

Mohammad Manirul Islam<sup>1</sup>, Md Golam Mowla Chowdhury<sup>2</sup>, Md Faisal Islam<sup>3</sup>, Sarforaj Ali Khan<sup>4</sup>, Hamudur Rahman<sup>5</sup>, Ashraf Rahman<sup>6</sup>

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## Abstract

**Background:** Benign prostatic enlargement (BPE) is a common problem of ageing male, and its surgical management constitutes significantly to the urological workload. Although transurethral resection of the prostate (TURP) is the gold standard surgical treatment for BPE, it is not without complications. Previously, there was no consensus on how to define complications. This made the comparison of different reported series unreliable and has highlighted the fact that standardized methods in reporting data on surgical complications or morbidity are needed. In 1992, Clavien and his colleagues presented guidelines on the classification of complications of surgery on the basis of severity grading. In 2004, it was modified by Dindo, Demartines and Clavien to increase the accuracy and applicability of the CCS. Although modified Clavien classification system (MCCS) was proposed to grade complications of general surgery, its application in other branches of surgery as well as urology has been initiated recently.

**Objective:** This prospective observational study was designed to observe the pattern of complications and their predictors following TURP using the modified Clavien classification system.

**Method:** One hundred and fifteen patients with benign prostatic hyperplasia submitted to monopolar TURP from April 2016 to March 2017 in department of urology, BSMMU, were evaluated for complications occurring up to the end of the first postoperative month. All complications were classified according to the modified CCS. If multiple complications per patient occurred, categorization was done in more than one grade. Negative outcomes such as mild dysuria during this early postoperative period or retrograde ejaculation were considered sequelae and were not recorded as complications.

**Result:** Overall complication rate was 22.6%. In this study more than half (60.6%) of the complications were grade I (20 out of 33 complications). Grade II complications were 33.33 % (11 out of 33 complications), Higher grade complications were scarce, both grade IIIa and IVa complications were 3.03% (1 complications for each grade out of 33 complications). There was no grade V complication in this study.

**Conclusion:** Higher prostate volume, lower preoperative hemoglobin level, higher resected volume and longer resection time were the predictors of post-operative complications following TURP.

**Keywords:** MCCS, Complications, TURP.

1. Assistant Registrar of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh
  2. Professor of Urology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh
  3. Professor of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh
  4. Associate Professor of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh
  5. Assistant Professor of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh
  6. Assistant Registrar of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh
- Correspondences:** Dr. Mohammad Manirul Islam, Assistant Registrar of Urology, National Institute of Kidney Disease and Urology (NIKDU), Dhaka, Bangladesh, Email: [manirulssmc280@gmail.com](mailto:manirulssmc280@gmail.com)

## Introduction

Benign prostatic enlargement (BPE) is a common problem of ageing male, and its surgical management constitutes significantly to the urological workload. Although transurethral resection of the prostate (TURP) is the gold standard surgical treatment for BPE, it is not without complications like hematuria, fever, catheter blockage, urinary retention following catheter removal, urinary incontinence, urinary tract infection, bladder perforation, urosepsis, transurethral resection syndrome etc.<sup>1</sup>. A recent multi-center study<sup>2</sup> has shown an overall complication rate of 11.1 %, while complication rates as high as 40 % have also been reported<sup>3</sup>.

Previously, there was no consensus on how to define complications and stratify them by severity. Due to this, a dilemma occurred to inform patient about the complications and outcome of the procedure. Complications associated with TURP have been frequently classified as minor or major based on different definitions. This has made the comparison of different reported series unreliable and has highlighted the fact that standardized methods in reporting data on surgical complications or morbidity are needed<sup>4</sup>.

In 1992, Clavien and his colleagues presented guidelines on the classification of complications of surgery on the basis of severity grading with examples of utility in cholecystectomy. This classification method made possible mutual comparisons between dissimilar surgeries<sup>5</sup>. In 2004, Dindo, Demartines and Clavien modified the original criteria to increase the accuracy and applicability of the CCS. They also performed largescale research and the objectivity of the modified Clavien classification system (MCCS) was verified. Currently, the effectiveness of the MCCS is broadly recognized, and the system is adapted for use in various surgery evaluations beyond hepatobiliary surgery.

