Original Article

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Role of Resistive Index as Prognostic Indicator in Treatment of Benign Prostatic Hyperplasia (BPH)

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Abstract

Objectives: To study correlation between International Prostate Symptom Score (IPSS), maximum flow rate (Q-max), Prostate Volume (PV), Post Void Residual Urine (PVR) and Resistive Index (RI) and to evaluate changes in these parameters in cases of benign prostatic hyperplasia (BPH) pre and post treatment. *Methods*: The study was conducted on 30 cases of BPH. Parameters studied were IPSS, Q-max, PVR, PV and RI. 22 patients were subjected to medical therapy [Group I] and 8 to transurethral resection of prostate (TURP) [Group II]. They were reassessed at 6-weeks and 6-months post treatment. *Statistical Analysis:* Pearson's coefficient of correlation was used for statistical analysis. *Results:* The mean age was 58.2 years (range 50–65). The mean pre-treatment IPSS of Groups I and II were 23.09±6.07 and 23.50±9.98 and prostate volumes were 48.90±12.42 ml and 37.75±9.5 ml respectively. Post-therapy, IPSS became 19.9±6.1 at 6-weeks and 14.18±5.8 at 6- months in Group I and 7.0±1.15 at 6-weeks and 4.5±1.0 at 6-months in Group II. In Group I, RI reduced from 0.75±0.05 to 0.69±0.03 at 6-weeks and to 0.62±0.04 at 6- months. In Group II, the RI reduced from 0.72± 0.06 to 0.59± 0.09 at 6-weeks and to 57±0.09 at 6-months. *Conclusions:* RI was significantly high in cases with moderate to severe symptoms that significantly reduced after treatment. It may become a non-invasive index for measuring bladder outlet obstruction in cases of BPH and may also serve as a prognostic marker.

Keywords: Benign Prostatic Hyperplasia (BPH); Bladder Outlet Obstruction (BOO); Prognostic indicator; Pressure-flow study; Resistive index (R.I.)

Key Message

Colour Doppler study of prostate (Resistive Index) may serve as a non-invasive prognostic indicator in cases of BPH which is an important index for measuring bladder outlet obstruction due to BPH with an added advantage of its non invasive and without any urinary tract infection complications. We need further controlled studies with larger number of cases.

Introduction

Currently, pressure flow study (PFS) is considered a reference standard for the diagnosis of bladder outlet obstruction (BOO) [1, 2]. However it is invasive, costly and may be associated with urinary tract infection in a small number of patients. Thus, there is an obvious need for other simpler and less invasive modalities to predict BOO.

Transrectal Ultrasonography (TRUS) is a useful modality to evaluate prostatic dimensions accurately. Resistive index (RI) of the prostatic tissue calculated on power doppler imaging has shown good correlation with severity of BOO [3, 4]. Many attempts have been made to make a non-invasive model for prognostic indicator in management of BPH patients, but power doppler imaging has never been included as a parameter in few such predictions. Transrectal colour doppler is a new instrument to find out resistive index (RI) which depicts vascular resistance in prostate [5].

This study was performed to evaluate the role of RI as prognostic indicator with the help of Transrectal power Doppler sonography (TRPDS) in combination with conventional grey scale TRUS, uroflowmetry and clinical parameters to find a less invasive method for clinical use.

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Material and Methods

36 male patients of age group 50 to 65 years having lower urinary tract symptoms due to BPH were enrolled for study in our unit in department of Surgery from 2012 to 2013. They were subjected to uroflowmetry, Trans abdominal USG, TRUS and Transrectal Colour Doppler Study of Prostate. Resistive Index was measured by pulse Doppler imaging of the blood flow samplings taken from capsular arteries and spectral wave form analysis was done (Figure 1). Maximum and minimum velocities were marked on wave form [7, 8]

RI = S-D / S

S = Max flow during systole D = Min flow during diastole

Among 36 patients, 6 cases either not consented or lost to first follow up. Finally the study was conducted on 30 newly diagnosed men with BOO due to BPH who had not received any treatment. 22 cases underwent medical treatment with tamsulosin 0.4 mg and dutasteride 0.5 mg. and 8 underwent surgical treatment (TURP). Parameters studied were IPSS, Q-max, PVR, PV, and R.I by transrectal doppler ultrasonography.

