

## Original Research Article

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# Determining the correlation between transition zone index with international prostate symptom score and peak flow rate on clinical outcome after transurethral resection of the prostate in benign prostatic hyperplasia

Nalinikanta Mohanty, Samir Swain, Arshad Hasan\*, Gyanprakash Singh, Datteswar Hota

Department of Urology, SCB Medical College and Hospital, Cuttack, Odisha, India

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**\*Correspondence:**

Dr. Arshad Hasan,

E-mail: arshadsurgery@gmail.com

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## ABSTRACT

**Background:** Benign prostatic hyperplasia (BPH) is a pathologic process which has common contribution to lower urinary tract symptoms (LUTS) in aging men. International Prostate Symptom Score (IPSS) is an important means of assessment in the clinical research of LUTS and BPH. Free flow rates (peak flow rate or Qmax) give an indirect measure for the probability of obstruction whereas subvesical obstruction only can be measured by invasive pressure-flow studies. Among the various surgical or minimally invasive techniques available for BPH like Intraprostatic stents (temporary/permanent), transurethral needle ablation (TUNA), transurethral microwave thermotherapy (TUMT), transurethral electrovaporization of prostate (TUVP), Transurethral incision of prostate (TUIP), lasers (Nd: YAG (Neodymium-doped yttrium aluminium garnet), Ho: YAG (Holmium yttrium aluminium garnet), potassium titanyl phosphate (KTP), diode, thulium laser) etc, transurethral resection of the prostate (TURP) is a safe and effective procedure. Comparison of difference in the pre and postoperative ultrasonic prostatic volume with amount of tissue resected at operation has established the accuracy of the method. The aims of present study are to determine the correlation between transition zone index with international prostate symptom score (IPSS) and peak flow rate (Qmax) on clinical outcome after TURP in BPH patients.

**Methods:** A prospective study was conducted to determine the effect of the extent of tissue resection on symptom improvement after TURP in men and to evaluate any potential correlation between prostate size and outcome.

**Results:** Total of 52 patients studied prospectively. Transitional zone (TZ) index was found to have a significant correlation with the clinical outcome.

**Conclusions:** Symptomatic improvement after TURP will depend on the amount of tissue resected in terms of IPSS and peak flow rates.

**Keywords:** BPH, TZ, LUTS, IPSS, TURP,

## INTRODUCTION

Prostate gland was initially thought to be divided into five anatomical lobes, but now three lobes are recognizable, two lateral and a median lobe. From an anatomical perspective, glandular tissue may be

subdivided into three distinct zones, peripheral (70% by volume), central (25% by volume), and transitional (5% by volume). Most carcinomas arise in the peripheral zone, whereas benign prostatic hyperplasia (BPH) affects the transitional zone. BPH is the most common disorder of the prostate gland. It is one of the major cause of

morbidity in the ageing men. International prostate symptom score (IPSS) is an important means of assessment in the clinical research of lower urinary tract symptoms (LUTS) and BPH.<sup>1</sup> Various surgical or minimally invasive techniques for BPH like intraprostatic stents (temporary/ permanent), transurethral needle ablation (TUNA), transurethral microwave thermotherapy (TUMT), transurethral electrovaporization of prostate (TUVP), Transurethral incision of prostate (TUIP), lasers (Nd: YAG (Neodymium-doped yttrium aluminium garnet), Ho: YAG (Holmium yttrium aluminium garnet), potassium titanyl phosphate (KTP), diode, thulium laser) etc, are available for prostatic surgery but transurethral resection of the prostate (TURP) has remained the gold standard and it is a safe and effective procedure.<sup>2</sup> Presently, the outcome of TURP is assessed in terms of symptom improvement as well as improvement in lower urinary tract function measured by uroflowmetry. Changes in prostate volume on TRUS before and after TURP were reported previously, but no studies have assessed the correlation between prostate size and outcome after TURP.<sup>3</sup> In the present study, the estimated weight of adenoma by transrectal ultrasonography (TRUS) was closely to the weight of the surgical specimen after TURP.