Its application in the area of urology has been initiated recently, including for robot assisted radical prostatectomy<sup>6</sup>, radical cystourethrectomy<sup>7</sup>, percutaneous nephrolithotomy[8], and laparoscopic pyeloplasty<sup>9</sup>. Few studies from tertiary care centers have evaluated the clinical outcomes of TURP using the MCCS with complication rates ranging between 15.7 and 20%<sup>1,10</sup>. There is no such study using modified

Clavien classification to evaluate the outcome of TURP in Bangladesh.

The aim of the study was to prospectively observe the pattern of complications and their predictors following standard monopolar TURP according to the MCCS which will help to inform patients preoperatively about complications and outcome of the procedure.

## Method:

This was a prospective observational study carried out in the Department of Urology Bangabandhu Sheikh Mujib Medical University Dhaka from April 2016 to March 2017. One hundred and seventeen patients with BPE admitted during the study period and underwent monopolar TURP in the Department of Urology, Bangabandhu Shiekh Mujib Medical University, Dhaka was included in the study. Patients with suspected prostate cancer, neurogenic bladder, active urinary infection, previous prostate surgery, cardiac, respiratory & renal comorbidity, coagulopathy and BMI  $\geq 30$  were excluded from the study. Serum hemoglobin and sodium levels were measured one day before the operation. Standard Monopolar TURP was done. Any complication(s) during the procedure – bleeding, TUR syndrome and blood transfusion was noted. After operation patient was sent to recovery room and immediately blood sample was collected to estimate serum electrolyte (sodium) and another sample at 6 hours of operation for estimation of serum hemoglobin. Postoperative complications- hemoglobin drop, hyponatremia, any clot retention, were noted. Catheter was removed on the third postoperative day based on the study protocol or 24 hours after visually clear urine and duration of catheterization was noted. After removal of catheter, subject was discharged after ensuring that the patient was able to void normally and duration of hospital stay was recorded. Patients was advised to follow up after one month or earlier if he noticed any deviation from normal. At follow up history, physical examination and investigation was done according to the symptoms (if needed). Basic preoperative patient data was recorded, and all complications occurring up to the end of the first month after the operation was classified prospectively according to the Modified Clavien Classification System (Table 1). In case of more than one complication in the same patient, categorization was done in more than one grade. Results were presented as complication rates per grade.

**Table 1:** Classification of surgical complications according to the modified Clavien classification system.

<b>Grade I</b>	Any deviation from the normal post-operative course without the need for pharmacologic treatment or surgical, endoscopic and radiologic interventions. Allowed therapeutic regimens are drugs as antiemetics, antipyretics, analgesics, diuretics, electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside
<b>Grade II</b>	Complications requiring pharmacologic treatment with drugs other than such allowed for grade 1 complications. Blood transfusions and total parenteral nutrition are also included
<b>Grade III</b>	Complications requiring surgical, endoscopic or radiologic intervention • Grade IIIa: Intervention not under general anesthesia • Grade IIIb: Intervention under general anesthesia
<b>Grade IV</b>	Life-threatening complications (including central nervous system complications) requiring intensive care unit stay • Grade IVa: Single organ dysfunction (including dialysis) • Grade IVb: Multi-organ dysfunction
<b>Grade V</b>	Death of the patient.
<b>Suffix "d"</b>	If the patient suffers from a complication at the time of discharge, the suffix "d" (for disability) is added to the respective grade of complication. This label indicates the need for a follow-up to fully evaluate the complication

## Results:

**Table II:** Baseline characteristics of patients with BPE submitted for TURP (n =115)

Demography variable	Mean±SD
Age (in years)	65.5±9.3
BMI (kg/m <sup>2</sup> )	22.1±1.9
PSA (ng/ml)	3.3±2.0
Prostate volume (cc)	57.2±13.5
IPSS	25.0±2.9
Qmax (ml/min)	10.2±1.9
PVR (ml)	86.3±66.8
Preoperative Hb (gm/dl)	12.1±1.3
Postoperative Hb (gm/dl)	11.0±1.2
Preoperative Na <sup>+</sup> (mmol/l)	137.8±2.03
Postoperative Na <sup>+</sup> (mmol/l)	136.1±1.4
Resected volume (gm)	27.1±7.0
Resection time (min)	50.0±14.8
Hospital stay (day)	4.5±1.3

