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A Study on the Correlation Between Clinical Outcome and Residual Prostatic Weight Ratio After Transurethral Resection of Prostate for Benign Prostatic Hyperplasia

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Abstract

Background: Transurethral resection of the prostate (TURP) remains the optimal surgical method to treat benign prostatic hyperplasia (BPH). The effects of the residual prostatic weight ratio (RPWR) on surgical outcome however remain still debatable.

Purpose: The purpose of the given study is to evaluate how RPWR and clinical outcome are related to each other in BPH patients who have had TURP undertaken.

Methods: In the current prospective study, 50 patients with the symptom of BPH-associated LUTS who underwent TURP at King George Hospital during the period between December 2022 and August 2024 were involved. RPWR divided patients into 2 groups of Group 1 (<50 percent) and Group 2 (>50 percent). Before and after the surgery, assessments were conducted on the following variables: IPSS, QOL score, PFR and PVR (post-void residual). Statistical analysis was performed with SPSS 25.

Results: The improvement of PFR was also remarkably greater in Group 1 (n=29) (mean increase: 10.24 ml/s vs 7.48 ml/s , $p<0.001$). Both groups showed significant improvement in IPSS (mean change was 11.72 and 8.47) and QOL (2.03 and 1.91), but statistically it was not significant. PVR was negligible at both groups (29.66 v 32mL).

Conclusion: TURP is effective in the improvement of LUTS in BPH patients whether RPWR is lower or not. However improved urinary flow was noted more in patients with lower level of RPWR (50%), indicating that degree of resection might influence the functional outcomes.

Keywords: TURP, BPH, residual prostatic weight ratio, IPSS, uroflowmetry, quality of life.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a common non cancerous disease afflicting the prostate gland among elderly men, mostly men who are above the age of 50 years [1-5]. This condition arises when glandular and connective tissue increases in the prostate creating nodules that distort the passage of urine through the urethra [1-5]. BPH is the major cause of bladder outflow obstruction (BOO) and lower urinary symptoms (LUTS) in men aged 75 years and older such as urinary frequency, urgency, nocturia, and unbalanced urinary flow [6].

Patients complaining of at least two of the following criteria, including low urinary flow rate (<15 mL/s), moderate to severe LUTS, and International Prostate Symptom Score (IPSS) 8 or greater and prostate volume above 30 mL, can be diagnosed with Clinical BPH [6]. The complex interactions of the hormonal imbalances, age-related physiological alterations, and genetics cause the pathophysiology, and the stimulation of growth of prostate cells occurs by androgens, especially dihydrotestosterone (DHT) [7,8].

BPH is a major worldwide burden to health since it has a prevalence of 20-62 percent amongst men over 50 [10]. There is a 50 percent risk to a man over 50 years and more than 80 percent risk to men who are past 80 years of age to develop BPH [10]. At autopsy, histological signs of BPH are found in 90 percent of men between 81 and 90 years old, whereas LUTS is present in 49 percent of men between 40 and 59, and 77 percent in men older than 80 years [11]. Prevalence BPH in men aged 50 years or older in India is between 25 to 50 percent, and more than half the men exhibit it by 60 years [16].

The untreated BPH may cause severe complications such as bladder stones, urinary tract infections repeatedly, damaged kidneys, hematuria, and chronic kidney disease. Also, BPH is a cause of sexual dysfunction and a decreased quality of life, where symptoms are associated with elevated anxiety and depression similar to other chronic illnesses [9,10].

Although medical management can be used as first-line therapy, surgical therapy is essential in extreme symptoms or to some extent mass obstruction. The most commonly accepted gold standard surgical treatment of BPH is transurethral resection of the prostate (TURP) [15]. The Residual Prostatic Weight Ratio (RPWR) which is a measure of the amount of prostatic tissue having been removed by the incorporation of preoperative prostate weight and that of the resected tissue, may influence the success of TURP.

The conventional prostate size measurement techniques, i.e. digital rectal exam, ultrasonography and cystourethroscopy may be inaccurate in the case of large prostates [11-14]. Even though limited evidence exists on the effect of extent of resection on patient outcomes of TURP, available literature shows inconsistent findings when it comes to the degree of correlation between completeness of resection and relief of symptoms [17-21]. The aim of the study is to assess the aspects of sufficiency of resection during TURP and evaluate the consequences of this intervention on the symptoms of the patients and their functional parameters.