## METHODS

A prospective study was conducted in 52 patients in our department between January 2017 to March 2019. All symptomatic BPH patients who were planned for TURP included in the study. Patients with prostatic malignancy & BPH patients who can be managed conservatively were excluded. Detail clinical history, physical examination, pre- & post-operative (after 16 weeks) IPSS score were recorded. All baseline investigations, including serum prostatic serum antigen (PSA), TRUS, uroflowmetry ( $Q_{max}$ ), & histopathological examination (HPE) of the resected prostate done. TURP of the symptomatic BPH patients done. The catheter is kept on traction with continuous bladder irrigation for 12 to 24 hours. The resected specimen is sent for HPE. The catheter is usually removed on 3<sup>rd</sup> to 5<sup>th</sup> day. The patient is discharged subsequently & followed on Outdoor Patient Department basis for a minimum of atleast 16 weeks.

### Statistical analysis

The clinical outcome will be evaluated by the difference ( $\Delta$ ) in IPSS score and  $Q_{max}$  before and 16 weeks after surgery. Correlation analysis & the paired t-test will be used for statistical assessment & will be considered significant at  $p<0.05$ .

The data collected was stored in Microsoft excel 2013 © Microsoft office. The data thus collected was statistically analyzed using descriptive statistics by SPSS version 16 at the end of study and presented as results. Continuous variables were expressed as either the mean  $\pm$  standard

deviation or median. All statistical outcomes were presented at 95% confidence intervals based on a two-sided test.

### Ethical aspects

The study was cleared by the departmental ethical committee. An informed consent was taken before enrolling the patient for the study.

## RESULTS

Patients of BPH, not responding to medical management were admitted for definitive management in the form of TURP. Total of 52 patients were studied prospectively. BPH is a disease of elderly males & all patients reported to us are either middle aged or elderly with maximum number from the age group of 56-60 years (26.9%) and mean age i.e. 62.1 yrs. Other base parameters illustrated in Table 1.

**Table 1: Basic parameters of patients included in the study.**

| Base parameters                    | Mean   |
|------------------------------------|--------|
| <b>Age</b>                         | 62.1   |
| <b>Hb level</b>                    | 12.0   |
| <b>TLC (Total leukocyte count)</b> | 7644.2 |
| <b>Blood urea</b>                  | 33.6   |
| <b>Serum creatinine</b>            | 1.2    |
| <b>Pus cell in urine R/M</b>       | 5/hpf  |
| <b>Pre-op IPSS</b>                 | 21.42  |
| <b>Post-op IPSS</b>                | 12.04  |
| <b>Pre-op Qmax</b>                 | 9.21   |
| <b>Post-op Qmax</b>                | 16.15  |
| <b>Pre-op serum PSA</b>            | 4.04   |
| <b>Post-op serum PSA</b>           | 3.1    |
| <b>TZ volume before TURP</b>       | 41.8   |
| <b>TZ volume after TURP</b>        | 15.7   |
| <b>PV before TURP</b>              | 62.6   |
| <b>PV after TURP</b>               | 31.9   |
| <b>TZI before TURP</b>             | 0.512  |
| <b>TZI after TURP</b>              | 0.444  |

All patients evaluated clinically preoperatively & 16 weeks postoperatively, based on International Prostate Symptom Score (IPSS). Preoperatively, majority of patients (57.7%) presented with a high IPSS (20-35) with 20 out of 30 such patients presenting with Acute Urinary Retention (AUR) & needed catheterization. Rest of the patients with IPSS between 8-19 were taken for surgery as they are not satisfied with medical management. When assessed postoperatively after 16 weeks of surgery, all patients have a significant improvement (IPSS <20) in their symptoms with maximum benefit in those having large prostatic volume preoperatively. Preoperative Mean IPSS was 21.42 while it improved to 12.04 postoperatively with  $\Delta$ IPSS=9.38 and is found to be significant at  $p<0.05$  (Table 1 and 2).

