RELATIONSHIP BETWEEN TZI AND TZV WITH IPSS, QMAX, AND BOO

[1]Paksi Satyagraha, [1]Tarmono, [1]Soetojo, [2]Budiono.

[1]Department of Urology, Faculty of Medicine/Airlangga University, Soetomo Hospital, Surabaya, Indonesia.
[2]Department of Community Health Sciences, Faculty of Medicine/Airlangga University, Soetomo Hospital, Surabaya, Indonesia.

ABSTRACT

Objective: *This study evaluate the relationship between the IPSS score, Qmax, and degree of bladder outlet obstruction with transitional zone volume (TZV) and transitional zone index (TZI) in clinical BPH patient.* ***Material & Methods:*** *This is an observational cross sectional study which 26 patients included with clinical BPH between September 2011 until January 2012. General information and other variables are recorded (total prostate volume, TZV, TZI, IPSS score, Qmax and degree of bladder outlet obstruction (BOO) according to Schaefer normogram. The data will be descriptive and analytically analyzed.* ***Results:*** *26 patients with clinical BPH are included in this study, with average age is 64,7 (± 5,98) years. The average volume of the total prostate volume and TZV are 30,35 (± 15,35) gram and 15,31 (± 11,77) gram. Meanwhile the average of TZI is 0,4 (± 0,13). After the normal distribution test was performed, all data is analyzed with Pearson correlation test. A strong correlation was found between IPSS and total prostate volume (r = 0,526, p = 0,006), TZV (r = 0,671, p = 0,000) and TZI (r = 0,812, p = 0,000). A strong correlation is also found between TZI and BOO (r = 0,560, p = 0,003). Meanwhile weak correlation is found between Qmax and total prostate volume (r = -0,105, p = 0,608), TZV (r = - 0,103, p = 0,616) and TZI (r = - 0,084, p = 0,734). Another weak correlation is shown between total prostate volume (r = 0,233, p = 0,253) and TZV (r = 0,37, p = 0,062) with degree of BOO according to Schaefer nomogram.* ***Conclusion:*** *TZV has significant correlation with IPSS score, but no significant correlation with Qmax and degree of BOO in patients with clinical BPH. Meanwhile TZI has a significant correlation with IPSS and degree of BOO in patients with clinical BPH. TZI could be performed as a single non invasive procedure to determine BOO in patients with clinical BPH.*

Keywords: *Prostatic hyperplasia, transition zone, ultrasonography, urodynamic.*

ABSTRAK

Tujuan Penelitian: *Penelitian ini mengevaluasi hubungan antara IPSS score, Qmax, dan derajat bladder outlet obstruction dengantransitional zone volume (TZV) dan transitional zone index (TZI) pada pasien BPH.* ***Bahan & Cara:*** *Penelitian ini adalahcross sectional study yang mengikutsertakan 26 pasien BPH, dilakukan antara bulan September 2011 sampai Januari 2012. Informasi umum dan variabel tambahan dicatat (total volume prostat, TZV, TZI, skor IPSS, Qmax dan derajat bladder outlet obstruction (BOO) berdasarkan nomogram Schaffer). Data dalam penelitian ini adalah deskriptif dan dianalisa secara analitik.* ***Hasil Penelitian:*** *26 pasien BPH dengan rerata umur 64,7 (± 5,98) tahun. Rerata volume ukuran prostat dan TZV adalah 30,35 (± 15,35) gram dan15,31 (± 11,77) gram. Sementara rerata TZI adalah 0,4 (± 0,13). Setelah tes distribusi normal dilakukan, semua data dianalisa dengan tes korelasi Pearson. Terdapat hubungan yang signifikan IPSS dan total volume prostat (r = 0,526, p = 0,006), TZV (r = 0,671, p = 0,000) dan TZI (r = 0,812, p = 0,000). Hubungan yang signifikan juga ditemukan antara TZI dan BOO (r = 0,560, p = 0,003). Sementara hubungan yang tidak signifikan ditemukan antara Qmax dan total volume prostat (r = -0,105, p = 0,608), TZV (r = -0,103, p = 0,616) dan TZI (r = - 0,084, p = 0,734). Hubungan yang tidak signifikan juga ditemukan antara total volume prostat (r = 0,233, p = 0,253) dan TZV (r = 0,37, p = 0,062) dengan derajat BOO berdasarkan nomogram Schaffer.* ***Simpulan:*** *TZV memiliki hubungan yang signifikan dengan skor IPSS, tapi tidak terdapat hubungan signifikan dengan Qmax dan derajat BOO pada pasien BPH. Sementara TZI memiliki hubungan yang signifikan dengan IPSS dan derajat BOO pada pasien BPH. TZI dapat dilakukan sebagai prosedur non invasif tunggal untuk menentukan BOO pada pasien BPH.*

