Asian Journal of Research and Reports in Urology

4(4): 50-57, 2021; Article no.AJRRU.71625

Perioperative Complications in Monopolar Transurethral Resection of Prostate: Single Center Retrospective Evaluation of 942 Cases

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SK and KA performed project development, design, data collection, data analysis, literature searches and manuscript writing/editing. Author MBA performed project development, data collection and manuscript writing/editing. Authors RB, BS, AK and JB performed data collection and manuscript editing. All authors read and approved the final manuscript.

Article Information

Editor(s):
(1) Dr. Muhammad Ujudud Musa, Federal Medical Centre, Katsina, Nigeria.
Reviewers:
(1) R Kesavan, Sri Lanka.
(2) Mawaddah Azman, Universiti Kebangsaan Malaysia, Malaysia.
Complete Peer review History: https://www.sdiarticle4.com/review-history/71625

Original Research Article

Received 15 June 2021
Accepted 20 August 2021
Published 24 August 2021

ABSTRACT

Aims: To describe the perioperative complications in monopolar transurethral resection of prostate (M-TURP) among the patients who underwent M-TURP for benigh prostate enlargement or palliative "channel" TURP in the hospital from the year 2010 to 2019.
Study Design: Retrospective single center study.
Place and Duration of Study: Department of Urology, B and B Hospital, Gwarko, Lalitpur, Nepal, between January 2010 and December 2019.
Methodology: Hospital based electronic records were retrieved for all M-TURP done during the above mentioned period. Variables considered were age, presenting symptoms, comorbidities, diagnosis, anesthesia type, operative duration, amount of prostatic tissue resected and any

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perioperative complication. Multinominal logistic regression model was used to calculate adjusted odds ratio of complications between different subgroups and *P* value < .05 was considered significant.

Results: The overall perioperative morbidity and mortality rate was 10.3% and 0.11% respectively. Most common complications were clot retention requiring bladder wash (3.29%), urinary tract infection (2.87%) and transurethral resection syndrome (1.06%). Incontinence, bladder injury and iatrogenic urethral injury occurred in 0.96%, 0.53% and 0.53% respectively. Single case of conversion to open surgery was recorded (0.11%). Average prostatic tissue resected was 35.4 ± 15.6 grams. Operative duration more than 90 minutes was significantly associated with complication with adjusted odds ratio 2.34 (95% CI 1.17-4.66, *P* value .02). Factors such as age, preoperative urinary retention, predominantly storage or voiding lower urinary tract symptoms, comorbidities, anti-platelet therapy, anesthesia, amount of prostate tissue resected did not show significant association.

Conclusions: Monopolar TURP has acceptable morbidity and mortality rates which can be further minimized by limiting the duration of surgery to 90 minutes.

Keywords: Lower urinary tract symptoms; monopolar TURP; operative complications; prostate surgery; transurethral resection of prostate.

ABBREVIATIONS

BNI : Bladder Neck Incision
BOO : Bladder Outlet Obstruction
BPO : Benign Prostatic Obstruction
EAU :European Association of Urology
HoLEP : Holmium Laser Enucleation of Prostate
LUTS : Lower Urinary Tract Symptoms
MI : Myocardial Infarction
M-TURP :Monopolar Transurethral Resection of Prostate
OR : Odds Ratio
PVP :Photoselective Plasma Vaporization of Prostate
SD : Standard Deviation
SPSS :Statistical Package for Social Sciences
TURP :Transurethral Resection of Prostate
TUR syndrome :Transurethral Resection Syndrome

1. INTRODUCTION

Transurethral resection of prostate (TURP) has stood the test of time remaining cornerstone in the management of bladder outlet obstruction (BOO) for the last nine decades. Although there have been various modifications of TURP, monopolar TURP (M-TURP) still remains the standard surgical treatment for men with moderate to severe lower urinary tract symptoms (LUTS) secondary to benign prostatic obstruction (BPO) [1]. Some of the known causes of peri-operative morbidity and mortality is due to complications such as TUR syndrome, clot retention, iatrogenic urethral injury and postoperative sepsis. Recently, mortality and morbidity of M-TURP has decreased to about 0.1 and 11.1% respectively [2].