**Table 2: Difference in IPSS, Qmax, TZI and prostatic volume before and after treatment.**

|               |   | Paired differences |                | 95% confidence interval of the difference |        | Significance (2-tailed) |
|---------------|---|--------------------|----------------|---|--------|-------------------------|
|               |   | Mean               | Std. Deviation | Lower                                     | Upper  |                         |
|               |   |                    |                |   |        |                         |
| <b>Pair 1</b> | Preop IPSS - Postop IPSS ( $\Delta$ IPSS)     | 9.38               | 2.242          | 8.765                                     | 10.004 | <0.001                  |
| <b>Pair 2</b> | Post op Qmax -Pre op Qmax ( $\Delta$ Qmax )   | 6.942              | 3.121          | 7.811                                     | 6.073  | <0.001                  |
| <b>Pair 3</b> | Pre op Sr PSA-Post op Sr PSA                  | 0.94               | 0.787          | 0.717                                     | 1.155  | <0.001                  |
| <b>Pair 4</b> | TZ index before TURP - TZ Index after TURP    | 0.068              | 0.083          | 0.044                                     | 0.091  | 0.001                   |
| <b>Pair 5</b> | Pros. Vol. before TURP - Pros Vol. after TURP | 30.64              | 5.025          | 29.255                                    | 32.053 | <0.001                  |

When assessed objectively for peak flow rate preoperatively on Uroflowmetry, majority of patients (67.3%) have a low Qmax (<10 ml/s) consistent with their symptomatology (IPSS) except Qmax of 20 patients who presented in AUR as uroflowmetry is not feasible in them. Almost all patients (98.1%) have a significant improvement 16 weeks postoperatively. The mean Qmax in preoperative time was 9.21 ml/s while it was 16.15 ml/s postoperatively with  $\Delta$  Qmax of 6.942 ml/s which is significant at  $p<0.05$ .

Serum PSA of all patients was done to rule out carcinoma prostate and to evaluate any variability peri-operatively. It was observed that majority (57.7%) of patients have preoperative serum PSA levels in the range of 4.1-10 ng/ml. The mean PSA in preoperative time was 4.04 while in postoperative time it was 3.10 with  $\Delta$  PSA=0.94 ng/ml which is significant at  $p<0.05$ .

All patients underwent TRUS preoperatively and 16 weeks postoperatively to ascertain the dimensions of transition zone of prostate and whole prostate gland for calculation of their respective volumes, TZ index. It was observed that preoperatively majority of patients (67.3%) have a TZ volume of >30.1 gms and total prostate volume (59.1%) in the range of 50-70 gm with mean.

Index of 0.512 and TPV of 62.63 gm. Postoperatively (16 weeks after TURP), 61.5% have TZ volume in the range of 10.1-20 gm with prostate volumes of 30.1-50 gm and <30 gm in 50% and 40.38% respectively with mean TZ.

0.444 and TPV of 31.98 gm. When calculated, the difference in TZI (0.068) and total prostate volume (30.64 gm) respectively are found to be significant at  $p<0.05$ . When calculated the correlation coefficient 'r' (a measure of linear relationship between two variables) of TZI with symptom score ( $r=0.007$ ,  $p<0.952$ ) and peak flow rate ( $r=0.200$ ,  $p<0.155$ ), it was found to be weakly correlated.