Kata kunci: *Prostatic hyperplasia, zona transisi, ultrasonografi, urodinamika.*

Correspondence: Paksi Satyagraha, c/o: Department of Urology, Faculty of Medicine/Airlangga University, Soetomo Hospital. Jl. Mayjen. Prof. Dr. Moestopo 6-8, Surabaya 60286, Indonesia. Phone: +62-31-5501318. Mobile phone: 081802280049.

INTRODUCTION

Prostate volume has been used a parameter in determining diagnosis and therapy in patients with clinical BPH. However, total prostatic volume which is an objective measure for BPH is not always related to these verity of lower urinary tract symptoms (LUTS) or other physiological parameters.[1]

McNeal divided prostate gland in several zones, which are the peripheral, central, transitional, anterior fibromuscular, and periurethral zone. Seventy percent of the total volume of an adult male prostate is peripheral zone, 25% central zone, the other 5% is transitional zone. Most prostatic hyperplasia are found within the transitional zone, while the growth of prostate carcinoma as mostly originate from the peripheral zone. Greene et al reported that sonographic measurement and transitional zone volume (TZV) correlated with aging and clinical evidence of BPH. However, in that study parameters for evaluating BPH, that is symptoms, urine flow and urodynamics, were not reported. In addition, the relationship of the transitional zone relative to whole prostate volume was not delineated.[1-6]

The TZ index, that is the ratio of TZV to TV of the prostate, was reported by Kaplan et al in 61 patients to have a stronger statistically significant correlation with symptoms (r = 0,75, p = 0,001) and maximum urine flow (r = -0,71, p = 0,001) than with prostate volume alone.[7] Two other studies that was conducted by Kurita and Milonas have reported significant differences between patients with LUTS compared to BPH patients with urinary retention, and concluded that TZI can be used as a fairly accurate predictor to define risk of urinary retention, as treatment basis, either medical treatment or surgery.[8,9]

A study in Indonesia has already been done in determining the correlation between TZV, TZI, and TV with IPSS prostate, it that there is a significant correlation between TZV and TZI to the IPSS. Thus, came to the conclusion, degree of obstruction in patients with BPH are predictable based on the amount of TZI.[10]

However, not all studies have similar result, several other researchers such as Witjes et al from the Netherlands, Lepor et al in the United States and Francoisi et al in Brazil showed weak association between prostate TV, TZV, and LUTS complaints. Witjes et al investigated 150 patients using prostatic volume, TZ index and pressure flow studies, and failed to note any significant relationships. They believed that none of these parameters used alone was sufficient to diagnose bladder outlet obstruction (BOO). Lepor et al also reported that total prostate volume and TZ dimensions correlate poorly with symptoms and have inadequate correlations with BOO for clinical usefulness. Meanwhile Francoisi et al found low correlation between the score lower urinary tract symptoms assessed by IPSS and the different volumes of the prostate gland (TV, TZV) and prostate TZI, and, on the other hand, an inverse correlation between the intensity of urinary symptoms and QoL, supporting the idea of multifactorial aspects related to the pathogenesis of urinary symptoms in men. From these studies show that TZI is insufficient alone to provide the diagnosis of BOO.[11-13]

OBJECTIVE

This study evaluate the relationship between the IPSS score, Qmax, and degree of bladder outlet obstruction with transitional zone volume (TZV) and transitional zone index (TZI) in clinical BPH patient.