They were reassessed at 6 weeks and at 6 months. Data analysis was done by mean; standard deviation, and Pearson's coefficient of correlation to get correlation between continuous variables (Figure 2).

Results

In this study, 30 patients were included, out of which 22 were given medical treatment (group I) and 8 were offered TURP (group II).

In group I (Table1), initial value of IPS score was 23.09 +/- 6.07. After 6 weeks of treatment, scores decreased to 19.91 +/- 6.11and at 6 months follow up it was decreased to 14.18 +/- 5.83. Total percentage decrease from baseline to second follow up was 40.25 +/- 12.18. Initial prostate volume was 48.96 +/- 12.42 ml which at first follow up (at 6 weeks) decreased to 43.95 +/- 15.41ml and on second follow up (at 6 months) it decreased to 38.55 +/- 14.30 ml. Percentage decrease from baseline to second follow up was 23.78 +/- 20.96. Initial post void residual urine (PVR) value was 94.25 +/- 61.03ml. On first follow up (at 6 weeks) it decreased to 74.89 +/- 51.74 ml and on second follow up (at 6 months) it decreased to 59.44 +/- 38.51. Total decrease in PVR was 29.14 +/- 27.17. Maximum urinary flow rate (Q max) increased from its mean initial value of 8.03 +/- 3.52 to 10.71 +/- 2.89 in 6 weeks. It further increased to 13.16 +/- 2.13 at 6 months. The total increase in max flow rate was 106.37 +/- 118.35% from initial value to second follow up. So as the RI was decreased from 0.75 +/- 0.05 to 0.69I +/- 0.03 in 6 weeks and further reduced to 0.-62+/- 0.04 at 6 months. Total decrease in percentage was 17.26 +/- 5.93.

In group II (Table1), initial value of IPS score was 23.50 +/- 9.98. After 6 weeks of treatment score decreased to 7.00 +/- 0.15 and at 6 months it decreased to 4.50 +/- 1.00. Percentage decrease from baseline to second follow up was 77.44 +/- 11.88.

Initial prostate volume was 35.75 +/- 9.54. At first follow up (at 6 weeks), it decreased to14.00 +/- 6.27 and at second follow up (at 6 months) it decreased to11.00 +/- 4.28. Percentage decrease from baseline to second follow up was 69.23 +/- 30.21.

Initial post void residual urine (PVR) value was 72.25 +/- 64.67. At first follow up (at 6 weeks), it decreased to 32.43 +/- 45.86 and at second follow up (at 6 months), it decreased to 33.50 +/- 47.54. Total decrease in PVRV was 64.66 +/- 23.07. Maximum urinary flow rate increased in 6 weeks to 13.25 +/- 1.50 from initial value of 10.75 +/- 1.71. After 6 months, it increased to 14.50 +/- 1.29. Total decrease was 36.08 +/- 12.41. So as the RI decreased from 0.72 +/- 0.06to 0.59 +/- 0.09 in 6 weeks up to 0.57 +/- 0.09. Total decrease was 22.07 +/- 5.58. RI has moderate positive correlation with IPSS score (r=0.531) i.e. as the IPS score rises, RI rises (Table 2). RI has negative moderate correlation with Q-Max(r = 0.570) i.e. as the max urinary flow rate decreases there is rise in RI (Table 2).

Similarly RI has moderate positive correlations with prostate volume (r=0.427) and post void residual volume (r=0.529) i.e. both rise with rise in RI(Table 2).

Table 1: Pre and post treatment parameter values

S. N.	Parameter	Group I (n-22) (Medical Treatment)				Group II (n -8) (TURP)			
		Initial values	First follow up (at 6 weeks)	Second Follow up (at 6 months)	Percentage change from baseline to second follow up	Initial values	First follow up (at 6 month	Second Follow up (at 6 moths)	Percentage change from baseline to second follow up
1.	IPSS Score	23.09± 6.07	19.91± 6.11***	14.18± 5.83***	-40.25± 12.18	23.50± 9.98	7.00± .15*	4.50± 1.00*	-77.44± 11.88