## DISCUSSION

BPH is one of the common disorder in men of more than 60 years of age. Rhodes et al, based on TRUS, calculated that the growth of the prostate in men with BPH in the age group of 40 to 79 years was estimated to be about 0.6 ml per year or 6 mL per decade of life.<sup>4</sup> However, prostate growth followed an exponential growth pattern with a slope estimate of 0.4 ml per year for men aged 40 to 59 years at baseline and of 1.2 ml per year for those 60 to 79 years at baseline. Patients with LUTS are clinically evaluated according to a standardized symptom severity and frequency questionnaire (i.e.; IPSS); the degree of prostatic enlargement as measured by TRUS, or MRI and lastly by the presence and degree of BOO as measured by flow rate recordings (uroflowmetry) or invasive pressure flow studies. Prostate volume measured by TRUS then height is more accurately determined by transaxial than by midsagittal scanning.<sup>5</sup> Park et al did a study to determine, when measuring prostate volume by TRUS, whether height is more accurately determined by transaxial or midsagittal scanning.<sup>5</sup> Using prostate ellipse volume calculation (height  $\times$  length  $\times$  width  $\times$   $\pi/6$ ), TRUS prostate volume was determined, and was compared with the measured volume of the specimen. Prostate volume measured by TRUS, regardless of whether height was determined transaxially or midsagittally, correlated closely with real specimen volume.

Bapat et al in a prospective study compare the relationship between changing bladder volumes to the volume of prostate.<sup>6</sup> They concluded that measurement of prostate volume increases with increase in bladder volume and calculated prostate volume at minimal bladder capacity (100-200 ml) was found to be the closest to the volume calculated by TRUS.

Kang et al conducted an assessment of the efficacy of transurethral resection of the prostate (TURP) and the improvement in the international prostate symptoms score (IPSS).<sup>7</sup> Park et al evaluated the effect of the ratio

of resected tissue in comparison with the transitional zone volume (TZV) on improvement of voiding symptoms and flow rate.<sup>8</sup> Higher PSA levels are observed in patients with enlarged prostate & those presenting in AUR. Gupta et al found similar relationships in Asian men; however, in general both prostate volume and serum PSA tend to be lower.<sup>9</sup> Canto et al, examined relationships between other PSA-derived parameters and certain subforms of PSA (BPSA) & found it to be strongly related to BPH compared with total serum PSA values.<sup>10</sup>

Antunes et al assessed the impact of the percent of resected tissue on the improvement of urinary symptoms.<sup>11</sup> Although weak correlations between prostate volume and symptoms as well as flow rate have been accepted, recently attention focused on correlations between the transition zone of the prostate and physiologic measures.

A prospective study conducted by Milonas et al. to establish the influence of operative parameters on outcomes after transurethral resection of the prostate.<sup>12,13</sup> Chen et al assessed in a prospective study the use of a new variable, the residual prostatic weight ratio (RPWR), for evaluating the clinical outcome after transurethral resection of the prostate (TURP).<sup>14</sup> There was a negative correlation between the RPWR and the Delta AUA, Delta Qmax and Delta Qave. Songra et al after a study of 50 patients (mean age 62.6 yrs, range 50-91) of symptomatic BPH who underwent TURP, concluded that there was a significant improvement in AUA score, Qmax and Qavg postoperatively.<sup>15</sup> Oranusi concluded that Correlation between IPSS and Qmax was negative but statistically significant which implies that an inverse relationship exists between IPSS and Qmax, and remains the only important parameter in uroflowmetry.<sup>16</sup>

Jiang et al showed when used together, IPSS, TPV and Qmax increase the PPV and +LR of BOO.<sup>17</sup> This result suggests that IPSS V/S ratio can be used to differentiate between patients with bladder outlet-related LUTD and bladder-related LUTD and that it is a more useful diagnostic tool than IPSS-T in assessing male BOO. IPSS-V/S>1 is a stronger predictor of bladder outlet-related LUTD than IPSS-T.

Roy et al in their study, observed that the visual prostate symptom score (VPSS) correlates significantly with the IPSS to quantify LUTS due to BPH.<sup>18</sup> The VPSS can be used instead of the IPSS for the assessment of symptom severity in men with LUTS, who are illiterate or have limited education.

## CONCLUSION

Symptomatic improvement after TURP will depend on the amount of tissue removed. TZ Index was found to be correlated with the clinical outcome in terms of IPSS & Peak flow rates.

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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the Institutional Ethics Committee

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