In 2008, Shrestha et al. did a prospective study in 100 patients undergoing M-TURP and found perioperative complication around 16% [3]. Over a decade following it, we assume the perioperative complication rate should have decreased because of increase in surgeons' expertise [4]. The objective of this study was to evaluate the perioperative morbidity and mortality in patients undergoing M-TURP at our center which is a tertiary hospital. The secondary objective was to determine factors leading to increased risk of complications.

This information would be valuable in predicting the outcome in respective subgroup of patients undergoing M-TURP and optimizing the perioperative care accordingly, to lower the complications. It will also benefit surgeons from other centers who are practicing M-TURP; as well as educate the patients who seek this treatment modality.

2. MATERIALS AND METHODS

Hospital based electronic records were retrieved from the IT (Information Technology) department for all consecutive TURP done in the past 10 years (January 1, 2010 to December 31, 2019) after approval from hospital Institutional Review Board (IRB) of B and B hospital. Informed consent was exempted by the ethical committee

due to retrospective nature of the study and as no patient identifiable data was used. Only patients who underwent M-TURP for BPO or palliative "channel" TURP (for metastatic prostate cancer with severe BOO symptoms) were included in the study. Patients undergoing redo/revision TURP, staged TURP, bladder neck incision (BNI), bipolar TURP or HoLEP (Holmium Laser Enucleation of Prostate) were not included. Manual review of operation notes and discharge summaries were done by the authors in search of missing data; excluding any cases that were incomplete. Microsoft Excel 2013® (Microsoft, Santa Rosa, California) was used for data sorting, cleaning and removing duplicates. The data was then exported to Statistical Package for the Social Sciences 20® (IBM, New York) in which final analysis was done.

Available variables taken into account were age, presenting urinary symptoms, comorbidities, prostate size, diagnosis, anesthesia type, operative duration and any perioperative complication. Perioperative period was defined as the time duration from admission until discharge of the patient. Based on predominant symptoms, the presenting urinary symptoms were grouped into two: storage LUTS (frequency, urgency and nocturia) or voiding LUTS (weak stream, straining, intermittency and incomplete bladder emptying). The criteria for labelling TUR syndrome was presence of either clinical symptoms (cardiovascular/neurological) or serum sodium level ≤ 125 mEq/L. Sepsis was defined as per international consensus definition [5]. Clot retention was regarded as complication only if it required taking the patient to operating room for cystoscopy and bladder wash using ellik evacuator with or without fulguration of bleeding point. Complications were classified on the basis of Clavien Dindo grading [6]. Complications up to grade II was grouped as minor whereas Grade III and beyond was grouped as major complication.

Descriptive statistics for continuous variables were expressed as mean ± standard deviation (SD) whereas ordinal variables were expressed as percentage. For analytical statistics, we decided to group continuous variables into logical categories to have better comprehension, in trade for some loss of information. Multinominal logistic regression model was used to calculate adjusted odds ratio of complications between different subgroups and *P* value < .05 was considered significant. B intercept value of regression model was not calculated.

3. RESULTS

There were total 942 cases that underwent M-TURP from January 1, 2010 to December 31, 2019 AD after excluding cases with incomplete data and duplicates. The summary of the patient demographics is presented in Table 1. Majority of the patients (71.3%) belonged to 40 - 60 years age group and 13 (1.4%) patients were 90 years or older. More than 60% patients presented with predominantly voiding LUTS whereas around 18.6% of the patients presented with urinary retention having per-urethral catheter in situ since varied duration. Hypertension was found in 41.8% of the cases among which 5.5% patients had cardiovascular disease necessitating anti-platelet therapy (either aspirin or clopidogrel) that was stopped around 7 days before the procedure.

