Section: Urology

Original Research Article

A PROSPECTIVE STUDY TO EVALUATE CORRELATION BETWEEN A PICTOGRAM UROFLOWMETRY AND UROFLOWMETRY IN ASSESSING MEN WITH LOWER URINARY TRACT SYMPTOMS

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ABSTRACT

Background: Our aim was to assess correlation of a four image Pictogram Uroflowmetry with Q_{max} obtained from a Uroflowmeter in male patients with lower urinary tract symptoms (LUTS). **Materials and Methods:** This was a prospective study done over a period of 6 months and patients who satisfied the inclusion and exclusion criteria were enrolled in the study. The following data was collected for all patients enrolled in study: Age**,** Uroflowmetry pattern (arc shaped, flattened, plateau, oscillating, interrupted, superflow), Maximum flow rate (Q_{max})**,** Average flow rate (Q_{avg})**,** Voided volume (VV) and Pictogram image selected. **Result:** The sample size of this study was 116. The mean value of Q_{max} were as follows: Image A- 21.6 ± 9.2 mL/s; Image B- 16.1 ± 4.4 mL/s; Image C- 12.6 ± 5 mL/s and Image D- 10.1 ± 4.8 mL/s. The confidence intervals calculated through linear regression model for the Q_{max} and each image were as follows: Image A- 19.6, confidence interval [CI] 95%: [16.7-22.6] mL/s; Image B- 14.8, CI 95%: [13.4-16.1] mL/s; Image C- 11.8, CI 95%: [10.2-13.3] mL/s and Image D- 9.2, CI 95%: [7.7-10.7] mL/s. Pictogram uroflowmetry had statistically significant negative correlation with Q_{max} ($r = -0.397$, $p < 0.001$) and Q_{avg} ($r = -0.345$, $p < 0.001$). **Conclusion:** Pictogram Uroflowmetry is a non-invasive and inexpensive tool which provides a range of Q_{max} and Q_{avg} values based on the image selected which can be helpful to screen, evaluate, treat and follow up men having LUTS.

INTRODUCTION

Lower Urinary Tract Symptoms (LUTS) refer to a range of symptoms related to the bladder, urethra, and prostate in men. These symptoms can significantly impact the quality of life and may indicate underlying conditions such as benign prostatic hyperplasia (BPH), urinary tract infections, stricture urethra, bladder dysfunctions, etc., to name a few.

LUTS can be categorized into storage, voiding, and post-micturition symptoms. Storage symptoms include frequency, urgency and nocturia whereas voiding symptoms include hesitancy, intermittency, straining and poor stream. Post-micturition symptoms include post-void dribbling and a sensation of incomplete emptying.

Diagnosis of LUTS typically involves a thorough medical history, physical examination, and diagnostic tests such as uroflowmetry, cystoscopy, and imaging studies. Although the prevalence of lower urinary tract symptoms (LUTS) is about 62% in men at any age, this prevalence increases consistently with age, reaching 80.7% in men over 60.[1]

Uroflowmetry measures the flow rate of urine during micturition. It's non-invasive and involves urinating into a uroflowmeter, which records the speed and volume of urine flow. By providing objective data on urinary flow, uroflowmetry aids in forming a comprehensive diagnosis when combined with other assessments and patient history. Uroflowmetry (UFM) yields valuable parameters like voided volume (VV), uroflowmetry pattern (arc shaped, flattened, plateau, oscillating, interrupted, superflow), maximum flow rate (Qmax) and average flow rate (Qavg).[2,3]

In this context a four-image pictogram was developed to assess the flow rate of urine in men with LUTS subjectively which would be a more convenient, simple and inexpensive tool. Tools like visual prostate symptom score (VPSS),[4] and visual analogue scale uroflowmetry score (VAUS),[5] evaluate LUTS subjectively but don't provide an estimate of the flow rate of urine.

The objective of this study was to assess correlation of pictogram with Qmax obtained from a Uroflowmeter in men having complaint of lower urinary tract symptoms.

MATERIALS AND METHODS

Approval for conducting this study was obtained from the institutional ethics committee (IEC/Approval/19/2022). This was a prospective study done over a period of 6 months (July 2023 to January 2024) at a tertiary care government medical college and hospital in accordance with the ethical standards of the institutional ethics committee. Men attending out-patient department or in-patients with LUTS who satisfied the inclusion and exclusion criteria were enrolled in the study after obtaining informed consent.