MATERIALS AND METHODS

Study Design and Setting

This is a prospective study that was carried out in the Department of Urology, King George Hospital at Visakhapatnam in India between the month of December 2022 and August 2024. The aim of the study was to determine the relationship that existed between clinical outcomes and Residual Prostatic Weight Ratio (RPWR) when transurethral resection of the prostate (TURP) is performed to treat Benign prostatic hyperplasia (BPH). The approval of the Institutional Ethics Committee was received as well as informed consent of all the participants was collected.

Study Population

They were selected among patients with BPH or acute urinary retention (AUR) caused by BPH who are diagnosed with lower urinary tract symptoms (LUTS) and who are booked to undergo TURP. The exclusion criteria included patients with LUTS that were not clearly attributed to BPH, any complications that included high renal functioning or bladder stones, a possible or proved cancer of the prostate, neurogenic bladder, or postoperative complications, including urinary retention, incontinence, or urethral strictures.

Preoperative Assessment

Extensive clinical history was taken and the type of LUTS and comorbid conditions have been noted. Only routine blood and urine tests were done, and urine cultures were done to guide antibiotics. The plain X-ray KUB and ultrasound KUB were used to evaluate the dilation of the upper tract, the status of the bladder as well as estimate the size of the prostate.

The transabdominal ultrasound was employed to define the prostate weight by a 3.5 MHz probe. Measures on three planes orthogonal to each other (the anteroposterior, transverse and craniocaudal planes) were taken to determine prostate volume which in turn was used to determine prostate weight. The International Prostate Symptom Score (IPSS) and Quality of Life (QOL) index was used in subjective assessment [50]. Uroflowmetry with peak flow rate (PFR) and minimum flow rate (MFR) and post-void residual urine (PVR) were objectively assessed with the exceptions of patients with indwelling catheters because of AUR.

Surgical Procedure

The procedure of TURP was done using spinal anesthesia with the patient in a lithotomy position. Initial cystoscopy has been used to study urethra and the prostate and eliminate the possibility of a bladder stone or malignancy. TURP was done using the 24F resectoscope and monopolar current and glycine irrigant. Time used in total resection was noted. Traction was placed in a 22F three-way Foley catheter following the resection and continuous bladder irrigation of 12 hours was observed. Four days after, catheter removal took place.

The piece of prostatic tissues was laid open, dried, and weighed on the electronic scale rounded off to the nearest integer. RPWR was determined based upon residual prostate weight (estimated preoperative prostate weight - resected weight) divided by the estimated preoperative prostate weight to 2 decimal places.

Follow-up and Outcome Assessment

Follow-up of patients was done after a period of one month (one month follow-up). Individuals with particular postoperative complications were omitted of the final analysis. The assessments analysed in the postoperative group comprised the repetition of the uroflowmetry, IPSS and QOL assessments.