2.	Prostate Volume	48.96 ± 12.42	43.95 ± 15.41***	38.55 ± 14.30***	-23.78 ± 20.96	35.75 ± 9.54	14.00 ± 6.27*	11.00 ± 4.28*	-69.23 ± 30.21
3.	Post-Void Residual Volume	94.25 ± 61.03	74.89 ± 51.74***	59.44 ± 38.51**	-29.14 ± 27.17	72.25 ± 64.67	32.43 ± 45.86	33.50 ± 47.54	-64.66 ± 23.07
4.	Max. Urinary Flow Rate	8.03 ± 3.52	10.71 ± 2.89***	13.16 ± 2.13***	106.37 ± 118.35	10.75 ± 1.71	13.25 ± 1.50*	14.50 ± 1.29**	36.08 ± 12.41
5.	Resistive Index	0.75 ± 0.05	0.69I ± 0.03***	0.-62 ± 0.04***	-17.26 ± 5.93	0.72 ± 0.06	0.59 ± 0.09*	0.57 ± 0.09**	-22.07 ±5.58

Table 2: Pearson's coefficient: correlation of RI with IPSS, PV, PVR and Q-max

		AUA	PV	PVR	QMax
RI	Pearson Correlation	.531(**) Positive & Significant	.427 (**) Positive & Significant	.529(**) Positive & Significant	-.665(**) Negitive & Significant

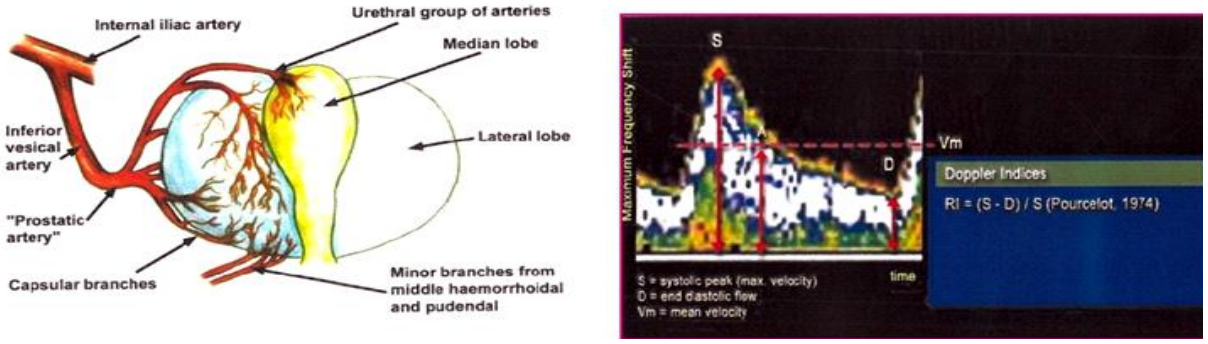

Fig. 1: Resistive index measurement by pulse doppler imaging of the blood flow samplings from capsular arteries showing spectral wave form

