Vol. 13(14), pp. 188-195, August, 2019
DOI: 10.5897/AJPP2019.5056
Article Number: 78D0BC761560
ISSN: 1996-0816

http://www.academicjournals.org/AJPP

ACADEMIC JOURNALS
expand your knowledge

African Journal of Pharmacy and Pharmacology

Full Length Research Paper

Efficacy of transurethral resection of prostate in patients of benign prostatic hyperplasia with lower urinary tract symptoms

Shahjahan Ur Rehman[1], Salman Iftikhar[2], Kamran Zaidi[1], Rao Salman Aziz[2], Yasir Arfat[3]* and Muhammad Sohail[1]

[1]Department of Urology, Lahore General Hospital, Lahore, Pakistan.
[2]Department of Pharmacology, Rashid Latif Medical and Dental College, Lahore, Pakistan.
[3]College of Chemistry and Chemical Engineering, Shaanxi University of Science and Technology, Xian, China.

Received 20 May, 2019; Accepted 5 July, 2019

Transurethral resection of the prostate (TURP) has been the prime procedure for decenniums to treat benign prostatic hyperplasia (BPH), but is mainly predicated on historic data that lacks utilization of validated measures. It is noteworthy that TURP done nowadays significantly differs from that performed 30 years ago. Men who had undergone TURP between 2013 and 2018 were reviewed. 50 patients presented in the Department of Urology, Lahore General Hospital, Pakistan, with lower urinary tract symptoms (LUTS) due to BPH (without retention) were recruited in the study. Related/required investigations were done and patients were operated for TURP after noting certain parameters. They were advised for follow up at 3 intervals (1st, 4th and 12th week postoperatively) and post-operative parameters were compared with pre-operative ones. International Prostate Symptom Score (IPSS), Quality of Life (QOL) and peak urinary flow rate (Qmax), and Post-Void Residual (PVR) were recorded. Operative details and postoperative complications were documented. Patients were then invited to attend for repeat assessment. Out of 50, 43(86%) patients had severe symptom score and 07 (14%) had moderate symptoms score (pre-operative). Out of total 50, 36 (72%) patients had Q_{max} less than 10 ml/s and 14 (28%) patients had Q_{max} between 10 and 15 ml/s as well as Post Micturition Residual Urine (PMRU) more than 50 ml pre-operatively. After 3 months of successful TURP, 49 (98%) patients' conditions improved and they developed a normal flow rate of more than 20 to 25 ml/s. All the 50 patients remained with a PMRU of less than 50 ml. There was an improvement in 47 patients and only 3 patients did not improve to their satisfaction. TURP is very effective and still considered a gold standard treatment for BPH with LUTS without retention of urine.

Key words: TURP, BPH, LUTS, PMRU

INTRODUCTION

Benign Prostatic Hyperplasia (BPH), a chronic progressive disorder causing Lower Urinary Tract Symptoms (LUTS) is a prevalent diagnosis among ageing males (Chughtai et al., 2016). One third of men above

60 years are most liable to develop obstructive symptoms due to BPH, and approximately 25% of them will eventually require surgical intervention (Patel and Parsons, 2014; Malhotra, 2000). TURP, by far, has been the standard surgical procedure for LUTS associated with BPH (Marszalek et al., 2009). Traditional diathermy endoscopic prostatectomy is still a favored surgical intervention more often than not for BPH, despite introduction of newer procedures because a good number of surgeons still believe that the outcomes are more durable (Kallenberg et al., 2011). Although TURP has been around for many years, the present operation differs considerably from that performed 30 years ago**.** There have been amendments in operative technique, instrument technology, and anesthetic methods. TURP is now safer, with a much lower mortality rate reported, but the effect these changes have had on long-term outcomes is largely unknown (Mebust et al., 2002; Rassweiler et al., 2006). The literature available on diathermy endoscopic prostatectomy either focuses on technical changes or associated limitations are compared. Long-term studies, that is, more than 3 years, which include TURP use, the procedure as the control arm (Rajeev et al., 2018). In these type of studies, the sample size is very small and strict inclusion criteria are employed, that is, prostate size restrictions that may render the study sample unrepresentative of the general TURP patient cohort (Ahyai et al., 2007; Tuhkanen et al., 2003; Kaya et al., 2007). Therefore, many studies on this issue have different or even contradictory results. Another limitation of older studies is that many were performed in the 1980's and early 90's (Meyhoff and Nordling, 1986; Nielsen et al., 1989; Roos et al., 1989). These studies typically use retrospective registry data and non-standardized survey instruments, while International Prostate Symptom Score (IPSS) and International Index Of Erectile Function (IIEF) emerged in the late 1990's which makes comparison with current data difficult (Kallenberg et al., 2011).