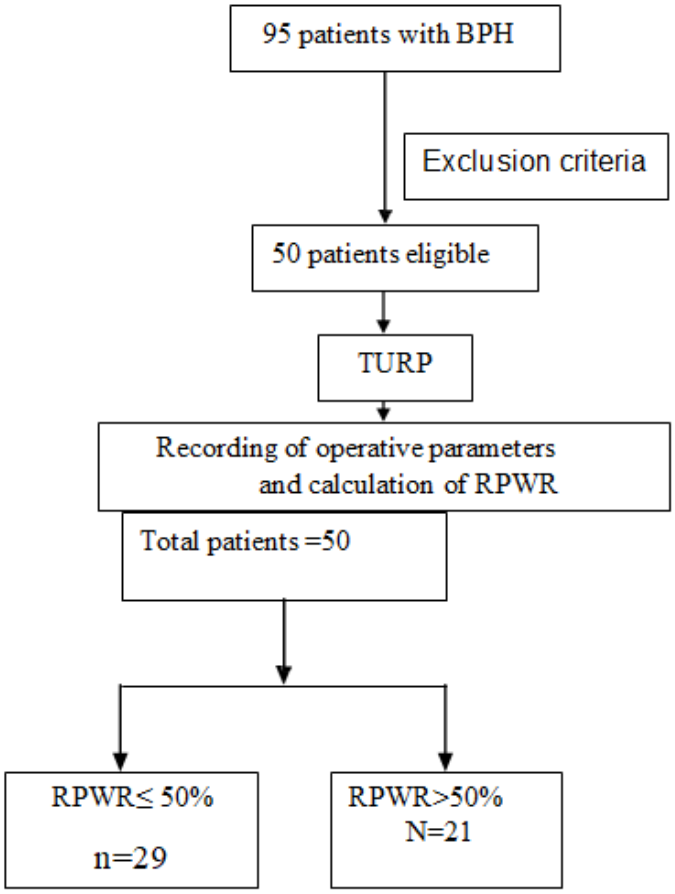
Statistical Analysis

Analysis was done through SPSS version 25. The stratification of patients was done in two groups; group 1 (RPWR <=50%) and group 2 (RPWR >50%). The change at the IPSS scores, QOL indices, PFR, and PVR between groups was compared. All parameters were computed with the means and standard deviations. Chi-square test was used in categorical variables whilst independent t-test in continuous variables. The levels of significance were to be $p<0.05$.

RESULTS

The number of patients on whom TURP was done due to prostatic hyperplasia during the study period totalled 95. Thereof 28 patients were excluded on the basis of predesignated exclusion criteria . Also, 7 patients had urinary retention at recovery subjecting them to exclusion in the study group. In addition to that, 10 patients failed to attend their follow up visit of one month. A set of 50 patients who remained were therefore re-recruited in order to be thoroughly evaluated and studied. Each of the included patients was preoperatively carefully examined and subjected to TURP carried following the technique described above. All resected tissues showed histopathological positive findings that were benign. Perioperative data such as the length of a procedure, the weight of resected tissues, and other problems that occurred during the procedure were registered. A resected weight was calculated to establish the residual prostatic weight and Residual Prostatic Weight Ratio (RPWR).

Patient Stratification



Patient Demographics and Baseline Characteristics

The average age of included population was 62.04 + 4.2 years old and average prostatic weight was 39.98 grams. These patients had significant urinary symptoms preoperatively, results of mean IPSS of 20.30 + 5.82 (range: 10-31) and poor quality of life, a mean of 4.28 + 0.701 (range: 2-5) on the QOL index. The average peak flow rate was 9.44 ± 1.82 ml/s showing considerable bladder outlet obstruction and the average post-void residual volume was 47.00 ± 18.95 ml.

Table 1: Pre operative values of the various parameters-Clinical Measures and Variability in Patients with BPH.

	Mean	SD	Variance
IPSS score	20.30	5.82	34.010
QOL index	4.28	0.701	0.491
Peak Flow Rate	9.44	1.820	3.313
PVR	47.00	18.952	359.184
Mean prostatic weight	39.98		

Patient Stratification

The patients were divided into two groups depending on residual prostatic weight ratio (RPWR) Group 1 (RPWR ≤ 50 ,n=13) and Group 2 (RPWR > 50, n=21). The groups differed in none of the preoperative parameters in any statistically significant manner (Table 1). The average age of Group 1 was 63.14 years relative to 60.52 years in Group 2 (p=0.335). The means of prostatic weight was 39.41 grams and 40.76 grams respectively (p=0.562). As well, there were no significant groups differences among IPSS scores, QOL indices, peak flow rates, and post-void residual volumes (all p>0.05).

Table 2: Preoperative Characteristics by RPWR Group

Parameter	RPWR ≤50% (n=13)	RPWR >50% (n=21)	p-value
Age (years)	63.14 ± 4.2	60.52 ± 3.8	0.335
Prostatic weight (g)	39.41 ± 8.5	40.76 ± 9.2	0.562
IPSS score	21.41 ± 5.9	18.76 ± 5.7	0.113
QOL index	4.17 ± 0.7	4.43 ± 0.7	0.205
Peak flow rate (ml/s)	9.66 ± 1.8	9.14 ± 1.9	0.299
Post-void residual (ml)	45.00 ± 18.2	49.76 ± 19.4	0.386

Overall Clinical Outcomes

All of the patients showed a great clinical improvement at one-month follow-up. The average IPSS score reduced by 51 percent , with the reduction between 20.30 and 9.94. The quality of life increased significantly, and the QOL score diminished 4.28 to 2.30. Peak flow rate rose from 9.44 ml/s to 18.52 ml/s (96 per cent improvement) and post-void residual volume reduced from 47.00 ml to 16.36 ml (65 per cent reduction).