BPE- Benign prostatic enlargement, TURP- transurethral resection of the prostate, BMI- body mass index, PSA- prostate specific antigen, IPSS- international prostate symptoms score, PVR- post voidal residue, SD- standard deviation.

In this study, mean age of the patient was 65.3±8.3 years, mean BMI was 22.1±1.9 kg/m<sup>2</sup>, mean PSA was 3.2±1.9 ng/ml, mean prostate volume was 57.2±13.5 cc, mean IPSS was 25.0±2.9, mean Qmax was 10.2±1.9 ml/min, mean PVR was 80.3±60.7 ml, mean of preoperative hemoglobin was 12.1±1.3 gm/dl, mean preoperative serum sodium was 137.8±2.03 mmol/l. Total number of patients presented with a catheter in situ preoperatively was 42 (36.5%).

A total of 20 complications was classified as Grade I. Among them transient hematuria occurred in 6 cases, clot retention in 4 cases. Transient incontinence, fever and failed voiding trial was found in 3 cases each. Catheter block by prostatic chips was found in 1 case. A total of 11 complications were classified as grade II. Among them blood transfusion and urinary tract infection were found in 9 and 2 cases respectively. 1 patient needed clot evacuation under anesthesia, a grade IIIa complication. Grade IVa complication was found in 1 case in which patient was shifted to ICU for management of disseminated intravascular coagulation. Management for all the complications are depicted in the table III.

**Table III** *Complication in the present series classified according to MCCS:*

Grade	Complication	Management
<b>I</b>	Hematuria (n=6)±blood clot retention (n=4)	Bedside bladder irrigation Prolonged)± clot evacuation±catheter traction
	Incontinence (n=3)	Perineal exercise and observation
	Fever (n=3)	Antipyretic
	Catheter block by prostatic chip block (n=1)	Bedside catheter change
	Acute urinary retention after catheter removal (n=2)	Bedside recatheterization
	Transient elevation of serum creatinine (n=1)	Watchful regulation of fluid balance
<b>II</b>	Hematuria (n=9)	Transfusion
	Urinary tract infection (n=2)	Antibiotics
<b>IIIa</b>	Blood clot within urinary bladder (n=1)	Clot evacuation under anesthesia
<b>IVa</b>	Disseminated Intravascular Coagulation (n=1)	Admission to intensive care unit

MCCS- Modified Clavien Classification System.

In this study, the mean preoperative Hb was 11.8±1.36 gm/dl in patients with complications and 12.24±1.32 gm/dl in patients without complications. Mean postoperative Hb was 10.3±1.55 gm/dl in patients with complications and 11.23±1.02 gm/dl in patients without complications. The postoperative Hb was significantly lower in patients with complications ( $p<0.001$ )

**Table IV:** Comparison of serum hemoglobin of the study patients (n=115)

Hb gm/dl	Group-I (n=26) Mean±SD	Group-II (n=89) Mean±SD	P value
Preoperative Hb gm/dl	11.8±1.36	12.24±1.32	0.140ns
Range (min, max)	10.1-14.4	10-15.6	
Postoperative Hb gm/dl	10.3±1.55	11.23±1.02	0.001s
Range (min, max)	7.3-12.8	10-13.8	

s= significant, ns= not significant, p value reached from unpaired t-test

The mean preoperative Na was 137.4±1.6 mmol/l in patients with complications and 137.9±2.13 mmol/l in patients without complications. Mean postoperative Na was 136±1.37 mmol/l in patients with complications and 136.1±1.4 mmol/l in patients without complications. The difference was statistically not significant ( $p>0.05$ ) between two groups.

