ORIGINAL RESEARCH

Male Lower Urinary Tract Symptoms in Correlation with Age, Quality of Life Scores, Parameters of Uroflowmetry and Prostate Size, A Single Institution Study

Romeo Lloyd T. Romero, MD; Alfredo S. Uy Jr, MD, FPUA; Eli Paulino F. Madrona, MD, FPUA; Rodney M. Del Rio, MD, FPUA; Meliton D. Alpas, MD, FPUA and Karl Marvin M. Tan, MD, FPUA

Section of Urology, Department of Surgery, Veterans Memorial Medical Center

Objective: To correlate male lower urinary tract symptoms between age, quality of life scores, parameters of uroflowmetry and prostate size.
Patients and Methods: Two hundred eight males were included in this study. Uroflowmetry parameters, age, International Prostate Symptom Score (IPSS), Quality of Life (QoL) scores and prostate size were gathered. For correlation, distribution of age, uroflowmetry parameters and prostate size were first compared to IPSS. Analysis of variance was used to compare age of patients, while Kruskall-wallis test was used to compare the QoL, uroflowmetry parameters, and prostate size on each IPSS groups. Ordinal logistic regression analysis was used to correlate IPSS to age, quality of life, uroflowmetry parameters, and prostate size both for multivariate and univariate analysis.
Results: There was no significant correlation between age and IPSS. However, on profile distribution, the age distribution between symptom scores were statistically similar. Qol scores were directly proportional to IPSS. Thus, patients with a worse QoL score were more likely to have higher IPSS. Qmax scores decreased as symptom severity increased. Patients with higher Qmax scores are less likely to have higher IPSS scores. Voided volume was observed to decrease as IPSS severity increased, but this was not statistically significant. Patients with higher post void residual scores were more likely to have higher IPSS. There was also no significant correlation between prostate size and IPSS.
Conclusion: There were no significant correlation between IPSS and age, voided volume and prostate size. On the other hand, patients with a worse QoL score and a high post void residual had higher IPSS. Patients with a high Qmax, are less likely to have an elevated IPSS.

Keywords: lower urinary tract symptoms, uroflowmetry, Quality of Life score, International Prostate Symptom Score (IPSS)

Introduction

Based on the International Continence Society standards, lower urinary tract symptoms (LUTS) is defined based on the perspective of an individual, which is either the patient or the caregiver. The symptoms are either volunteered or elicited. Symptoms can be categorized into three main groups: Storage symptoms-frequency, nocturia, urgency and urinary incontinence.

Voiding symptoms - slow stream, splitting or spraying, intermittency, hesitancy, straining and terminal dribble, post micturition symptoms-feeling of incomplete emptying and post micturition dribble.[1] Abrams, et al. established that LUTS suggestive of bladder outlet obstruction are voiding symptoms in the absence of infection or obvious pathology other than outlet obstruction.[1] Urinary frequency, nocturia and weak stream are the most common male LUTS, the severity of symptoms closely correlates with the quality of life.[2] It is important to note that some patients with a non-enlarged prostate may present with obstruction, because prostatic obstruction is dependent on the site rather than the size of the adenoma.[2] Bladder outlet obstruction occurs when there is an increase in detrusor pressure and reduced flow rate when voiding. Conditions such as benign prostatic obstruction may be diagnosed due to the histologic benign prostatic hyperplasia.[1,2] It is known that benign prostatic hyperplasia has no correlation with LUTS. However, the severity of symptoms must be correlated by uroflowmetry and IPSS.[3] The IPSS (Figure 4) is the most used scoring system in the diagnosis of bladder outlet obstruction due to BPH. Severity of LUTS can be classified as mild (IPSS 0-7), moderate (IPSS 8-19) of severe (IPSS 20-35). The QoL is also scored from 0 to 6. QoL is a more useful tool in the management of LUTS.[2,4] Another test to evaluate the patient's urine flow is the Uroflowmetry. It is a reliable and useful, non-invasive tool to assess bladder outlet obstruction and detrusor activity. Uroflowmetry parameters however may not be predictive of symptom severity.[5,6]

This study aims to correlate the severity of male LUTS, described using the IPSS with patient age, QoL score, uroflowmetry parameters and prostate size.

Patients and Methods

This was a descriptive, cross-sectional, retrospective study of 208 male patients who underwent uroflowmetry from 2014 to 2018. Included in this study were male patients aged 40 to 80 years who presented with LUTS. Excluded were those who underwent previous prostatic and urethral surgery, and those with known neurological conditions.