MATERIAL & METHOD

A cross sectional observational study of 26 clinical BPH patients between September 2011 until January 2012 (4 months) in the Outpatient Urology Clinic of Soetomo Hospital Surabaya. Inclusion criteria for this study were patients with BPH and LUTS with age over 50 years old and willing participate this study. While the exclusion criteria were patients clinically suggestive of prostate malignancy (PSA > 4 ng/dl) or bladder malignancies, patients who received alpha-blockers, 5α reductase inhibitor therapy, or previous prostate surgery. This study also excluded BPH patients with one or more abnormalities such as bladder stone, urethral stones, urethral strictures, diabetes mellitus, and neurological disorders. Data was analyzed descriptively and analytically. Prior to hypothesis testing, Kolmogorov-Smirnov test was performed for assessment of normal distribution. The relationship between TZV and TZI to IPSS, uroflowmetry, prostate volume and the degree of BOO were examined using the correlation tests.

RESULTS

We found the youngest patient was 53 years old and the oldest was 78 years old (table 1), with the

mean age was 64,7 (± 5,98) years old. Nine patients (34,6%) came with mild complaints, 8 people (30,8%) came with moderate and the other 9 (34,6%) came with severe symptoms. Meanwhile, the mean IPSS in the study was15,15 (± 8,03). From the results we found 13 patients (50%) with maximum flow rate (Qmax) lower than 10 ml/sec, 11 patients (42,3%) with Qmax 10 – 15 ml/s and 2 patients (7,7%) with Qmax more than 15ml/sec. Meanwhile the Qmax in this study was 9,59 (± 3,41) ml/s. The urodynamic studies showed 6 patients (23,1%) with grade II BOO, 7 patients (26,7%) with grade III BOO, 6 patients (23,1%) with grade IV BOO, 6 patients (23,1%) with grade V BOO, and 1 patient (3,8%) with grade VI BOO. This research has excluded patients with pathological urodynamic results other than BOO. TRUS examinations were performed and mean result of TV, TZV of the prostate are 30,35 g (± 15,35), 15,31 g (±11,77). Meanwhile the mean value of TZI is 0,4 (± 0,13).

Before correlation test performed to analyzed the data in this research, we performed the Kolmogorov-Smirnov test for normal distribution sample test. Results showed the variables are normally distributed, so the correlation test used in the study was Pearson correlation test.

The study examined the correlation between IPSS score with TV, TZV, and TZI. Using Pearson correlation analysis, a significant correlation between total IPSS with TV (r = 0,526, p = 0,006), TZV (r = 0,671, p = 0,000) and TZI (r = 0,812, p = 0,000) is found. In addition to the total score of IPSS, this study also performed correlation analysis between irritative and obstructive IPSS score with TV, TZI and TZV. All of this variables showed statistically significant correlation with IPSS (table 2).

The study also analyzed the correlation between Qmax with TV, TZV and TZI. Table 3 shows that there were no significant correlation between Qmax with TV (r = -0,105, p = 0,608), TZV (r = -0,103, p = 0,616) and TZI (r = -0,084, p = 0,734).

Tabel 1. General data research sample (n = 26).

	Minimum	Maximum	Mean	SD
Age	53	78	64,7	5,98
IPSS				
• Irritative	1	12	6,5	3,30
• Obstructive	1	19	8,8	5,53
• Total	4	31	15,2	8,03
Total Prostat Volume	20,24	87,42	35,05	15,35
Transisional Zone Volume	5,38	56,16	15,31	11,77
Transisional Zone Index	0,18	0,64	0,4	0,13
Qmax	3,40	15,7	9,59	3,41
BOO	2	6	3,58	1,21

Table 2. Correlation between TV, TZV, and TZI with IPSS (n = 26).

	TV	TZV	TZI
Iritative IPSS			
• Pearson Correlation	0,504	0,598	0,645
• Sig (2-tailed)	0,009	0,001	0,000
Obstructive IPSS			
• Pearson Correlation	0,441	0,594	0,761
• Sig (2-tailed)	0,024	0,001	0,000
Total IPSS			
• Pearson Correlation	0,526	0,671	0,812
• Sig (2-tailed)	0,006	0,000	0,000

Table 3. Correlation between TV, TZV, and TZI with Q max (n = 26).