**Table V:** Comparison of Serum Sodium of the study patients (n=115)

Na+ mmol/l	Group-I (n=26) Mean±SD	Group-II (n=89) Mean±SD	P value
Preoperative Na mmol/l	137.4±1.6	137.9±2.13	0.268ns
Range (min, max)	135-141	135-145	
Postoperative Na mmol/l	136±1.37	136.1±1.4	0.681ns
Range (min, max)	135-140	135-143	

ns= not significant, p value reached from unpaired t-test

Table VI shows comparison of prostate volume, PVR, resected volume and resection time of the study patients. Mean prostate volume, mean PVR, mean resected volume and mean resection time was higher in patients with complications than that of patients without complications. Among them mean prostate volume, mean resected volume and mean resection time was significantly higher in patients with complications (P value <0.001).

Table VII shows multivariate logistic regression analysis of possible predictors for occurrence of grade I complication. Prostate volume had a 0.476 (95% CI 0.295 to 0.767%) times increase risk to develop grade I complication. Preoperative hemoglobin level had a

3.298 (95% CI 1.096 to 9.927%) times increase risk to develop grade I complications. Resection time had a 2.034 (95% CI 1.325 to 3.123%) times increase risk to develop grade I complications. But other factors not significantly associated with grade I complication in multivariate logistic regression analysis.

Table VIII shows multivariate logistic regression analysis of possible predictors for occurrence of grade II complications. Preoperative hemoglobin level had a 0.091 (95% CI 0.014% to 0.607%) times increase risk to develop grade II complications. But other factors not significantly associated with grade II complication in multivariate logistic regression analysis.

**Table VI:** Comparison of prostate volume, PVR, Resected volume and Resection time of the study patients (n=115)

BPH	Patients with Complications (n=26) Mean±SD	Patients without complications (n=89) Mean±SD	P value
Prostate volume (cc)	65.23±13.76	54.87±12.59	0.0015 <sup>s</sup>
Range (min, max)	40-80	40-80	
PVR(ml)	110.0±49.1	93.8±57.5	0.361 <sup>ns</sup>
Range (min, max)	10-190	0-180	
Resected volume (gm)	32.62±6.75	25.45±6.28	0.0015 <sup>s</sup>
Range (min, max)	20-41	17-40	
Resection time(min)	66.5±13.2	45.15±11.46	0.0015 <sup>s</sup>
Range (min, max)	43-82	30-74	

**Table VII:** Multivariate logistic regression analysis of possible predictors for occurrence of grade I complications (n=115)

Variables	OR	S.E	p value	95% CI for OR	
				Lower	Upper
Prostate volume	0.476	0.244	0.002 s	0.295	0.767
Pre Op Hb	3.298	0.562	0.034 s	1.096	9.927
Resect time	2.034	0.219	0.001 s	1.325	3.123

s- Statistically significant, OR- odds ratio, SE- standard error, CI- confidence interval

**Table VIII:** Multivariate logistic regression analysis of possible predictors for occurrence of grade II complications (n=115)

Variables	OR	S.E	p value	95% CI for OR	
				Lower	Upper
Prostate volume	0.101	0.101	0.066ns	0.988	1.469
PrOp Hb	0.091	0.97	0.013s	0.014	0.607

s- Statistically significant, ns- Statistically not significant, OR- Odds ratio, SE- Standard error, CI- Confidence interval



## Discussion

This prospective observational study was conducted to observe the pattern of complications and their predictors following TURP using the modified Clavien classification system. TURP is considered as gold standard treatment for BPE. In spite of high success rate, it is not without complications like hematuria, urinary tract infection, acute myocardial infarction, transurethral resection syndrome and mortality<sup>1</sup>.

The lack of a uniform way of reporting negative surgical outcomes has been recognized as an obstacle in interpreting the related literature. The absence of a standardized system for reporting a surgeon's post-operative complications can also impede the patient's ability to give informed consent. The modified CCS has been proposed as a standard tool to report complications, which should be used accordingly to increase the quality of the related urological literature.<sup>11</sup>

The urological community has only recently started to adopt the system for grading complications of oncologic procedures such as radical prostatectomy<sup>12</sup>, cystectomy<sup>13</sup>, and renal surgery<sup>14</sup>. However, its use in non-oncologic procedures including TURP remains still limited and to the best of our knowledge there is no such study in Bangladesh.