A four-image pictogram was developed [Figure 1] with images labelled A, B, C and D, each showing men voiding in standing position with progressively thin urinary stream as well as decreasing distance the stream reached, with A having the thickest urinary stream and reaching farthest whereas D had the thinnest stream and reaching the least distance. The patients were instructed to drink 1 litre of water and uroflowmetry was performed when they developed urge to void urine. All patients voided in standing position and those who were uncircumcised were instructed to void after retraction of prepuce. All uroflowmetry tests were conducted on a single MMS (Medical Management Systems) uroflowmeter as per International Continence Society Good Urodynamic Practices and Terms 2016 guidelines,[6] and after obtaining informed consent. Finally, the patients selected the image from pictogram which pertained to the voiding they had on uroflowmetry.

Inclusion criteria were: men over 18 years of age having LUTS and undergoing uroflowmetry (UFM). Exclusion criteria were: age <18 years, inability to void in standing position, blindness, non-representative curves on UFM, voided volume < 150 mL on UFM. The following data was collected for all patients enrolled in study: age, uroflowmetry pattern (arc shaped, flattened, plateau, oscillating, interrupted, superflow), maximum flow rate (Qmax), average flow rate (Qavg), voided volume (VV) and pictogram image selected.

The collected data was entered in Microsoft Excel 2021 and statistical analysis was performed with IBM SPSS version 29 software. The expression of continuous variables was done in from of mean and standard deviation. Statistical significance was taken as p value of <0.05. ANOVA test was used to evaluate any association of Qmax and Qavg with the chosen pictogram image and a linear regression model was developed. Spearman's rank test was used for correlation analysis. The authors confirm the availability of, and access to, all original data reported in this study.

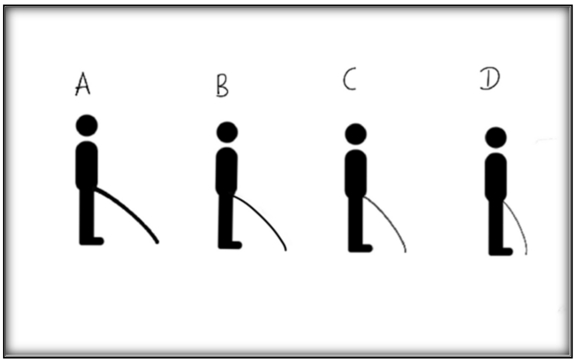

Figure 1: Pictogram Uroflowmetry

RESULTS

The number of patients enrolled in this study were 116. The mean age of the study population was 58 ± 14 years. The mean values of Uroflowmetry parameters were- Qmax: 12.79 ± 6.04 mL/s, Qavg: 6.89 ± 3.97 mL/s and Voided volume: 245 ± 89 mL [Table 1].

The most commonly observed pattern on uroflowmetry was arc shaped (35.3%) followed by flattened (32.1%) and plateau (19.6%). oscillating (7.2%), interrupted (6.7%) and superflow (6.1%) patterns were observed less frequently [Figure 2].

All participants were able to select the desired image from pictogram without assistance highlighting that simplicity and feasibility of the pictogram. Amongst the images on pictogram, Image C was selected most frequently (48.75%) followed by Image B (26.12%), Image D (16.43%) and Image A (8.57%) [Figure 3].

The mean values of Qmax were as follows: Image A- 21.6 ± 9.2 mL/s; Image B- 16.1 ± 4.4 mL/s; Image C- 12.6 ± 5 mL/s and Image D- 10.1 ± 4.8 mL/s [Figure 4].

The mean values of Qavg were as follows: Image A- 13.4 ± 5.2 mL/s; Image B- 8.7 ± 4.1 mL/s; Image C- 6.9 ± 3.7 mL/s and Image D- 5.3 ± 3.1 mL/s [Figure 5].

The confidence intervals calculated through linear regression model for the Qmax and each image were as follows: Image A- 19.6, confidence interval [CI] 95%: [16.7-22.6] mL/s; Image B- 14.8, CI 95%: [13.4-16.1] mL/s; Image C- 11.8, CI 95%: [10.2-13.3] mL/s and Image D- 9.2, CI 95%: [7.7-10.7] mL/s [Figure 6].