	TV	TZV	TZI
Qmax			
• Pearson Correlation	-0,105	-0,103	-0,084
• Sig (2-tailed)	0,608	0,616	0,734

Table 4. Correlation between TV, TZV, and TZI with BOO (n = 26).

	TV	TZV	TZI
BOO			
• Pearson Correlation	0,233	0,371	0,560
• Sig (2-tailed)	0,252	0,062	0,003**

** Significant correlation on level 0,01 (2-tailed)

A significant correlation was found between TZI with BOO (r = 0,560, p = 0,003). Additionally there were correlation but not statistically significant between BOO with TV (r = 0,233, p = 0,253), and TZV (r = 0,371, p = 0,062) (table 4).

DISCUSSION

Twenty six patients included in this study, the youngest was 53 years old, and the oldest was 78 years old. Overall mean age was 64,77 (± 5,98) years old. The similar group of age is obtained from the patients that were included to this study compared to the prevalence of BPH, 20% in 41-50 years old male, 50% in 51-60 years old male, and 90% in male older than 80 years old.[14]

Patients that were included in this research present with one of three categories of IPSS, 9 (34,6%) with mild category, 8 (30,8%) moderate, and 9 (34,6%) severe. Instrument recommended to assess clinical presentation of BPH with LUTS is IPSS; however, scores obtained by this instrument were often different from reality. Patients were able to mention the quantity of nocturia experienced correctly, but more likely to exaggerate frequency experienced from morning until afternoon, and score for intermittency and weak urine flow were often not similar to true events in IPSS scoring by the patients themselves.[15]

Data on maximum urine flow showed that 13 patients (50%) with Qmax < 10 ml/s, 11 patients (42,3%) with Qmax 10-15 ml/s, and only 2 (7,7%) with Qmax > 15 ml/s. Free uroflowmetry examination by Qmax was once thought to be the only examination to determine BOO, although interpretation is difficult especially in cases of BPH with detrusor overactivity.[16] Moreover, weak urine flow alone is nonconclusive as a diagnostic symptom of BOO, due to the fact that 25-30% of cases are caused by detrusor hypocontractility. Other study found that a normal urine flow, or even higher than normal flow (⩾ 15 ml/s), 7% had proven to be obstructive. One research suggests that maximum urine flow rate does not have a significant high sensitivity and specificity. A study in 1998 was conducted by the International Continent Society on BPH. It shows that Qmax value has sensitivity of 70% and 47% of specificity in determining BOO. This research also shows that Qmax less than 10 ml/s only corrects on positive predictive value as much as 10%, thus free uroflowmetry can not be used as single instrument to diagnose BOO.[16-20]

Another variable recorded in this study was the degree of BOO which was done through examination of urodynamics pressure flow study and then interpreted based on the degree of obstruction according to Schaffer nomogram. There were no patients who came without obstruction, 19 patients (73,1%) had mild–moderate obstruction, and other 7 patients (26,9%) came with severe obstruction.

Twelve (46,2%) subjects had 20-29 cc prostate volume. Nine patients (34,6%) had a 30-39 cc volume, and 5 patients (19,2%) had > 40 cc volume. After measuring the TZV, TZI then determined. The lowest TZI was 0,18 and the highest was 0,64. Majority of the research sample, 19 (70,1%) patients, had < 0,5 TZI, and 7 (26,9%) other patients had > 0,5 TZI. In this study, a significant correlation found between TZV with TV (p = 0,000) and was found between TZI with TV (p = 0,001). A study shows that in patients with BPH LUTS, TZI of more than 0,50 significantly shows the worsening of clinical symptoms, maximum urinary stream and detrusor pressure.[7]