Table 3: Pre- and Post-operative Comparison of Clinical Measures in Patients with Benign Prostatic Hyperplasia.

	Pre-op	Post-op
IPSS	20.30	9.94
QOL score	4.28	2.30
PFR	9.44	18.52
PVR	47.00	16.36

Group-Specific Outcomes

Group 1 (RPWR ≤50%)

Patients with RPWR ≤ 50 percent, exhibited significant positive changes in all parameters. IPSS scores (21.41 to 9.69) dropped by 11.72 on average and the QOL scores (4.17 to 2.14) made a positive change by 2.03 points on average. The proportion of peak flow rate improved by 10.24 ml / s on average (range 9.66 to 19.90 ml / s) and post void residual volume improved by 29.66 ml on average (range 45.00 to 15.34 ml).

Group 2 (RPWR >50%)

Clinical improvement was also well noted in patients with RPWR >50%. A decline in IPSS scores was noted, (18.76 to 0.29), mean improvement: 8.47 points, and QOL scores improved (4.43 to 2.52), mean improvement: 1.91 points. The peak flow rate improved to 16.62 ml/s (mean improvement: 7.48 ml/s) and the post-void residual volume improved to 17.76 ml (mean improvement:32.00 ml).

Table 4: Clinical Outcomes Comparison Between RPWR Groups

Parameter	RPWR ≤50%	RPWR >50%	p-value
ΔIPSS	9.69 ± 2.94	10.29 ± 4.10	0.552
ΔQOL	2.41 ± 0.99	2.52 ± 0.60	0.12
ΔPFR (ml/s)	19.90 ± 2.24	16.62 ± 2.80	<0.001
ΔPVR (ml)	15.34 ± 9.06	17.76 ± 13.44	0.451
Data presented as mean ± standard deviation. ΔIPSS: change in International Prostate Symptom Score; ΔQOL: change in Quality of Life index; ΔPFR: post-operative peak flow rate; ΔPVR: post-operative post-void residual volume.			

Figure 1 :Pre- and Post-operative Comparison of Clinical Measures in Patients with Benign Prostatic Hyperplasia.

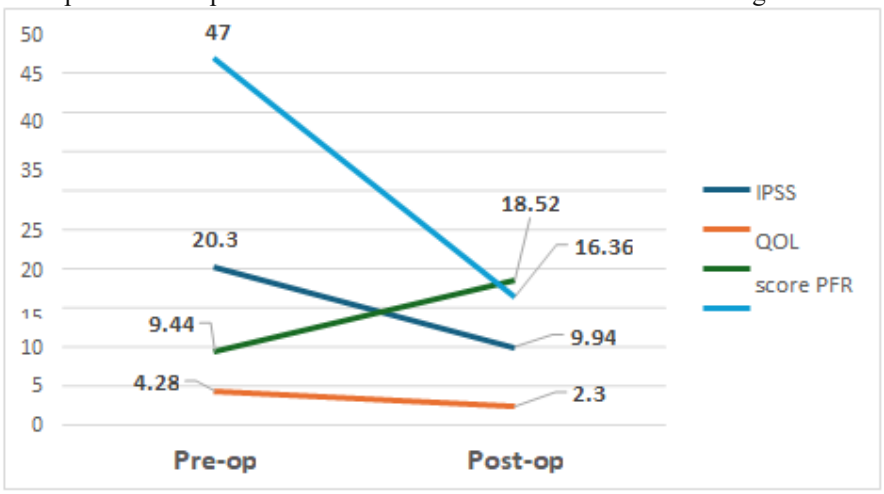


Figure 2 : Improvement in parameters RPWR≤50%.