The average prostate tissue resected was 35.4 ± 15.6 grams with more than 80 grams in 4.1% cases. Operative duration was more than 60 mins in 35.6% and more than 90 mins in 9.4% of the cases. The overall complication rate was around 10.4% among which 2.3% were minor and 8% were major including 0.11% mortality. The various complications with their frequency of occurrence are depicted in Table 2. The odds of having any perioperative complication among patients in which surgery lasted more than 90 minutes was 2.34 (95% CI 1.17 – 4.66, *P* value .02) after adjusting for other variables. Age, presenting predominant symptom, urinary retention, comorbidities, diagnosis, type of anesthesia and prostate size were not significantly associated with complications as shown in Table 3.

4. DISCUSSION

Monopolar TURP, although an efficient treatment modality has its own fair share of complications, which fortunately has been decreasing over the time [7]. In our study, we found that the rate of any perioperative complication was 10.4%. This implies relative risk reduction in perioperative complications of 35% in comparison to 2008 study done by Shrestha et al. [3]. Furuya et al. found that the complication decreases as the skill of the surgeon increase; with about 81 cases required to reach a plateau [4]. Regarding the procedure, we used 26F continuous flow irrigation system resectoscope with 1.5% glycine solution as the irrigating fluid. All the cases were done by four experienced urologists using the same technique. Part of the resection was also

Table 1. Descriptive statistics of the study group

Patient demographics	Value	Unit
Age (years)	68.9 ± 9.6	Mean ± SD
	38 – 97	Min - Max
Presenting symptom		n (%)
AUR (on catheter)	175 (18.6)	
Predominantly voiding LUTS	566 (60.1)	
Predominantly storage LUTS	376 (39.9)	
Comorbidities		n (%)
On anti-platelet	52 (5.5)	
Hypertensive	394 (41.8)	
Diabetic	150 (15.9)	
Prostate size (grams)	35.4 ± 15.6	Mean ± SD
Operative duration (minutes)	59.3 ± 23.8	Mean ± SD
Peri-operative complications	98 (10.4)	n (%)

** AUR Acute Urinary Retention; LUTS Lower Urinary Tract Symptoms; SD Standard Deviation*

Table 2. Complications as per Clavien-Dindo grading [6]

Peri-operative Complications	Grade	n (%)
Minor		
Spinal Headache	I	8 (0.85)
Incontinence	I(d)	9 (0.96)
Iatrogenic urethral injury	II	5 (0.53)
Major		
TUR Syndrome	III(a)	10 (1.06)
Clot retention requiring bladder wash	III(b)	31 (3.29)
Conversion to Open	III(b)	1 (0.11)
Intraoperative Bladder Perforation	III(b)	5 (0.53)
Postoperative MI	IV(a)	1 (0.11)
Postoperative sepsis	IV(a)	27 (2.87)
Peri-operative Death	V	1 (0.11)
Total complications		98 (10.40)

done by final year urology residents under direct supervision of the consultant surgeon. There were no difference in technique between standard M-TURP (for BPO) and channel TURP other than that much conservative resection was done during channel TURP; just satisfactory enough to relieve the obstruction.

The major complications were clot retention requiring bladder wash (3.29%), bladder perforation (0.53%) and urinary tract infection (2.87%). A contemporary study by Tasci et al. reported similar results with clot retention in 2.3%, perforation 0.75% and significant urinary tract infection in 6.5% among 3589 procedures [8]. Resectionists are always in search for an equilibrium between inadequate hemostasis and charring of the prostatic bed, both of which may increase risk of secondary bleeding and subsequent morbidity.