In this study male patients of age 50 years or more with symptomatic benign enlargement of prostate requiring surgery with prostate size between 40 to 80 grams were selected. A total of 117 patients underwent TURP in the department of urology, BSMMU were included in the study according to inclusion and exclusion criteria. Two patients were excluded from the study, one for postoperative diagnosis of Carcinoma prostate from histopathology of prostatic chips, another patient requiring reoperation for residual adenoma (treatment failure).

In the present study, all the procedures were performed by professors, Department of Urology, BSMMU and complications were prospectively recorded up to the first postoperative month. Data from 115 patients were analyzed for baseline variable as age, BMI, Serum PSA, prostate volume, IPSS, Q-max, hemoglobin level of blood, serum sodium level, resected volume, resection time and hospital stay. Perioperative complications like hematuria, clot retention, transient incontinence, failed voiding trial, urinary tract infection and DIC was graded according to MCCS.

In this study, age of the patients ranged from 50 years to 85 years. The mean age of patients was  $65.3 \pm 8.3$  years which was similar with the study done by Nunzio et al.<sup>13</sup>; Runqui et al.<sup>16</sup> and Mamoulakis et al.<sup>10</sup>

Mean prostatic volume was  $57.2 \pm 13.5$  cc in this study which was equal to the study done by Nunzio<sup>13</sup> et al. (2013) but higher than study done by Mamoulakis et al. [10] where mean prostatic volume was 54cc (range 40-70cc).

A total of 33 complications in 26 out of 115 patients were found up to the first postoperative month. Thus, overall complication rate was 22.6%. It is higher than the reported rate of 11% in Runqui et al.,<sup>16</sup> 15.5% in Nunzio et al.,<sup>13</sup> 15.7% in Mamoulakis et al.,<sup>10</sup> 17.3% in Kwon et al.,<sup>17</sup> and 17.6% in Choi et al.,<sup>18</sup> This complication rate was almost equal to the study done by Mandal et al.,<sup>1</sup> (20%). The reason behind this higher complication rate may be multiple surgeons performed those 115 TURP in the present study. In this study mean preoperative hemoglobin concentration was  $12.1 \pm 1.3$  gm/dl and that of other study was higher  $14.2 \pm 1.5$  gm/dl<sup>15</sup> which might have caused this higher rate of complications by increasing need for post-operative blood transfusion.

20 of the complications (60.6%) were classified as grade I out of 33 complications in this study. This rate was almost equal to the reported rate of 59.1% in Mamoulakis et al.<sup>10</sup> But higher rate of grade I complications were reported by Mandal et al.<sup>1</sup>, Choi et al. [18] and Nunzio et al.<sup>17</sup> 65.9%, 69.2% and 78% respectively.

Transient hematuria was found in 6 (5.2%) out of 115 patients (grade I complication) which is higher than the study done by Mamoulakis et al.<sup>10</sup> and Mandal et al.<sup>1</sup> where it was 2.5% and 4.5% respectively. Transient hematuria in this study was managed by catheter traction and continuation of bladder irrigation with normal saline solution. In 4 of the cases hematuria subsided before third post-operative day and catheter could be removed on third POD as per study protocol. 1 patient needed 4 days and another 5 days of catheter drainage due to persistence of hematuria.

Four patients (3.5%) out of 115 patients had clot retention before catheter removal. Single episode of clot retention occurred in 2 patients, two episodes in 1 patient and one developed repeated clot retention for 3 days that necessitates extension of catheterization for 4 days. All these cases were treated by simple syringing

for evacuation of blood clot and prolongation of bladder irrigation with normal saline solution. These were considered as grade I complication. Mamoulakis et al.<sup>10</sup> reported 5 of their patients out of 198 patients (2.5%) had clot retention which is lower than the present study.