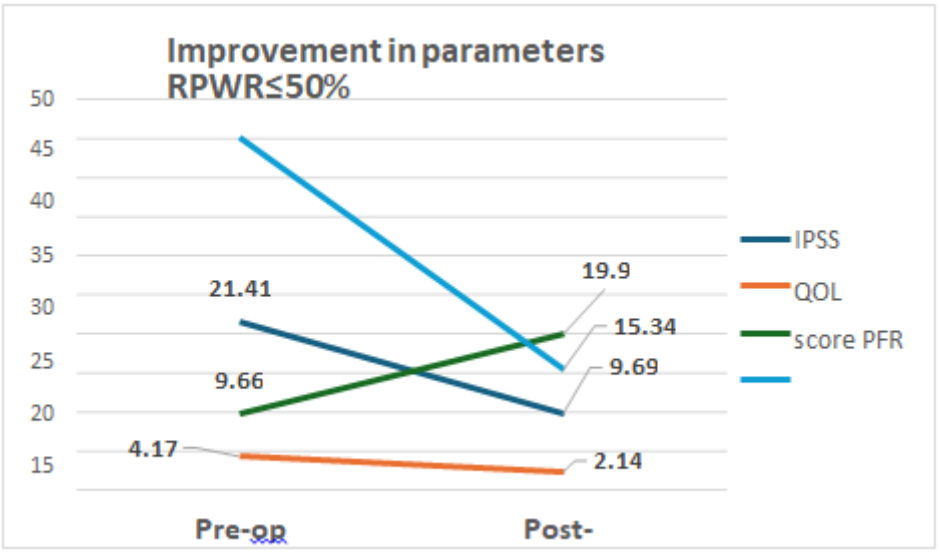
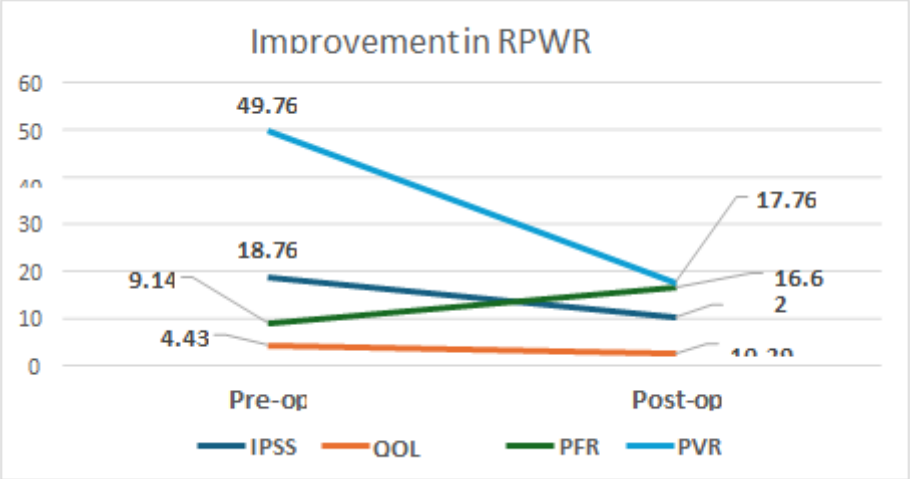


Figure 3 : Improvement in RPWR>50%



Comparative Analysis Between Groups

Statistical analysis using Student t-test was performed and significant differences were noted among groups ($p<0.001$) with Group 1 having the higher results. Mean or average peak-flow rate after surgery was 19.90 ± 2.24 ml/s (Group 1) and 16.62 ± 2.80 ml/s (Group 2).

The improvement of the IPSS score (p=0.552), QOL (p=0.12) and reduction of post-void residual showed no statistically significant variations among groups. However, the group 1 demonstrated the trend towards more IPSS improvement (11.72 vs 8.47 points) and the improvement in the quality of life (2.03 vs 1.91 points).

Table 6: Comparison of Clinical Outcomes between RPWR <50% and RPWR >50% Groups

Parameter	RPWR ≤50% (Mean ± SD)	RPWR >50% (Mean ± SD)	p-value
ΔIPSS	9.69 ± 2.941	10.29 ± 4.101	0.552
ΔQOL	2.41 ± 0.990	2.52 ± 0.602	0.12
ΔPFR	19.90 ± 2.242	16.62 ± 2.801	<0.001
ΔPVR	15.34 ± 9.056	17.76 ± 13.442	0.451
Note: Δ denotes the change (post-op minus pre-op for PFR, pre-op minus post-op for IPSS, QOL, PVR).			

Complications

The study period showed no significant complications whatsoever. To ensure that the primary outcome of RPWR on clinical parameters was focused on, patients that had post-operative complications like urinary retention, incontinence were excluded.

DISCUSSION

Transurethral resection of the prostate (TURP) is considered as a gold standard surgery to treat lower urinary tract symptoms (LUTS) caused by benign prostatic hyperplasia (BPH). The present study confirms this state, which has been proved by considerable post-operatory effects on subjective parameters International Prostate Symptom Score (IPSS) and Quality of Life (QoL) index, as well as on objective analysis parameter of peak urinary flow rate (Qmax) and post-void residual urine volume (PVR). These findings are also supported by a meta-analysis of 20 prospective randomized controlled trials, with up to five years of follow-up whereby it was confirmed that TURP causes improvement of Qmax, low burden of symptoms, and an increase in QoL together with a decline in PVR (Ahyai et al., 2010)[22].