Nonetheless, TURP has its own complications, for instance about 80% of patients develop retrograde ejaculation, and 13% may need blood transfusions, while 15% complain of erectile dysfunction. Long term complications may necessitate a repeat procedure in 10% of the patients within 5 year while 5% may develop bladder neck stenosis or urethral stricture (Kallenberg et al., 2011; Yang et al., 1999). Fresh studies are therefore needed to update and validate the previously available literature. Hence, the aim of this study is to assess the long-term clinical outcomes following TURP in elderly Pakistani males (60+). The UN agreed cutoff is 60+ years to refer to the older or elderly persons.

MATERIALS AND METHODS

Patients

The study included 50 patients with BPH who were diagnosed at the Department of Urology, Lahore General Hospital, Pakistan between 2013 and 2018, with LUTS due to BPH (without retention) were included in the study. Minimum age of the patient was 60 years and maximum 86 years old. Related/Required investigations were done and patients were operated for TURP after noting certain parameters. They were advised for follow up at 3 intervals (1st, 4th and 12th week postoperatively) and post-operative parameters were compared with pre-operative ones. Elderly patients with high surgical risk were defined as patients aged ≥60 years who experienced at least one internal comorbidity, e.g., hypertension or diabetes. Patients with BPH were included in the study if (1) they were aged ≥60 years, (2) they regularly used α-receptor blockers, 5α-reductase inhibitors, and/or muscarinic-receptor blockers for more than six months but did not achieve a satisfactory International Prostate Symptom Score (IPSS); and (3) they were willing to undergo TURP and provided written informed consent. All persons gave their informed consent prior to their inclusion in the study. Patients were assigned centrally at the Department of Urology, Lahore General Hospital, Pakistan, and each eligible patient was interviewed. The details of the surgical methods, such as benefits and drawbacks, risk, and expected expenses, were fully explained to the eligible patients. Next, the patients were given suggestions based on their specific condition. However, the surgical method, that is, TURP, was eventually decided by the patients. The type of surgical method selected was known to both the patient and his surgeon.

The trial was approved by the Ethical Committee of Lahore General Hospital, Pakistan and the methods were carried out in accordance with the approved guidelines.

Preoperative preparation

In addition to routine examinations, following measures were taken for patients with different internal comorbidities before they underwent TURP, (1) controlling blood pressure within 140/90 mmHg in hypertensive patients; (2) maintaining fasting blood glucose at 6 to 8 mmol and 2-h postprandial blood glucose below 11 mmol/L; (3) improving and maintaining pulmonary or cardiac function in patients with chronic bronchitis, emphysema, or cardiac dysfunction; and (4) controlling blood pressure or treating anemias with active symptomatic treatment in patients with chronic renal insufficiency. Patients with deteriorating or unstable comorbidities were transferred to other departments for further treatment before being reconsidered for inclusion in the study.

Surgical procedure

A TURP system (Olympus, Tokyo, Japan) was used for treating patients in the TURP group (280 W for cutting and 100 W for coagulation; 0.9% NaCl as irrigation fluid). All the patients were

*Corresponding author. E-mail: yasir@mail.nwpu.edu.cn or ravian466@yahoo.com

placed in the lithotomy position and were given general anesthesia with Propofol (Yang et al., 2016). Bladder irrigation was initiated immediately after the patient was transferred to a ward or intensive care unit (ICU).

Outcome measures and follow-up

The following data were collected before the surgery and at one year after the surgery: (1) IPSS, (2) maximum flow rate (Qmax), (3) post-void residual (PVR), and (4) QoL. Preoperative prostate volume (PV) was measured by performing B-ultrasonic examination. All the patients were asked to visit our department at any time if they experienced any discomfort.

Statistical analysis

SPSS software version 13.0 was used for data analysis. Discrete and continuous variables were compared using Chi-square test and t test, respectively. P values less than 0.05 were considered statistically significant.