One patient (0.9%) developed acute retention of urine on first POD due to catheter block. Syringing failed to relieve that blockage. Catheter removal reveals catheter eye was blocked by prostatic chips. Bedside recatheterization was done. That patient had no complained thereafter and it was classified as grade I complication. 1.5% and 5.3% of the patients needed bed side catheter change in the study by Mamoulakis et al.<sup>10</sup> and Mandal et al.<sup>1</sup> respectively which is higher than the present study.

Transient urinary incontinence was observed in 3 cases (2.6%) which is a little higher than study done by Mandal et al.<sup>1</sup> where it was 1.8% but lower than the study done by Choi et al.,<sup>18</sup> (5.4%). All of them were advised perineal exercise and observed. 1 of them improved in two weeks other 2 at third week, a grade I complication.

Three patients (2.6%) failed to void after catheter removal and developed retention of urine. All of them were presented with catheter in situ for longer duration. After counselling re catheterization was done and both of them could void after bladder trial for 48 hours, so considered as grade I complication. This result is almost equal to that of Choi et al.,<sup>18</sup> (2.2%) but higher than Runqui et al.,<sup>16</sup> Kwon et al.<sup>17</sup> and Nunzio et al.<sup>15</sup>, (0.4%, 0.6% and 1.7% respectively).

Fever responding to antipyretics (Grade I complication) in the post-operative period was seen in 3 patients (2.6%). Fever due to other complications such as UTI and blood transfusion were not included in this group (they were classified separately into other categories). Mandal et al.<sup>1</sup> reported 3% of their patients had fever which match with this study.

Grade II complications were found 33.33% (11 out of 33 complications) in the present study. This was almost equal to the study done by Mamoulakis et al.<sup>10</sup> (29.5%) but higher than Nunzio et al.<sup>15</sup>, Mandal et al.<sup>1</sup> and Choi et al.<sup>18</sup>, (12%, 16.3% and 24.3% respectively).

Regarding bleeding (intraoperative bleeding or postoperative hematuria), the most severe therapeutic consequence was the need for transfusion, a clear grade II complication. Blood transfusion was considered

necessary in 9 patients (7.8%). In 2 cases per-operative transfusion was given due to bleeding during TURP and 7 patients received blood transfusion post operatively due to significant drop in post-operative hemoglobin level. This transfusion rate is higher than the reported study (4.0%) by Mamoulakis et al.<sup>10</sup> Lower pre-operative hemoglobin level and low threshold for transfusion (transfusion at post-operative hemoglobin level less than 10 gm/dl) were responsible for the higher blood transfusion rate in this study.

Two patients (1.7%) developed urinary tract infection post operatively documented by growth of significant colony count of bacteria on urine culture. Both of them were preoperatively catheterized and 1 underwent a second procedure (clot evacuation under anesthesia). Both of them improved by antibiotic treatment (grade II complication). Mandal et al.<sup>1</sup> reported 3.3% of their patients had urinary tract infection which is higher than the present study. Maintenance of strict asepsis may be the cause of this low incidence of urinary tract infection in the present study.

Grade III complication was found 3.03% (1 out of 33 complications). This was almost equal to the study result of Mamoulakis et al.<sup>10</sup> and Nunzio et al.<sup>15</sup> which was 2.3% and 4% respectively. This patient developed decreased drainage of urine through catheter and ultrasonography revealed a large blood clot inside the urinary bladder. He underwent cystoscopic clot evacuation under spinal anesthesia.

Grade IV complication was found 3.03% (1 out of 33 complications). Reported series of Nunzio et al.<sup>15</sup>, and Mandal et al.<sup>1</sup> had the almost same result 4% and 4.5% respectively. Mamoulakis et al.<sup>10</sup>, and Runqui et al.<sup>16</sup>, had higher rate of grade IV complication (6.8% and 7.8% respectively). After TURP this patient developed profuse hematuria not responded to catheter traction & an increasing rate of bladder irrigation. Prompt investigation revealed raised fibrin degradation product and d-dimer level in serum and he was diagnosed as a case of disseminated intravascular coagulation and was transferred to ICU. There he received three units of blood and three units of fresh frozen plasma. He was kept in ICU for 7 days, then was shifted to ward. He was discharged on 14th POD without any residual morbidity.