The confidence intervals calculated through linear regression model for the Qavg and each image were as follows: Image A- 11.5, confidence interval [CI] 95%: [9.3-13.7] mL/s; Image B- 8.1, CI 95%: [6.4-

9.8] mL/s; Image C- 6.6, CI 95%: [5.9-7.3] mL/s and Image D- 5.4, CI 95%: [4.8-6.1] mL/s [Figure 7].

Pictogram uroflowmetry had statistically significant negative correlation with Qmax (r = - 0.397, p < 0.001) and Qavg (r = -0.345, p < 0.001).

Table 1: Overall uroflowmetry parameters in study.

Variables	Mean±SD
Age (years)	58± 14
Q_{max} (mL/sec)	12.79± 6.04
Q_{avg} (mL/sec)	6.89± 3.07
Voided Volume (mL)	245± 89

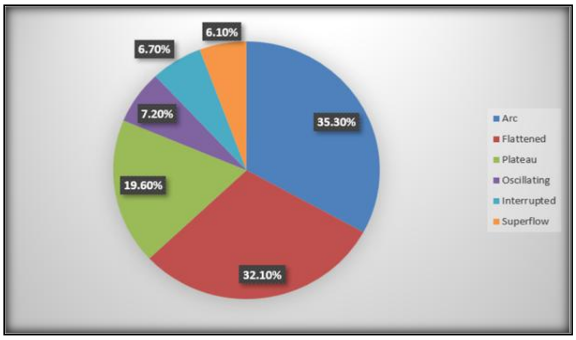

Figure 2: Distribution of Uroflowmetry Pattern (%)

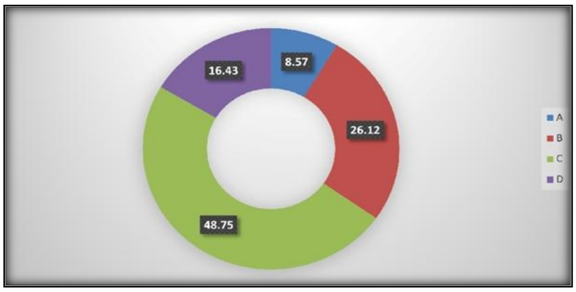

Figure 3: Distribution of Pictogram Selection (%)