RESULTS

A total of 50 patients of benign prostate hyperplasia with lower urinary tract symptoms presenting without retention of urine were included in the study. IPSS, QOL, PMRU, and Q max were analyzed at pre-operatively and 1st, 4th and 12th week post-operative, as shown in Figure 1. 43 out of 50 patients (86%) had severe symptom score and 07 (14%) patients had moderate symptom score (pre operatively). According to American Urological Association Designed International Prostate Symptom Scoring System (IPSS), mild score ranges from 0-7, moderate score ranges from 8-19, and severe score ranges from 20-35.

Pre and postoperative symptom score

Selection criteria for surgery was IPSS > 16 and Q max <10 ml/s. transurethral resection of prostate was done in the patients; the control visit was performed at 3 months. Treatment success was defined as Q max above 15 ml/s, residual urine of less than 100 ml, a 50% reduction in IPSS and absence of urinary retention. Preoperative Mean QOL (score) in the present study was 4.80. Our patients' QOL (score) also improved within first week postoperatively from 4.80 to 1.48. At 2nd follow up, maximum number of patients reported a very satisfying QOL (score) shown in Table 1.

The mean PMRU preoperatively was 210 ml and postoperatively mean PMRU at 1st follow up at 1st week was 49.4 ml. Mean PMRU at 2nd follow up at 4th week was 8.86 ml and at 3rd follow up at 12th week it was 4.60 ml. Results indicate that a high proportion of patients successfully operated (71.1%) had a combination of IPSS> 16 and Q max < 10 ml/s (Table 1).

Post-operative comparison

Post-operative follow-up of IPSS in Table 2 shows that after remarkable improvement in IPPS score between 1st and 4th week with a p value <0.0001, there was only minor change between 4th week and 12th week, with the p value <0.510, which shows that no significant change occurred during this period. Post-operative follow-up of QOL score in Table 3 shows that after remarkable improvement in QOL score, between 1st and 4th week with a p value between < 0.0015 and <0.0018, there was only minor change between 4th week and 12th week with the p value <0.900, which shows that no significant change occurred during this period.

Post-operative follow-up of PMRU in Table 4 shows that after remarkable improvement in PMRU, between 1st and 4th week with a p value was <0.0001, there was only minor change between 4th and 12th week, the p value < 0.1200, shows no significant change during this period. Post-operative follow-up of maximum urinary flow rate (Qmax) in Table 5 shows that after remarkable improvement in Qmax between 1st and 4th week with a p value < 0.0010 and < 0.0005, there was only minor change between 4 and 12th week, the p value < 0.940, shows that no significant change occurred during this period. The mean IPSS was 25.20 (preoperatively) and postoperatively mean IPSS at 1st follow up at 1st week was 7.22. Mean IPSS at 2nd follow up at 4th week was 2.38 and at 3rd follow up at 12th week it was 2.02.

The mean QOL (score) preoperatively was 4.80 and postoperatively mean QOL (score) at 1st follow up at 1st week was 2.12. Mean QOL (score) at 2nd follow up at 4th week was 1.50 and at 3rd follow up at 12th week it was 1.48. The mean PMRU preoperatively was 210 ml and postoperatively mean PMRU at 1st follow up at 1st week was 49.4 ml. Mean PMRU at 2nd follow up at 4th week was 8.86 ml and at 3rd follow up at 12th week it was 4.60 ml. The mean Qmax preoperatively was 7.94 ml/s and postoperatively mean Qmax at 1st follow up at 1st week was 7.22 ml/s. Mean Qmax at 2nd follow up at 4th week was 22.2 ml/s and at 3rd follow up at 12th week it was 26.9 ml/s.

DISCUSSION

Transurethral resection of prostate remains the standard tool for the urologists to manage BPH (Marszalek et al., 2009; Rajeev et al., 2018). The new techniques may be more facile to utilize and are less traumatic for the patients but they require long term evaluation and are more extravagant. The quandary of dealing with large prostate (more than 100 g) still remains, for which open