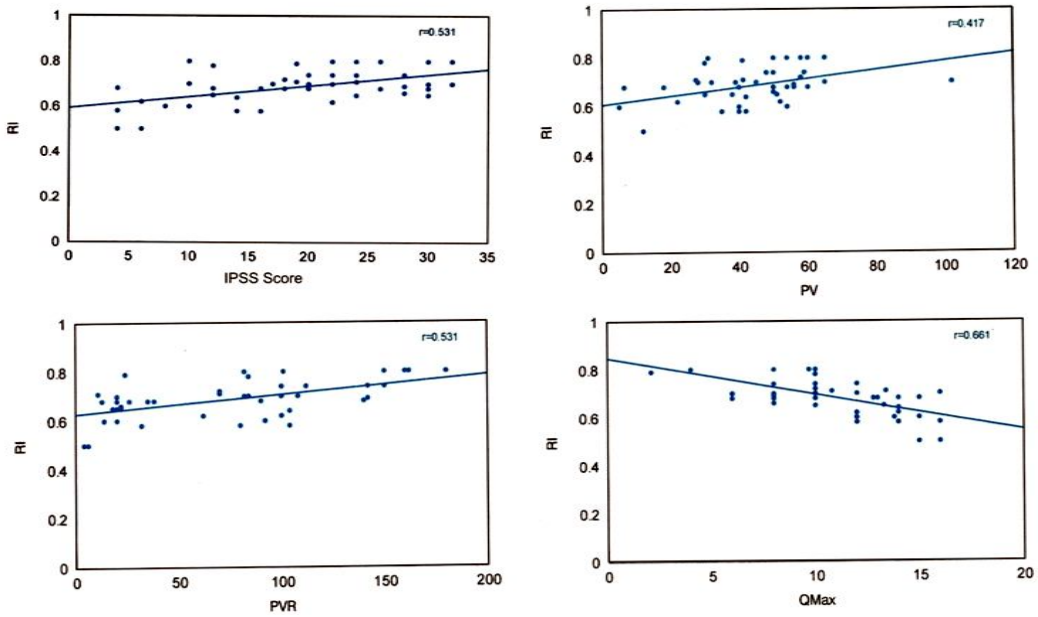

Fig. 2: Pearson's coefficient: correlation of RI with IPSS, PV, PVR and Q-max

Comments

BPH and BOO are two different entities and severity of BOO is not related with the size of the prostate. However, bladder outlet obstruction correlates well with the intraprostatic pressure, because hyperplastic prostate is like a closed system in which outer capsule closes the inner glandular tissue. As the gland grows, intraprostatic pressure rises. This has been supported by the correlation of urethral pressure profile with the size of the prostatic adenoma resected at surgery.

Along with prostatic urethra, the increased intraprostatic pressure must also compress the blood vessels running in the prostate. Anatomy of the

prostate gland can be measured accurately by transrectal ultrasound, but the dynamic compression on prostatic tissue needs doppler imaging. Leventis et al. studied normal prostatic vascular anatomy and concluded that power doppler of prostatic tissue demonstrates reproducible flow pattern. They also suggested that power doppler can help to compare vascular anatomy of normal prostate with that of diseased prostate [3]. In our study we used power doppler to get the vascular anatomy of prostate. Use of contrast agents increases the effectiveness of visualizing blood vessels, but these are costly and may not be affordable.

Kojima et al. in their preliminary report had noticed a significantly higher RI of prostate in BPH patients with BOO as compared to healthy individuals (0.72 vs. 0.64, $p<0.0001$). They also noticed a significant decrease in RI after surgical treatment of BPH patients [4, 5]. In our study we get significant decrease in RI in surgical treated patients from 0.72±0.06 to 0.57±0.09 i.e. 22.07±5.58% corresponds to 77.44±11.88% change in symptom score at 6 months (Tab1). In medically treated patients on Tamsulosin 0.4 mg + Dutasteride 0.5 mg significant decrease in RI from 0.75±0.05 to 0.62±0.04 i.e. 17.26±5.93% change corresponds to 40.25+12.18% change in symptom score at 6 months (Table1).

Goyal Rajiv et al [6] evaluated prospectively sixty-nine male patients with more than 50 years of age, presenting with lower urinary tract symptoms for BOO secondary to BPH. Colour Doppler was done to measure resistive index (RI). All patients also underwent pressure flow study and depending upon its results, the patients were divided into Group 1 [Abram-Griffiths (AG) number < 40] and Group 2 (AG number >40). Significant independent factors for prediction of BOO were maximum flow rate, resistive index, and median lobe projection into the bladder and post void residual volume.

BOO scoring system was developed based on these 4 factors, which showed a specificity of 77.8% and a sensitivity of 85.7%, with an overall predictive value of 82.6%. Transrectal power doppler ultrasonography (resistive index) in combination with uroflowmetry, median lobe projection in bladder and post void residual measurement can predict BOO with a high specificity and sensitivity [7]. In a study conducted by Andreas P. Berger et al, they found that RI of the transition zone was significantly higher in patients of BPH than those with normal prostate or having prostate malignancy [8].

In our study we found that with transrectal power doppler USG (Resistive Index) in combination with uroflowmetry, post void residual measurement may serve as a non-invasive prognostic indicator in cases of BPH.

Conclusions

RI is significantly high in cases of BPH with moderate to severe symptoms which significantly reduces after both medical and surgical treatment. Trans rectal RI has moderate positive correlation with IPS score (r=0.531), has negative moderate correlation with Q max (r = 0.570), has moderate positive correlations with prostate volume. (r=0.427) and post void residual urine (PVR) (r=0.529). Colour Doppler study of prostate (Resistive Index) may serve as a non-invasive prognostic indicator in cases of BPH which is an important index for measuring bladder outlet obstruction due to BPH with an added advantage of its non invasive and without any urinary tract infection complications. We need further controlled studies with larger number of cases.

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