Among the five cases of bladder perforation, three were during ellik evacuation of prostatic chips. This is usually precipitated by over distension of poorly compliant bladder by irrigating fluids [9]. In the remaining two cases, there was fluid extravasation into the extraperitoneal and intraperitoneal space. The cause of such extravasation is believed to be either due to overzealous resection near the bladder neck or smaller capsular perforations. Intraperitoneal bladder perforations were managed by immediate exploration and surgical repair in two layers whereas extravasation were managed by placement of drain through lower abdomen (at the site of maximum collection, with or without ultrasound guidance) followed by prolonged catheterization. Another rare cause of perforation is intravesical explosion; due to activation of TURP loop inside the accumulated air bubble. Such explosive air bubble is composed of hydrogen, oxygen and other gases created by pyrolysis of prostatic tissue and hydrolysis of water during resection with additional introduction of oxygen containing atmospheric air during bladder wash [10].

The other major complication we encountered was transurethral resection (TUR) syndrome in 1.06% that were all detected intraoperatively or

during postoperative recovery. They were managed successfully by diuretics, correction of hyponatremia and close monitoring. A systematic review and meta-analysis done by Cornu et al. in 2015 found TUR syndrome in 1.42% (19 out of 1339 patients) belonging to M-TURP arm [11]. On the contrary, a recent study by Sagen et al. found only single case of TUR syndrome among 354 men subjected to M-TURP [12]. Even though this complication is decreasing, it is the Achilles' heel of M-TURP; and one of the reasons for looking into alternative treatments like bipolar-TURP and green light laser photoselective plasma vaporization of prostate (PVP) [13,14]. To note, not a single TUR syndrome was seen with newer modalities of prostate surgery as shown in a systematic review and network meta-analysis done by Huang et al in 2019, which included 109 trials with 13676 participants [15].

Iatrogenic urethral injury occurred in 0.53% which is an avoidable complication and can lead to urethral stricture in later life. The cause may be attributed to blind nature of urethral dilatation and disproportionate caliber of urethra to the size of the instrument. The rate of incontinence in our study was 0.96%, which were all stress urinary incontinence. The common cause of this is the injury to the proximal part of external sphincter distal to verumontanum [16]. Post TURP stress incontinence has been reported up to 8.4% by a systematic review in 2736 patients. They also concluded that the outcome of sling surgery in this group of patients have been less successful [17]. We believe that the lower incontinence rate in our study is because we limit our resection 1mm proximal to verumontanum. Ketabchi et al. have recommended preserving anterior fibromuscular zone of prostate for preventing stress incontinence after TURP [18]. In patients that develop incontinence postoperatively, we teach them exercise to strengthen their pelvic floor muscle and advice to continue after discharge.

There was one case of myocardial infarction (MI) and a single death in patient undergoing M-TURP. The cause of sudden death was massive MI and the patient had background of both diabetes and hypertension under medication. Cardiac complications after TURP is not uncommon, with acute MI and 90 days mortality rates reported up to 4.8% and 0.7% respectively [19]. Conversion to open is a very rare phenomenon which we had to consider as the last resort in one patient. The reason for converting to open procedure was poor endoscopic vision during TURP. There was persistent hemorrhage and catheter tamponade measures failed to control the oozing.

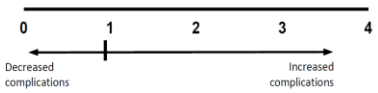
On subgroup analysis, we found non-significant association of complications with increasing age, presenting with predominantly voiding/storage LUTS or urinary retention, comorbidity of hypertension or diabetes, history of antiplatelet use, type of anesthesia, amount of prostatic tissue resected and whether TURP was done for BPO or palliation in metastatic prostate cancer. This may be because of reduced statistical power after redistribution of patients into smaller subgroups and hence larger cohort will be required to confirm the association.

The only significant association with complication was when operating duration exceeded 90 minutes with adjusted OR 2.34 (1.17-4.66 95% CI, *P* value .02). Similar to our study, Nunzio et al. in multicenter study of found only longer operative time to be independent risk factor for increased risk of perioperative complications with 2.4% increase in risk per minute of resection during M-TURP (OR 1.024, 95% CI 1.007-1.040, *P* value .004) [20]. The reason for such association may be that longer surgery duration is directly related to more irrigating fluid absorption over time leading to hemodynamic changes, hypothermia, blood loss and proportionately more chances of infection, coagulopathy, deep vein thrombosis and pulmonary embolism [21]. In a study by Reidinger et al., they found overall complications rate of 9% but increased to 14.7% if operative duration was 90-120 minutes eventually reaching 20.7% if duration exceeded 120 minutes [21]. Looking at the results, we may infer that dividing the M-TURP surgery into two consecutive sessions (with an interval of few days) would be safer than taking more than 90 minutes to complete it. Of course, this has to be validated by further comparative studies.