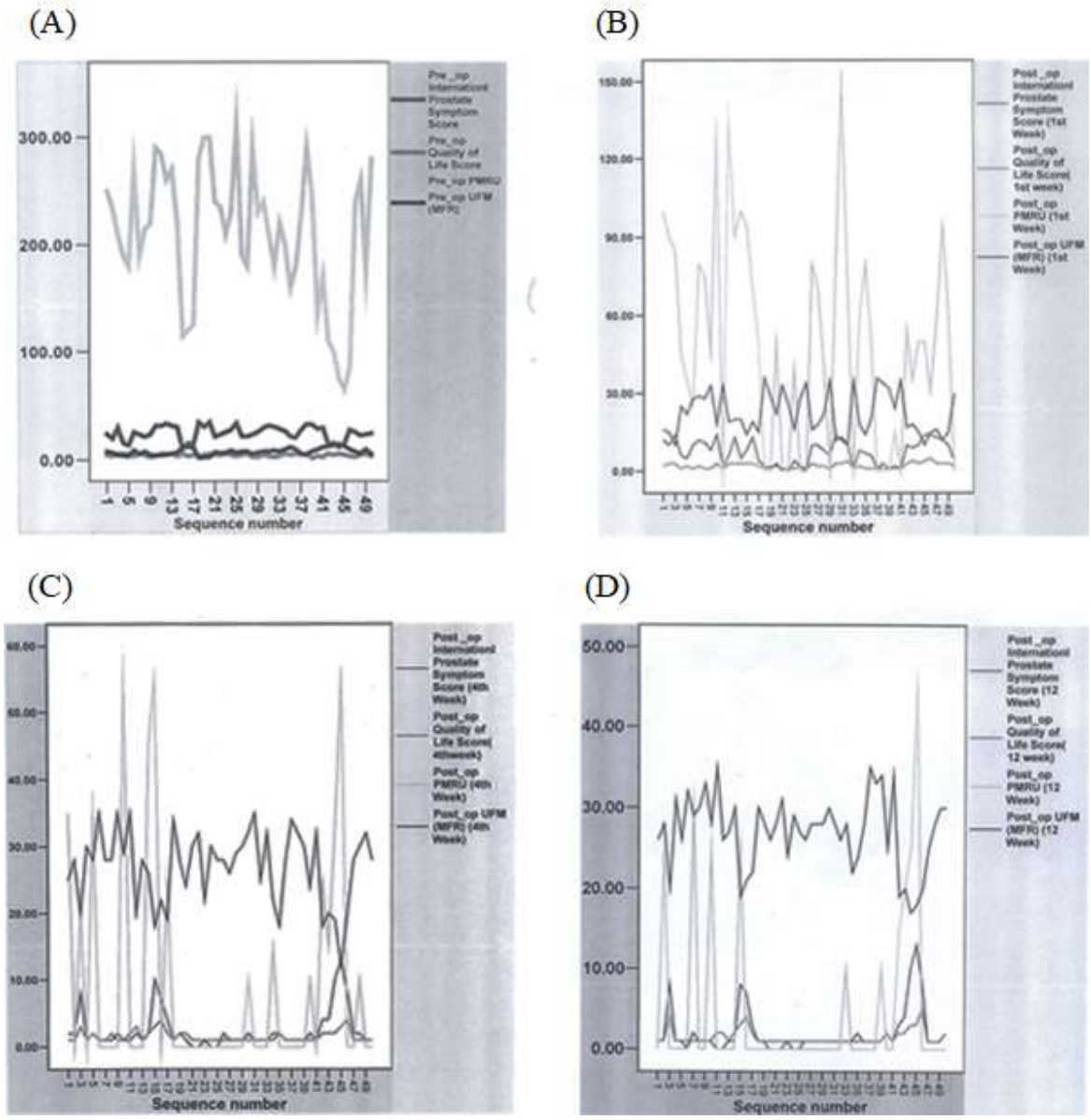

Figure 1. (A) Pre-operative (IPSS, QOL, PMRU, Q max), (B) Post-operative (IPSS, QOL, PMRU, Q max) at 1st week, (C) Post-operative (IPSS, QOL, PMRU, Q max) at 4th week, (D) Post-operative (IPSS, QOL, PMRU, Q max) at 12th week.

prostatectomy or double sitting surgery is advised in most cases, that is, resection of one lobe in one surgery and other lobe in second surgery. This greatly reduces the chances of TURP syndrome (Porter and McCormick, 2003).

The morbidity/complications rate with TURP was lower in our patients as compared to the international studies (Cornu et al., 2015). The low morbidity/complications in this study is probably due to extra care regarding sterilization, associated risk factors such as medical diseases preoperatively, proper catheter care, good patient's compliance and evaluation and management of the patients (Saint et al., 2016).