This research looks for the relationship between IPSS with TV, TZV, and TZI. From statistical tests, a significant relationship found between these variables (p < 0,05) (table 2). Complaints of LUTS in patients which included in this study, the obstructive, irritative and total, have increased in accordance to the increase in TV, TZV, and TZI. These results are similar to a study performed in 2004, which evaluated the relationship between prostate TZV, TZI, and TV with IPSS. From 49 men with LUTS complaints caused by BPH in this study, obtained a significant relationship between increasing of TZV, TZI, and prostate volume with increasing number of IPSS. But, this study only assessed relationship of TZV and TZI

with subjective complaints without comparing other BPH clinical variables.[10] Another study analyzed relationship between TZV and TZI with IPSS and found stronger relationship between TZV with IPSS (r = 0,48, p = 0,03) and also between TZI with IPSS (p = 0,001; r = 0,75).[7] The strong relationship between TZI and IPSS are also shown in studies conducted by Lee et al. From the 58 patients with BPH who underwent TURP, a significant correlation was found between TZI by IPSS (p = 0,0001; r = 0,3652).[21]

In addition to assess the relationship with the IPSS, Qmax was also considered to have correlations with TV, TZV, and TZI. In this study 50% of sample had Qmax < 10 cc/sec. From the correlation test using the Pearson test, we found that there were a weak correlation between the TZV with Qmax (r = -0,103, p = 0,616) and TZI (r = - 0,084, p = 0,734) but this result was not statistically significant.

There are still various data in in determining the relationship between TZV and TZI to Qmax through free uroflowmetry in previous studies. Our results are similar to previous study conducted by Lepor and Witjes et al, which found a weak relationship between TZV and TZI to Qmax. While Lee et al have found no significant relationship between TZI not the Qmax (p = 0,79) in 58 men who underwent TURP.[21] But from these studies the cause of the differences that occur with the preliminary study conducted by Kaplan et al is who found a strong correlation between TZV and TZI to Qmax is inconclusive. [7,12,13]

The correlation test which was done between TZI with BOO by urodynamic examination of pressure-flow study and Schaeffer's diagram showed a significant correlation between TZI with BOO (r = 0,560, p = 0,003). There are also a relationship between TV (r = 0,233, p = 0,252) and TZV (r = 0,371, p = 0,062) with BOO but not statistically significant (table 4).

Literature mentioned that TV of the prostate can not be used as a single examination to determine BOO. A retrospective study in 521 men showed poor relationship between prostate volume with BOO.[1] Because of the study, then several methods performed to refine the diagnosis of BOO in patients with BPH. TZI prostate showed a fairly strong relationship with BOO in 61 men with clinical parameters of BPH. This study also showed that the complaints of clinical BPH was significantly elevated in patients with TZI of more than 0,50.[7] Some researchs about TZI on BPH LUTS patients and urinary retention also show thatTZI has a significant correlation with clinical parameter of BPH and could be the predictor for urinary retention and therapy outcomes.[8,9,21]

There are different results concerning the correlation of TZI with some clinical parameters of BPH,[10-12] but the controversy might be caused by differences in research methodology used in choosing sample studies. Besides, the was multifactorial cause of LUTS which became one of the factor responsible for differences of the result. However, the consistency of inclusion and exclusion criterias could add a value to this research, although the research has smaller sample than the others.

CONCLUSION

TZV has correlation with IPSS score, but the correlation was not significant with Q max and BOO degree in BPH patient with LUTS. TZI has correlation with IPSS score and BOO degree, but not significant with Q max in BPH patient with LUTS. TZI could be performed as a single non invasive examination in clinics to determine the BOO in BPH patients with LUTS.

REFERENCES

1. Belal M, Abrams P. Noninvasive methods of diagnosing bladder outlet obstruction in men. Part 1: Nonurodynamic Approach. J Urol. 2006; 176: 22-8.
2. Brooks JD, Chung BI, Sommer G. Anatomy of the lower urinary tract and male genitalia. In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, editors. Cambpbell-Walsh Urology. Philadelphia: Elsevier Saunders; 2012. p. 56-9.
3. Greene DR, Egawa S, Hellerstein DK, Scardino PT. Sonographic measurements of transition zone of prostate in men with and without benign prostatic hyperplasia. Urology. 1990; 36(4): 293-9.
4. Presti JJ, Kane C, Shinohara K, Carroll K. Neoplasms of the prostate gland. In: Tanagho E, McAnich J, editors. Smith's General Urology. New York: Mcgraw Hill; 2008. p. 348-74.
5. Purnomo B. Hiperplasia prostat benigna dasar-dasar Urologi. 3rd ed. Jakarta: Sagung Seto; 2011. p. 123-42.
6. Trabuisi E, Halpern E, Gomella L. Ultrasonography and biopsy of the prostate. In: Walsh P, Retik A, Vaughan EJ, Wein A, editors. Campbells-Walsh Urology. Philadelphia: WB Sauders; 2012. p. 2735-47.
7. Kaplan SA, Te AE, Pressler LB, Olsson CA. Transition zone index as a method of assessing benign prostatic hyperplasia: Correlation with symptoms,