Data were gathered from patient records and included the patient's age, IPSS, QoL score, and prostate size measured using a transabdominal ultrasound. Uroflowmetry parameters comprised of maximum flow rate (Qmax), voided volume and post void residual urine (PVR). Flow rate was defined as the volume of fluid expelled via the urethra per unit time, expressed in ml/s. Qmax was defined as the maximum measured value of the flow rate after correction for artifacts. Voided volume was defined as the total volume expelled via the urethra. Lastly, PVR was defined as the volume of urine left in the bladder at the end of micturition.

The sample size was computed using the G*Power Software. The parameters for sample size computation were based on findings of the reference study titled "Correlation between lower urinary tract symptoms and objective measures or uroflowmetry" by Turk, H. (2017). According to this, there were significant differences on QoL of patients with mild, moderate and severe IPSS ($p<0.001$). The average Qol scores increase as IPSS scores increase (IPSS 0 - 7 = 2.00; IPSS 8 - 19 = 4.00; IPSS 20 - 35 = 5.00). Given the significant results, the computed effect size was 0.3078737. Alpha error was 0.05 at 1895% confidence interval. A sample size of 207 corresponds to 91.18% actual power (power of analysis). The sample sizes for each power of analysis were:

Power of Analysis	Sample Size
99%	288
95%	216
90%	207
80%	144

Frequency and percentage were used to tabulate the IPSS score interpretation of the

patients. Mean and Standard deviation were used to describe the average age of patients, while median and range were used to describe the QoL, Qmax, voided volume, PVR, and prostate size. For correlation, distribution of age, QoL, Qmax, voided volume, post void residual, and prostate size was first compared to IPSS. Analysis of variance was used to compare age of patients, while Kruskall-Wallis test was used to compare the QoL, Qmax, voided volume, post void residual, and prostate size for each IPSS group. Ordinal logistic regression analysis was used to correlate IPSS to age, QoL, Qmax, voided volume, PVR, and prostate size both for multivariate and univariate analysis. SPSS version 25.0 was used for data analysis. Null hypotheses were rejected at 0.05α-level of significance.

Results

The mean IPSS score was 10. Majority of patients had moderately-severe symptoms (44.9%). The mean age of the patients was 66.59 ± 9.11. The rest of the patient demographics are in Table 1.

Quality of life score was significantly worst in patients with severe symptoms (p <0.0001) (Table 2). Qmax was lowest in patients with severe symptoms (p=0.0010) while voided volume was significantly lowest in those with severe LUTS (p <0.0001). It has been observed that QoL scores worsen as IPSS severity increases (Figure 1). It has also been observed that Qmax decreases as IPSS severity increases (Figure 2). Voided volume decreases as IPSS severity increases (Figure 3).

Table 3 presents the correlation of IPSS to patients age, quality of life, Qmax, volume, residual, and prostate size. The model used ordinal logistic regression analysis by setting-up the independent factors as covariate. There was no significant correlation between IPSS and age (p=0.217), volume (p=0.909), and Prostate size (p=0.976). On the other hand, QoL was significant with p-value of 0.000, the odds ratio was 5.079 (2.875 - 8.971) which indicates that patients with a worse QoL score are 5.079 times more likely to have higher IPSS scores. Qmax was significant with p-value of 0.001, the odds ratio was 0.822 (0.736 - 0.918) which indicates that patients with higher Qmax scores are 0.822 times less likely to have higher IPSS scores. Post void residual was significant with p-value of 0.026, the odds ratio was 1.010 (1.001 - 1.019) which indicates that patients with higher post void residual scores are 1.010 times more likely to have higher IPSS scores.

The model was then adjusted by removing the insignificant factors and retaining the useful independent variables. Quality of life remained

Table 1. Patient profile (N=208).

	Frequency/ Mean/Media	Percentage/ SD/Range
IPSS scores	10.00	1.00 to 35.00
Mild	81	39.1%
Moderate	93	44.9%
Severe	33	15.9%
Age	66.59	9.11
QoL	1.00	0.00 to 6.00
Qmax	13.50	2.60 to 37.80
Voided volume	246.00	15.80 to 792.00
Post void residual	15.00	0.00 to 417.00
Prostate size	33.00	16.00 to 167.00

Table 2. Distribution of profile on IPSS.