When evaluating surgical modalities for BPH, it is important to assess the impact of each treatment on both the direct (peak urinary flow rate and residual urine) and indirect outcomes. The latter being outcomes that are of greater relevance to the patient as they directly affect either the extent or quality of life (Eckhardt et al., 2001b). The discussion of the outcome is expanded from the analysis carried out for the Agency for Health Care Policy and Research (AHCPR) Guidelines (Eckhardt et al.,

Table 1. Pre and postoperative symptom score.

Variable	Pre-operative data	Post-operative data week1	Post-operative data week2	Post-operative data week3
IPSS	25.20	15.9	22.7	23.1
QOL	4.80	12.4	17.0	16.2
PMRU	210	15.0	21.6	22.5
Q max	7.94	7.22	22.2	26.9

Table 2. Post-operative follow-up of IPSS comparison between 1st, 4th and 12th week.

Week	t value	Standard deviation	Df	P Value
1st and 4th week	6.33	3.83	98	<0.0001
1st and12th Week	6.81	3.82	98	<0.0001
4 and 12th week	1.64	2.81	98	<0.510

Table 3. Post-operative follow-up of QOL comparison between 1st week, 4th week and 12th week

Week	t value	Standard deviation	Df	P Value
1st and 4th week	3.28	0.94	98	<0.0015
1st and12th Week	3.20	0.99	98	<0.0018
4 and 12th week	1.11	0.87	98	<0.900

Table 4. Post-operative follow-up of PMRU comparison between 1st, 4th and 12th week

Week	t value	Standard deviation	Df	P value
1st and 4th week	6.54	30.9	98	<0.0001
1st and12th Week	7.56	29.6	98	<0.0001
4 and 12th week	1.56	13.7	98	<0.1200

Table 5. Post-operative follow-up of MFR comparison between 1st, 4th and 12th week.

Week	t value	Standard deviation	Df	P Value
1st and 4th week	-3.38	6.97	98	<0.0010
1st and12th Week	-3.62	6.62	98	<0.0005
4 and 12th week	-0.001	5.02	98	<0.940

2001a). In this series, the selection criteria for TURP were subjective clinical presentation as assessed by American Urological Association (AUA) scoring method which was taken as median. However, we carried out Digital Rectal Examination (DRE) of prostate and abdominal ultrasound on every patient. Prostate size estimation by digital rectal examination is a reliable procedure; it is a subjective sign dependent on the skill and experience of the examiner (Liu et al., 2004). Conventionally, patients were reviewed in out-patients' department for 03 months after TURP.

In the present study, the age ranged from 60 to 86 years. Mean age of patients in 63% cases was similar to other studies where an average age of 69 years was reported (Speakman, 1999). No relationship is found between the size of prostate and the degree of bladder outlet obstruction (Stage and Hairston, 2005). Immediate complications are related to the size of the adenoma,

resection time, technique and age of patients and the presence of severity of pre-TURP symptoms. Off and on stress incontinence was reported in 3 patients that relieved later on. Total incontinence was not found in the present study although it has been reported in many other studies which could be due to sphincter damage or edema of sphincter tissues. In the present study, substantial numbers of patients were satisfied with the results of TURP which is comparable with other studies (Donovan et al., 1996). In our study we tried to determine the different parameters that affect the outcome of TURP in patients of BPH with LUTS presenting without retention of urine. The four parameters were IPSS, QOL (score), PMRU, and urine flow rate. We also tried to assess any correlation of certain factors such as age, prostate size and severity of symptoms with the outcome of TURP. In this study, all the four parameters improved after TURP. Most of the patients improved at first follow up at 1st week post operatively and almost all the patients improved to their maximum at 2nd follow up at 4th week post operatively. There was a minor improvement at 3rd follow up at 12th week post operatively.

Three patients who did not improve to their level of satisfaction were among those 08 patients whose pre-operative PMRU was between 50 and 100 ml. These patients reported persistent irritative symptoms after TURP. There was no marked improvement in their IPSS and QOL (score). This low PMRU could be one reason that leads to less or no improvement in symptoms after TURP. Although 05 patients whose PMRU was between 50 and 100 ml improved satisfactorily. Considering these results, we can say that sometimes irritative symptoms due to BPH, do not improve much as compared to the improvement in obstructive symptoms. In a study, van Venrooij et al. (2008) compared the outcomes after TUR-P in urodynamically obstructed versus urodynamically unobstructed, or selected equivocal men and concluded that TURP could be a good treatment alterative for selected equivocal or unobstructed men who opt for resection, did not benefit from medical therapy, and as a requirement for treatment discontinuation. They also added that TUR-P can result in a significant reduction in urethral resistance, even in unobstructed man (van Venrooij et al., 2008).