urine flow and detrusor pressure. J Urol. 1995; 154(5): 1764-9.
8. Kurita Y, Masuda H, Terada H, Suzuki K, Fujita K. Transition zone index as a risk factor for acute urinary retention in benign prostatic hyperplasia. Urology. 1998; 51(4): 595-600.
9. Milonas D, Trumbeckas D. Prostate-specific antigen and transition zone index – powerful predictors for acute urinary retention in men with benign prostatic hyperplasia. Medicina. 2003; 39: 1071-7.
10. Dahril, Tjahjodjati, S S, Z H, ME M, B S. Hubungan antara zona transisional, index zona transisional dan volume total prostat dengan IPSS. Jurnal Urologi Indonesia. 2004; 11(2): 31-4.
11. Franciosi M, Koff WJ, Rhoden EL. Correlation between the total volume, transitional zone volume of the prostate, transitional prostate zone index and lower urinary tract symptoms (LUTS). Int Urol Nephrol. 2007; 39(3): 871-7.
12. Lepor H, Nieder A, Feser J, O'Connell C, Dixon C. Total prostate and transition zone volumes, and transition zone index are poorly correlated with objective measures of clinical benign prostatic hyperplasia. J Urol. 1997; 158(1): 85-8.
13. Witjes W, Aarnink R, Ezz-El-Din K, Wijkstra H, Debruyne F, de la Rosette J. The correlation between prostate volume, transition zone volume, transition zone index and clinical and urodinamic investigation in patients with lower urinary tract symptoms. BJUI. 1997; 80: 84-90.
14. Roehrborn C. Benign prostatic hyperplasia: Etiology, pathophysiology, epidemiology, and natural history. In: Walsh P, Retik A, Vaughan EJ, Wein A, editors. Campbells-Walsh Urology. Phliladelphia: WB Saunders; 2012. p. 2570-610.
15. Rosette J, Alivizatos G, Madersbachen S, Sanz C, Nording J, Emberton M, et al. Guidelines on benign prostatic hyperplasia. European Association of Urology Guidelines; 2008. p. 12.
16. Schafer W. Analysis of bladder-outlet function with the linearized passive urethral resistance relation, linPURR, and a disease-specific Approach for Grading Obstruction: From Complex to Simple. World J Urol. 1995; 13: 47-58.
17. Gerstenberg TC, Andersen JT, Klarskov P, Ramirez D, Hald T. High flow infravesical obstruction in men: Symptomatology, urodynamics, and the results of surgery. J Urol. 1982; 127(5): 943-5.
18. Rollema H, VanMastrigt R. Improved indication and follow-up in transurethral resection of the prostate using the computer program CLIM: A prospective study. J Urol. 1992; 148: 111-8.
19. Belal M, Abrams P. Noninvasive methods of diagnosing bladder outlet obstruction in men. Part 2: Noninvasive Urodynamics and Combination of Measures. J Urol. 2006; 176: 29-35.
20. Reynard J, Yang Q, Donovan J, Peters T, Schafer W, De la Rosette J, et al. The ICS-'BPH' Study: Uroflowmetry, lower urinary tract symptoms, and bladder outlet obstruction. BJUI. 1998; 82: 619-23.
21. Lee C, Jeon Y, Lee N. The correlation between transition zone index, versus IPSS and peak flow rate after transurethral resection of the prostate in BPH. Korean J Urol. 1999; 40: 1318-22.