In this study, TURP was performed in patient with either to normal sodium level or preoperatively corrected to normal level. Operation time range from 30 to 82 minutes. With standard procedure, no patient

in this study developed TUR syndrome. In the study of Mandal et al.<sup>1</sup>, they found TUR syndrome in 7 cases (1%) in 722 patients (grade IVb complication).

There was no mortality (grade V complication) in this study. Nunzio et al.<sup>15</sup> also reported no mortality among their 295 cases. But Mandal S et al. (2013) reported 3 deaths among their 722 cases (0.4%).

One of the patients after failed voiding trial was catheterized and developed second failed voiding trial after 7 days. Urethrocystoscopy revealed residual adenoma in apical lobe. Again, re-TURP was done and post-operative period was uneventful, this was considered as treatment failure, not included in complication. Also 1 patient was diagnosed as carcinoma prostate from histopathology of prostatic chips and was excluded from the study.

Negative outcomes, such as mild dysuria during this early postoperative period not related to remarkable morbidity or retrograde ejaculation, were considered sequelae rather than complications and were not recorded. Nobody was complicated with severe dysuria.

In the present study, patients were followed up systematically up to the first postoperative month. Therefore, TURP complications, which typically appear in the longer term, were not graded. All the complications that occurred following TURP in this study, could be easily classified according to MCCS. One might be surprised by the fairly high incidence of complications reported; however, one who is familiar with the Clavien system will recognize that the vast majority of complications were minor in severity and would not have been reported if a non-standardized reporting system had been used.

Pre-operative baseline variables between patients with complications and patients without complications were compared. It was observed that almost half (46.2%) patients belonged to age 61–70 years in patients with complications and 33(37.1%) in patients without complications. The mean age was  $65.15 \pm 7.65$  years with ranged from 55 to 85 years in patients with complications and  $65.58 \pm 9.82$  years with ranged from 50 to 85 years in patients without complications. The difference was statistically not significant ( $p > 0.05$ ) between two groups.

Mean preoperative Hemoglobin was  $11.8 \pm 1.36$  gm/dl in patients with complications and  $12.24 \pm 1.32$  gm/dl in patients without complications. Mean postoperative

Hb was  $10.3 \pm 1.55$  gm/dl in patients with complications and  $11.23 \pm 1.02$  gm/dl in patients without complications. The postoperative Hb was significantly lower in patients with complications ( $p < 0.001$ )

Mean preoperative Sodium was  $137.4 \pm 1.6$  mmol/l in patients with complications and  $137.9 \pm 2.13$  mmol/l in patients without complications. Mean postoperative Na was  $136 \pm 1.37$  mmol/l in patients with complications and  $136.1 \pm 1.4$  mmol/l in patients without complications. The difference was statistically not significant ( $p > 0.05$ ) between two groups.

Comparison of prostate volume, PVR, resected volume and resection time of the study patients shows mean prostate volume, mean PVR, mean resected volume and mean resection time was higher in patients with complications than that of patients without complications. Among them mean prostate volume, mean resected volume and mean resection time was significantly higher in patients with complications (P value  $< 0.001$ ). Therefore, higher prostate volume, higher resected volume and longer resection time.

Multivariate logistic regression analysis of possible predictors for occurrence of complications shows higher prostate volume, lower preoperative hemoglobin level & longer resection time were predictors for grade I complications and lower preoperative hemoglobin was predictor for grade II complications.

## Conclusion

In this study, complication rate following TURP was 22.6%. According to the modified Clavien classification system, grades I and II complications constituted the main bulk (60.6% and 33.33% respectively). Higher grades complications were scarce. Among them grade IIIa complication was 3.03% and grade IVa complication was also 3.03%. Higher prostate volume, lower preoperative hemoglobin level, higher resected volume and longer resection time were the predictors of post-operative complications following TURP.

## Limitations of the study

It was a single center study with small sample size and short follow up period so late complications not reported. Another drawback is TURP was done by multiple surgeons.

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