None of our patients were with decompensated urinary bladder. Every patient underwent cystometery to rule out any neurogenic bladder. It has been proven in many studies that relieving the urethral resistance also relieve the patient from lower urinary tract symptoms, if they are due to BPH. Prostatic resection decreases the amount of power required by the bladder per ml urine expelled (Dmochowski, 2005). Preoperative IPSS range (mean) in the present study was 25.20. In the present study, IPSS improved from 25.20 to 2.02 within one week postoperatively. Maximum improvement was observed at second follow up at 4th week postoperatively. After that there was only minimal change in the IPSS at our 3rd follow up at 12th week postoperatively. Same has been proven by van Venrooij et al. (2018). Symptoms and well-being were quantified by American Urological Association symptom index (SI), quality-of-life score (QOL). They studied the improvements of Qmax, and nocturia, after TURP and the improvements of IPSS, QOL, and PMRU (van Venrooij et al., 2008).

It was concluded that voiding data should have a prominent role in the initial evaluation of men with LUTS suggestive of BPH. Preoperative Mean QOL (score) in the present study was 4.80. Our patients QOL (score) also improved within first week postoperatively from 4.80 to 1.48. At 2nd follow up, maximum number of patients reported a very satisfying QOL (score). Seki et al. (2006), conducted a study to determine preoperative predictive variables regarding treatment outcomes following transurethral resection of the prostate (TURP) of patients with symptomatic benign prostatic enlargement (BPE) (Seki et al., 2006). All the patients had completed the evaluation of International Prostate Symptom Score (I-PSS), and quality of life (QOL) index, and had undergone full urodynamics before the surgery. Outcomes were assessed at 12 months after surgery. The association between those variables obtained by preoperatively performed urodynamic analysis and the degree of improvement in lower urinary tract symptom and QOL following TURP was statistically elucidated in a large number of patients with symptomatic BPE. A higher degree of baseline BOO positively predicts the postoperative improvement in I-PSS and QOL, while the baselines DO negatively. Post void residual urine, a very accurate and non-invasive method to see any bladder outlet obstruction was also a part of our parameters.

The preoperative mean PMRU in this study was 210 ml. The PMRU improved from 210 to 4.60 ml. Maximum improvement was noted at 2nd follow up at 4th week post operatively. This has also been proved in a study conducted by Porru et al. (2002) in Italy to evaluate the predictive value of a combination of IPSS, uroflowmetery and ultrasound determination of residual urine volume in the determination of bladder outflow obstruction and in predicting treatment outcome. Forty-five out of a group of 60 BPH symptomatic patients were included. Pre-operative evaluation: IPSS, QOL score, uroflowmetrey and residual urine along with other required tests was done. Selection criteria for surgery was IPSS > 16 and Q max <10 ml/s. transurethral resection of prostate was done in these patients; the control visit was performed at 3 months. Treatment success was defined as Q max above 15 ml/s, residual urine of less than 100 ml, a 50% reduction in IPSS and absence of urinary retention (Porru et al., 2002).

The overall success rate was 86% when measured by the IPSS. Its preoperative value was 16.9, and dropped