On the other hand, Reich et al found that complications increased when resected prostate size was ≥ 60gms [2]. European Association of Urology (EAU) guidelines 2020 suggests that the upper limit of prostate size suitable for M-TURP should be 80gms taking into account surgeon's experience, resection speed and size of the resectoscope used [1]. But we believe the duration of surgery is more important than weight of prostate tissue resected as the resection speed may vary even between experienced surgeons.

Table 3. Multinominal analysis of complications in between various subgroups

Variable	Cases	Any complication	OR (95% CI)	*P* value
1. Age group				
Less than 60 years	674/942		Referent	
60 to 80 years	161/942		1.27 (0.66 - 2.44)	.47
More than 80 years	107/942		1.51 (0.64 - 3.55)	.34
2. Presentation				
Self voiding	767/942		Referent	
Retention (on catheter)	175/942		1.21 (0.72 - 2.05)	.47
3. Predominant symptom				
Storage LUTS	376/942		Referent	
Voiding LUTS	566/942		0.91 (0.58 - 1.41)	.66
4. Comorbidity				
None	483/942		Referent	
Antiplatelet therapy	52/942		1.44 (0.64 - 3.26)	.38
Hypertension	394/942		1.21 (0.77 - 1.89)	.42
Diabetes	150/942		1.17 (0.67 - 2.05)	.59
5. Operation type				
Standard TURP	909/942		Referent	
Channel TURP	33/942		0.96 (0.28 - 3.29)	.95
6. Type of Anesthesia				
Spinal anesthesia	861/942		Referent	
General anesthesia	81/942		0.87 (0.39 - 1.97)	.75
7. Prostate Size				
Less than 30 gms	271/942		Referent	
30 to 80 gms	632/942		1.13 (0.65 - 1.97)	.65
More than 80 gms	39/942		1.28 (0.43 - 3.76)	.66
8. Operation duration				
Less than 60 mins	607/942		Referent	
60 to 90 mins	246/942		1.36 (0.8 - 2.26)	.26
More than 90 mins	89/942		2.34 (1.17 - 4.66)	.02



* OR Adjusted Odds Ratio; CI Confidence Interval; LUTS Lower Urinary Tract Symptoms; TURP Transurethral Resection of Prostate

There are limitations to this study. The total volume of irrigation fluid used (i.e., 1.5% Glycine solution), drop in serum Na+ and hemoglobin levels, and contribution of urology residents in resection of each gland were unknown. This would have helped rationalize the increased risk of perioperative complications even further. Moreover, hospital stay and need for blood transfusion was not taken into account as this is subjective in our part of the world. The decision to transfuse blood depends on patient's preoperative hemoglobin level, cardiovascular status and opinion of the treating physicians involved.

5. CONCLUSION

These perioperative complications gives a glimpse of real world data where monopolar TURP is still widely used. Overall, monopolar TURP has acceptable complication rates which can be further minimized by limiting the duration of surgery to 90 minutes. Surgeons can divide the surgery into two consecutive sessions if needed, to limit operative duration and counsel their patient beforehand accordingly.

CONSENT AND ETHICAL APPROVAL

Ethical Approval was granted by the local institutional review board (IRC_2020_06_01-001) on 1st June 2020. Individual consent requirement was waived by the committee in view of retrospective nature of the study and as no person identifying data were used.

ACKNOWLEDGEMENTS

We wholeheartedly thank Nagmani Singh for reviewing the manuscript and providing valuable

feedback. There were no sponsor for this research.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle4.com/review-history/71625