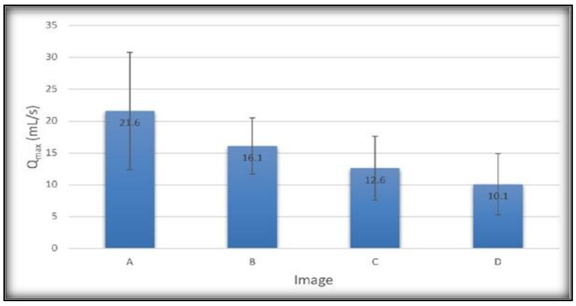

Figure 4: Mean Value and Standard Deviation of Q_{max}

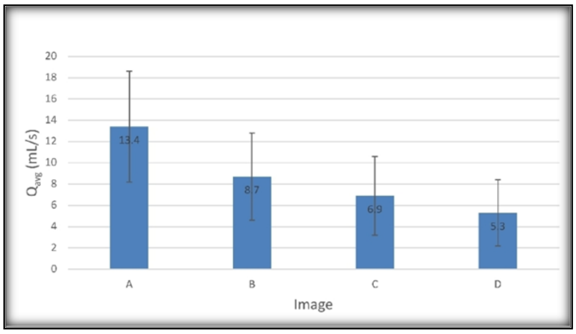

Figure 5: Mean Value and Standard Deviation of Q_{avg}

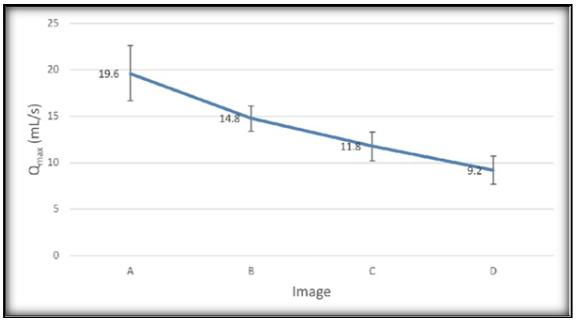

Figure 6: Distribution of 95% Confidence Intervals of Q_{max}

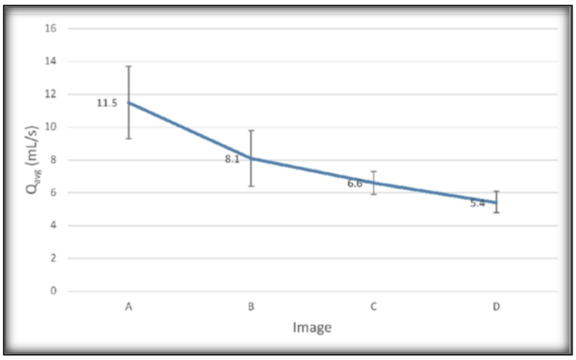

Figure 7: Distribution of 95% Confidence Intervals of Q_{avg}

DISCUSSION

LUTS is a common urological presentation whose prevalence increases with age. With steady rise in life expectancy, it is likely to be encountered more frequently in urological practice. LUTS are commonly evaluated using IPSS and uroflowmetry. IPSS can be time consuming and elderly patients may require assistance in filling it due to challenges with literacy, cognitive abilities and visual acuity.[5] Uroflowmetry is an objective tool which is relatively expensive and requires specialized equipment and trained staff. Pictogram uroflowmetry was designed with the idea to get objective estimate of urine flow from a non-invasive subjective tool like pictogram which is quick, accessible, convenient and inexpensive.

Various innovations have been tried with Uroflowmetry including but not limited to home-based uroflowmetry, audio-based uroflowmetry, automated curve analysis and visual analogue uroflowmetry (visual analogue uroflowmetry score-VAUS,[5] visual prostate symptom score-VPSS,[4]

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visual uroflow scale- VUS,[7] and analogical uroflowmetry- ANUF).[8]

Visual scores are easily interpreted by the patients as shown in study by van der Walt et al,[9] where educational level required to fill IPSS vs. VPSS without assistance was assessed. Similar results were obtained by Wessels et al,[10] Ceylan et al,[11] and Heyns et al.[12] Rogel et al,[8] found ANUF to have excellent feasibility with none of the patient requiring assistance in selecting image. In our study also, all patients were able to select a representative image without help.

The mean age and voided volume of patients in this study were lower than that of study done by Rogel et al,[8] and Memon et al,[13] whereas the mean Qmax was higher than that obtained by Memon et al but lower than that of Rogel et al. The most common pattern of uroflowmetry observed in this study was arc-shaped, same as that of Rogel et al,[8] but with lesser frequency.

The mean values of Qmax obtained for the 4 images for Pictogram uroflowmetry was similar to that for 4 images of ANUF obtained by Rogel et al.[8] The negative correlation obtained between Pictogram uroflowmetry and Qmax was also observed by Park et al,[14] Ceylan et al,[11] & Roy et al,[15] (VPSS & Qmax), Zhang et al,[7] (VUS & Qmax) and Rogel et al,[8] (ANUF & Qmax).

Although validated visual analogue scales like VPSS exist to assess LUTS, they don't provide an estimate of Qmax which can guide in evaluation, management and follow up of men with LUTS. Concomitant use of the International Prostate Symptom Score and visual analogue scale questionnaires as suggested by Ushijima S et al,[16] has a similar limitation. ANUF is a tool which gives a range of Qmax and Qavg values based on the image selected and is derived from European population. Pictogram Uroflowmetry provides range of Qmax and Qavg values for the image selected and is based on data from Indian population. The Qmax obtained may vary from single or multiple uroflowmetry studies,[17] and hence a representative void was used to depict Qmax in this study.

Factors like single centre design and limited sample size contribute to limitations of this study. The correlation with IPSS, literacy, visual acuity and cognition were not assessed. Pictogram uroflowmetry was not compared with other visual analogue tests like VPSS, VAUS, VUS and particularly ANUF. Pictogram is unable to provide quantitative data as provided by Uroflowmetry and attributes like shape of curve which help in diagnosis of etiology of LUTS are also lacking with Pictogram Uroflowmetry. Hence, it is a useful adjunct to uroflowmetry in resource limited settings and not intended as an alternative.

CONCLUSION

Pictogram Uroflowmetry is a useful, non-invasive, convenient and inexpensive tool for men with LUTS. It provides a range of Qmax and Qavg values based on the image selected which can be helpful to screen, evaluate, treat and follow up men having LUTS. It is based on the demonstrated correlation between Qmax and Qavg with the image selected in Indian population, in this study. It is meant to be used as an adjunct to uroflowmetry in resource limited settings and its merit lies in the simplicity of the design and usage.

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