significantly to 4 (P =0.005). The score improved significantly after surgery only in the obstructed group compared to the non-obstructed group (P=0.001), however, preoperative IPSS did not correlate with objective treatment results. Patients with no or mild infra vesical obstruction had only minimal improvement of IPSS and Uroflowmetry after surgery proved that Qmax improved and overall patient was satisfied. Normal urinary flow rate in men is 20 to 25 ml/s. If flow rate decreases to 15 ml/s, there is a suspicion of obstruction, but if the flow rate decreases below 10 ml/s then it is stated that a definite obstruction is there. This can be labeled as a case of obstruction distal to bladder neck only if the detrusor power has been assessed urodynamically by cytometry. It is not possible to confirm obstruction only on the basis of decreased urine flow rate. Improvement in flow rate above 15 ml/s was considered success. Urinary flow rate, a very important parameter in diagnosis and comparison with post-operative results, also improved significantly from 7.94 to 26.9 ml/s. A study was conducted by Hakenberg et al. (2003), to assess the value of preoperative symptom score assessment and pressure-flow measurement in men undergoing transurethral prostatectomy (TURP). There were significant improvements in mean IPSS (−10.87 points) and peak flow rate (+ 7.06 mL/s) 3 months after TURP. Clinical decision-making remains a valid instrument for selecting patients for TURP. Both the IPSS and pressure-flow assessment are useful to exclude patients who are unlikely to benefit from TURP. The present results of the preoperative evaluation [Qmax, IPSS, QOL (score), and PMRU], post-operative variables [Qmax , IPSS, QOL(score), and PMRU], and the improvement in these scores were similar to those reported in other published studies (Thomas et al., 2004). In the present study, there was no effect of age, prostate size or severity of symptoms on the outcome of TURP. Also, there was no major complication either preoperatively or in the early post-operative period. Considering the results of the present study, we can say that there is no need to wait until the patient goes into retention of urine and then operate him. If there is indication, the patient fulfills the inclusion criteria and he is willing, then we can operate him for TURP as early as possible. By doing this, he can be saved from psychological trauma of being catheterized and any undue urinary tract infection due to catheterization, and above all of these, he can be saved from deterioration of kidneys (leading to renal failure) due to back pressure of PMRU.

Conclusion

With the present observations, it can be concluded that TURP is very effective even in those patients who present with lower urinary tract symptoms due to BPH without retention of urine. Urologists should not wait if the patient is not responding to the medical treatment. TURP should be done as early as possible to save the patient from undue catheterization and its complications. In the present set up where the socioeconomic situation is not that stable and health insurance is not provided to majority of our patients, early TURP can save the patient from financial burden and psychological trauma.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Ahyai SA, Lehrich K, Kuntz RM (2007). Holmium laser enucleation versus transurethral resection of the prostate: 3-year follow-up results of a randomized clinical trial. European Urology 52:1456-63.

Chughtai B, Forde JC, Thomas DDM, Laor L, Hossack T, Woo HH, Kaplan SA (2016). Benign prostatic hyperplasia. Nature Reviews Disease Primers 2:16031.

Cornu JN, Ahyai S, Bachmann A, DE LA Rosette J, Gilling P, Gratzke C, Mcvary K, Novara G, Woo H, Madersbacher S (2015). A systematic review and meta-analysis of functional outcomes and complications following transurethral procedures for lower urinary tract symptoms resulting from benign prostatic obstruction: an update. European urology 67:1066-1096.

Dmochowski RR (2005). Bladder outlet obstruction: etiology and evaluation. Reviews in Urology 7(6):3.

Donovan JL, Abrama P, Peters TJ, Kay HE, Reynard J, Chapple C, DE LA ROSETTE JMCH, Kondo ONDOA (1996). The ICS–'BPH' Study: the psychometric validity and reliability of the ICSmale questionnaire. British Journal of Urology 77:554-562.

Eckhardt MD, Van Venrooij GE, Boon TA (2001a). Symptoms and quality of life versus age, prostate volume, and urodynamic parameters in 565 strictly selected men with lower urinary tract symptoms suggestive of benign prostatic hyperplasia. Urology 57:695-700.

Eckhardt MD, Van Venrooij GE, Van Melick HH, Boon TA (2001b.) Prevalence and bothersomeness of lower urinary tract symptoms in benign prostatic hyperplasia and their impact on well-being. Journal of urology 166:563-568.

Hakenberg OW, Pinnock CB, Marshall VR (2003). Preoperative urodynamic and symptom evaluation of patients undergoing transurethral prostatectomy: analysis of variables relevant for outcome. BJU international 91:375-379.

Kallenberg F, Hossack OT, Woo H (2011). Long-term followup after electrocautery transurethral resection of the prostate for benign prostatic hyperplasia. Advances in Urology.

Kaya C, Ilktac A, Gokmen E, Ozturk M, Karaman IM (2007). The long-term results of transurethral vaporization of the prostate using plasmakinetic energy. BJU international 99:845-848.

Liu CC, Wang CJ, Huang SP, Chou YH, WU WJ, Huang CH (2004). Relationships between American Urological Association symptom index, prostate volume, and disease-specific quality of life question in patients with benign prostatic hyperplasia. Kaohsiung Journal of Medical Sciences 20:273-278.

Malhotra V (2000).Transurethral resection of the prostate. Anesthesiology Clinics 18:883-897.