	IPSS Scores			
	Mild	Moderate	Severe	p-value
Age	65.30 ± 8.69	67.04 ± 9.78	68.52 ± 7.87	0.189
Quality of life	1.00 (0 - 3)	2.00 (0 - 5)	4.00 (2 - 6)	0.000
Qmax	19.60 (7.60 - 37.80)	11.6 (7.5 - 24.7)	6.6 (2.6 - 15.5)	0.000
Voided volume	269.0 (15.8 - 645.0)	246.0 (125 - 792.0)	164.0 (125.0 - 463.0)	0.001
Post void residual	12.0 (0 - 240)	16.0 (0 - 390)	23 (0 - 417)	0.093
Prostate size	31 (16 - 167)	35 (17 - 91)	30 (10 - 62)	0.258

Figure 1. Column bar graph depicting comparison of QoL among patients identified with mild, moderate, and severe IPSS.

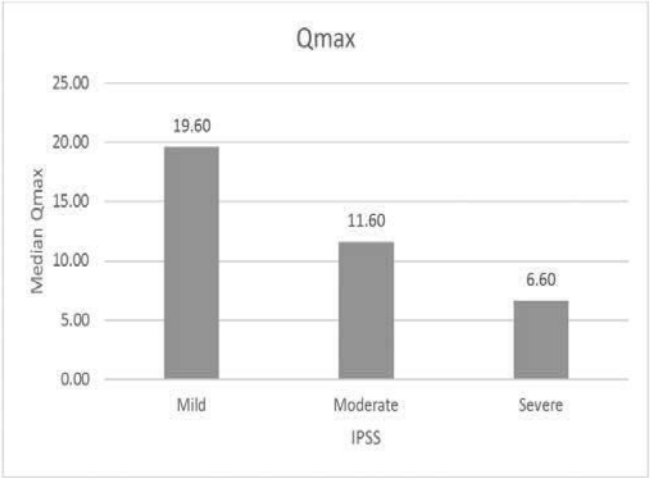

Figure 2. Column bar graph depicting comparison of Qmax among patients identified with mild, moderate, and severe IPSS.

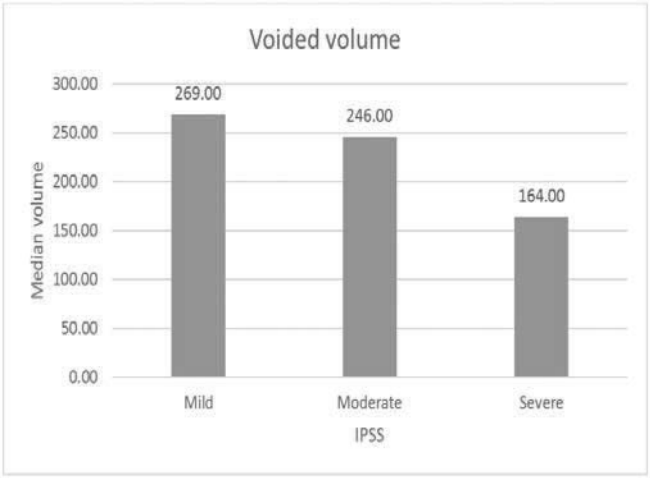

Figure 3. Column bar graph depicting comparison of voided volume among patients identified with mild, moderate, and severe IPSS.

significant with p-value of 0.000, Qmax was retained with p-value of 0.000, while post void residual was retained with p-value of 0.028. Prostate size was retained despite of insignificance because it is a helping variable to make residual significant with IPSS.

Discussion

In correlating age with IPSS, it was non-significant with a p value of 0.217, however on profile distribution, it revealed that the age distribution between symptom scores was statistically similar (p 0.189). On QoL scores, it showed a directly proportional relationship

Table 3. Correlation analysis.

	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	1.030 (0.976 - 1.087)	0.277		
QoL	5.079 (2.875 - 8.971)	0.000	4.953 (2.834 - 8.656)	0.000
Qmax	0.822 (0.736 - 0.918)	0.001	0.815 (0.738 - 0.900)	0.000
Voided volume	1.000 (0.996 - 1.004)	0.909		
Post void residual	1.010 (1.001 - 1.019)	0.026	1.010 (1.001 - 1.019)	0.028
Prostate size	1.000 (0.976 - 1.025)	0.976	1.004 (0.980 - 1.028)	0.760

International Prostate Symptom Score (I-PSS)