Although TURP has been proven to be an effective method, there is no standard on what is considered to be the best volume of prostatic tissue that should be removed. In 1931 McCarthy gave old historical guidelines recommending resection until bladder could be viewed uninterrupted. Blandy (1978) reinforced the importance of a complete resection of adenomas in the surgical capsule, as Nesbitt also supported complete resection achieving the best results. Nevertheless, modern techniques seek to ensure that the resection does not take more than 60 minutes, more conservative removal is preferred because of the fears of complications.

However in our research in as much as both patients groups improved clinically after surgery, the patients who had a Residual Prostatic Weight Ratio (RPWR) less or equal to 50 percent received more advantages. Group 1 showed the reduction of IPSS mean by 11.72, and group 2 defined 8.47. Although this disparity was not futilely statistical, it addresses in the direction of more radical removal. These findings may need a bigger sample size in order to be ascertained statistically.

Likewise, both groups displayed a two-point increase in QoL, and the majority of patients were satisfied with postoperative results. Group 1 had a significant increase of Qmax (10.24 ml/s) than Group 2 (7.48 ml/s) which was statistically significant ($p <.0001$). This finding implies that a larger portion of the adenomatous tissue resected could relieve the outlet obstruction of the bladder in a better way. Although such hypothesis cannot be universally supported through classical literature, our results can lead to the conclusion that the priority given to Qmax is the main measure of surgical success.

Conversely, alterations in PVR did not differ significantly between the groups ($p = 0.451$), although there was a significant reduction in both of them. The use of PVR as a primary marker of obstruction is less common, although it can

be useful during follow up of patients with using conservative therapy. Such insignificance of the difference can suggest that moderate resection is enough to relieve the incomplete emptying of the bladder.

The correlation between the residual prostate volume and clinical improvement presents conflicting results in the research of comparative literature. Whereas most researchers found the benefit of more radical resection, Chen et al.[17] and Songra et al.[18] documented the superiority of more extensive resection and Aagaard et al.[19] and Hackenberg et al.[21] did not show any correlation. Our results speak in favour of the former with the larger tissue removal, as seen by the lower RPWR, having a beneficial effect on both the flow rate and symptoms.

The comparative results with the other research by B.K. Agrawal et al.[26], Omer Turgut et al.[24], and Alberto A. Antunes et al.[25], are correlated to our findings, especially the ones on the betterment of IPSS, Qmax, and QoL. There was however some difference in the weight of resection and the amount of PSA reduction, and this perhaps could be shown as either different surgical technique, instrument or even the size of the initial gland size.

Additional competency measures with references to the studies by M.C. Songra et al.[18] Y.P.S. Rana et al.[23] Arshad Hassan et al.[27] and Peng Zhang et al.[28], support our conclusion. In these studies, there were marked improvements in both IPSS, Qmax, and QoL regardless of the preoperative prostate volume or age of a patient. Significantly, we found the same result as them on both Qmax and IPSS, but there was statistical difference in some cases.

Limitations

Our research has the limitations that it has a short follow-up period as we only assessed the patients within one month after surgery. There is some evidence that the data represents a continued improvement in the long term, but more prolonged assessment is required. Also there may be a slight error in the estimation of prostate volume since transabdominal ultrasonography is used instead of trans-rectal ultrasound (TRUS). Finally, although PSA usually decreases after TURP, we failed to count PSA after the surgery, a factor that would have provided greater strength to our analysis.

CONCLUSION

TURP is one of the effective methods that are used to deal with symptoms of urinary complaints in BPH patients, as noted in our study. Although significant improvement was observed in the two categories, the group with Residual Prostatic Weight Ratio (RPWR) of 50 percent and below presented a better improvement in flow rate and symptoms alleviation. Higher satisfaction and quality of life on the whole, however, were similar among groups. These results indicate that more comprehensive tissue removal can be advantageous in some parameters such as the peak flow but even the moderate resection has got good clinical outcomes. An extended period of follow up and additional studies will be required to determine the ideal percentage of resection that will give the best patient response.

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