Marszalek M, Ponholzer A, Pusman M, Berger I, Madersbacher S (2009). Transurethral Resection of the Prostate. European Urology Supplements 8:504-512.

Mebust WK, Holtgrewe HL, Cockett AT, Peters PC, Writing Committee TAUA (2002). Transurethral prostatectomy: immediate and postoperative complications. Cooperative study of 13 participating institutions evaluating 3,885 patients. The Journal of Urology 141(2):243-247

Meyhoff HH, Nordling J (1986). Long term results of transurethral and transvesical prostatectomy. A randomized study. Scandinavian Journal of Urology And Nephrology 20(1):27-33

Nielsen KT, Christensen MM, Madsen PO, Bruskewitz RC (1989). Symptom analysis and uroflowmetry 7 years after transurethral resection of the prostate. The Journal of Urology 142(5):1251-1253

Patel ND, Parsons JK (2014). Epidemiology and etiology of benign prostatic hyperplasia and bladder outlet obstruction. Journal of the Urological Society of India 30(2):170.

Porru D, Jallous H, Cavalli V, Sallusto F, Rovereto B (2002). Prognostic value of a combination of IPSS, flow rate and residual urine volume compared to pressure-flow studies in the preoperative evaluation of symptomatic BPH. European urology 41(3):246-249.

Porter M, Mccormick B (2003). Anaesthesia for transurethral resection of the prostate. Update in Anaesthesia 16:21-26.

Rajeev TP, Singh Y, Barua SK, Sarma D, Kashyap MP (2018). From gold standard to platinum standard in BPH surgery: a perspective from a tertiary care center of the Indian subcontinent. International Surgery Journal 5:1499-1504.

Rassweiler J, Teber D, Kuntz R, Hofmann R (2006). Complications of transurethral resection of the prostate (TURP)--incidence, management, and prevention. European Urology 50(5):969-980.

Roos NP, Wennberg JE, Malenka DJ, Fisher ES, Mcpherson K, Andersen TF, Cohen MM, Ramsey E (1989). Mortality and reoperation after open and transurethral resection of the prostate for benign prostatic hyperplasia. New England Journal of Medicine 320(17):1120-1124.

Saint S, Greene MT, Krein SL, Rogers MA, Ratz D, Fowler KE, Edson BS, Watson SR, Meyer-lucas B, Masuga M (2016). A program to prevent catheter-associated urinary tract infection in acute care. New England Journal of Medicine 374:2111-2119.

Seki N, Takel M, Yamaguchi A, Naito S (2006). Analysis of prognostic factors regarding the outcome after a transurethral resection for symptomatic benign prostatic enlargement. Neurourol Urodyn 25:428-32.

Speakman MJ (1999). Who should be treated and how? Evidence-based medicine in symptomatic BPH. European Urology 36(Suppl. 3):40-51.

Stage AC, Hairston NJC (2005) . Symptom scores: mumbo jumbo or meaningful measures? Current Prostate Reports 3(3):129-134.

Thomas AW, Cannon A, Bartlett E, Ellis-Jones J, Abrams P (2004). The natural history of lower urinary tract dysfunction in men: the influence of detrusor underactivity on the outcome after transurethral resection of the prostate with a minimum 10-year urodynamic follow-up. BJU international 93(6):745-750.

Tuhkanen K, Heino A, Aaltomaa S, Ala-opas M (2003). Long-term results of contact laser versus transurethral resection of the prostate in the treatment of benign prostatic hyperplasia with small or moderately enlarged prostates. Scandinavian journal of Urology and Nephrology 37(6):487-493.

Van Venrooij GE, Van Melick HH, Eckhardt MD, Boon TA (2008). Diagnostic and predictive value of voiding diary data versus prostate volume, maximal free urinary flow rate, and Abrams-Griffiths number in men with lower urinary tract symptoms suggestive of benign prostatic hyperplasia. Urology 71(3):469-474.

Yang EJ, LI H, Sun XB, Huang L, Wang L, Gong XX, Yang Y (2016). Bipolar versus monopolar transurethral resection of the prostate for benign prostatic hyperplasia: safe in patients with high surgical risk. Scientific Reports 6:21494.

Yang Q, Abrams P, Donovan J, Mulligan S, Williams G (1999). Transurethral resection or incision of the prostate and other therapies: a survey of treatments for benign prostatic obstruction in the UK. *BJU* International 84:640-645.