Patient Name: _____ **Date of birth:** _____ **Date completed** _____

In the past month:	Not at All	Less than 1 in 5 Times	Less than Half the Time	About Half the Time	More than Half the Time	Almost Always	Your score
1. Incomplete Emptying How often have you had the sensation of not emptying your bladder?	0	1	2	3	4	5	
2. Frequency How often have you had to urinate less than every two hours?	0	1	2	3	4	5	
3. Intermittency How often have you found you stopped and started again several times when you urinated?	0	1	2	3	4	5	
4. Urgency How often have you found it difficult to postpone urination?	0	1	2	3	4	5	
5. Weak Stream How often have you had a weak urinary stream?	0	1	2	3	4	5	
6. Straining How often have you had to strain to start urination?	0	1	2	3	4	5	
	None	1 Time	2 Times	3 Times	4 Times	5 Times	
7. Nocturia How many times did you typically get up at night to urinate?	0	1	2	3	4	5	
Total I-PSS Score							

Score: 1-7: *Mild* 8-19: *Moderate* 20-35: *Severe*

Quality of Life Due to Urinary Symptoms	Delighted	Pleased	Mostly Satisfied	Mixed	Mostly Dissatisfied	Unhappy	Terrible
If you were to spend the rest of your life with your urinary condition just the way it is now, how would you feel about that?	0	1	2	3	4	5	6

Figure 4. International Prostate Symptom Score (http://www.urospec.com/uro/Forms/ipss.pdf)

between IPSS (0.000), patients with a worse quality of life score are 5.079 times more likely to have higher IPSS scores. Alternatively, Qmax scores decrease as IPSS severity increases(0.000), in correlation with Qmax to IPSS, there was a significant difference with a p-value of 0.001, odds ratio was 0.822 (0.736 - 0.918) which indicates that patients with higher Qmax scores are 0.822 times less likely to have higher IPSS scores. As per voided volume, it decreases as IPSS severity increases, conversely there was no significant correlation documented (0.909). Post void residual was significant with p-value of 0.026, meaning patients with higher post void residual scores are 1.010 times more likely to have higher IPSS scores. Prostate size has no significant correlation to the IPSS(0.976).

In a study by Türk and Ün, symptom scores were directly proportional with age, post-void residual and PSA, however as the symptom scores go from mild to severe, the Qmax was markedly decreased.[6] The Qmax or maximum flow rate, was thought to be the most important parameter in assessing symptom severity.[4] Prostate volume is significantly correlated with age, as well at the Qmax and the IPSS.[4]

The QoL is strongly correlated with LUTS, though it should be individualized because it cannot be measured or estimated by variables.[7]

Similar to present results, Singla, et al. found that BPH has no correlation with LUTS. Post void residual and average flow rate have a positive correlation with symptom severity and Qmax was the most representative of symptom severity of LUTS. However, the other Uroflowmetry parameters such as time to peak flow, flow time, voiding time, and voided volume had no correlation with symptom severity.[3,4]

In the study done by Sundaram, et.al, more than 50% of men aged 61-70 presented with LUTS. It was concluded that LUTS are mostly due to benign prostatic hyperplasia leading to bladder outlet obstruction. In this study, there was no significant correlation between LUTS and mean Qmax in any age group. The mean prostate size was more than 40g which is an indication for surgical intervention.[8]

Although some studies may find a mild statistically significant correlation between age, IPSS and prostate volume, these evidences may require further studies in larger populations. Other factors that are significantly associated with moderate to severe LUTS are smoking and being widowed.[9]

Metabolic syndrome may convey increased odds of developing LUTS in older men. The presence of metabolic syndrome has a positive association with increase in prostate volume and an increase in the antero-posterior diameter of the prostate. This may be due to intraprostatic inflammation.[10,11] Other factors such as hypertension, heart disease, hypercholerosterolemia and hypertriglyceridemia may increase the risk for BPH in men less than 50 years of age.[12] LUTS, QoL, age and uroflowmetry parameters have also been associated with poor erectile function. In a study by Verim, et al., the severity of IPSS and Qol were associated with erectile dysfuction.[13]

Further studies correlating severity of LUTS with BPH parameters using larger populations are needed. Additional parameters that could be used in future studies include prostate specific antigen, body mass index, and International Index of Erectile Function (IIEF). Uroflowmetry parameters that can still be investigated included time to maximum flow, average flow rate, voiding time and flow time. Other factors such as metabolic syndrome, cardiovascular disease, the use of alpha blockers, malignancy and smoking may also be accounted for.

Conclusion

In conclusion, patients with a worse QoL score and a high PVR will most likely have a higher IPSS. Patients with a high Qmax, are less likely have an elevated IPSS.

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