

Prostatic Diseases and Male Voiding Dysfunction

The Diagnosis of Benign Prostatic Obstruction: Validation of the Young Academic Urologist Clinical Nomogram



Cosimo De Nunzio, Riccardo Lombardo, Mauro Gacci, Martina Milanese, Fabiana Cancrini, Giorgia Tema, Andrea Cocci, Giovanni Giordano, Costantino Leonardo, Marco Carini, and Andrea Tubaro

OBJECTIVE	To externally validate the Young Academic Urologist (YAU) nomogram for the prediction of benign prostatic obstruction (BPO) in patients with lower urinary tract symptoms and benign prostatic enlargement.
MATERIALS AND METHODS	Between January 2013 and September 2014, a consecutive series of patients with lower urinary tract symptoms and benign prostatic enlargement underwent standardized pressure flow studies (PFSs) in 2 tertiary Italian centers. Variables assessed were International Prostatic Symptom Score, Prostate Specific Antigen (PSA), prostate size, transitional zone volume, maximal urinary flow rate (Q _{max}), postvoid residual urine. BPO was defined as a Schäfer grade ≥ 3 at PFSs. Q _{max} and transitional zone volume were plotted on the YAU nomogram to predict the presence of BPO. Receiver operating characteristic curve analysis was used to evaluate predictive properties of the nomogram for the final diagnosis of BPO.
RESULTS	A total of 449 patients were consecutively enrolled. In those, 310 patients (69%) presented a BPO (Schäfer ≥ 3) at PFSs. The novel YAU nomogram presented an area under the curve of 0.76; 95% confidence interval: 0.72–0.82 for the diagnosis of BPO. At the best cutoff value of 80% (nomogram probability), the sensitivity was 74% and specificity was 79%, the positive predictive value was 89%, and the negative predictive value was 56%.
CONCLUSION	Although further studies are needed to confirm our results, the YAU nomogram was, in our experience, an excellent tool to predict the presence of BPO. UROLOGY 86: 1032–1036, 2015. © 2015 Elsevier Inc.

Lower urinary tract symptoms (LUTSs) can be classified into storage, voiding, and postmicturition symptoms.¹ Traditionally, in male patients, they have been related to benign prostatic obstruction (BPO) and/or bladder dysfunction.^{2–4}

Pressure flow studies (PFSs) are considered the gold standard in the diagnosis of bladder outlet obstruction (BOO) in male patients.⁴ However, according to the European Association of Urology guidelines, PFSs should be performed only in individual patients before surgery or when evaluation of the underlying pathophysiology of

LUTSs is warranted.^{4,5} Moreover, the clinical benefit of the patient is often lacking; the procedure is invasive and carries a consistent risk of complications (discomfort, hematuria, fever, urinary tract infection).^{6,7}

Lately many efforts have been made to avoid PFSs by less-invasive methods.^{8–11} BOO diagnoses by bladder/detrusor wall thickness,⁹ bladder weight measures,¹⁰ and intraprostatic bladder protrusion¹¹ have been proposed by many authors. However, all these methods are still considered investigational.⁴

Recently, the Young Academic Urologists (YAU) have developed a clinical nomogram to predict BPO in patients suffering from LUTSs due to benign prostatic enlargement (BPE).¹² The nomogram includes only 2 parameters, and it is simple to use and represents an accurate tool to predict BPO.¹² This approach, although not yet validated, would avoid in clinical practice the use of invasive PFSs in about 83% of the patients.¹² The aim of our study was to externally validate and test the performance characteristics of the YAU

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From the Department of Urology, Ospedale Sant'Andrea, La Sapienza University, Rome, Italy; the Department of Urology, Ospedale Careggi, Florence, Italy; and the Department of Urology, Policlinico Umberto I, La Sapienza University, Rome, Italy

Address correspondence to: Cosimo De Nunzio, M.D., Ph.D., Department of Urology, Ospedale Sant'Andrea, II° Faculty of Medicine, "La Sapienza" University, Rome, Italy. E-mail: cosimodenunzio@virgilio.it

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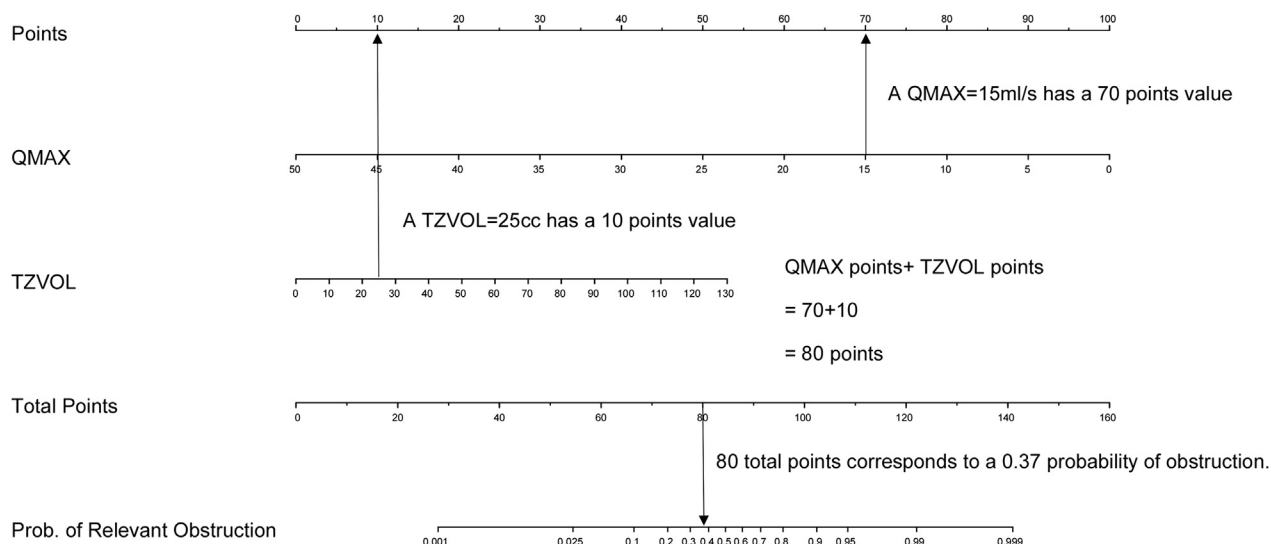


Figure 1. We present the case of a patient with a maximal urinary flow rate (Qmax) of 15 mL/s and a transitional zone volume (TZV) of 25 mL. To obtain the nomogram-predicted probability of benign prostatic obstruction (BPO) diagnosis on pressure flow studies, locate the patient's variable values at each axis. Draw a vertical line to the "points" axis to determine how many points are attributed for each variable value (70 points for a Qmax of 15 mL/s and 10 points for a TZV of 25 mL). Sum the points for all variables and locate the sum on the "total points" line (total points: 80 points). Draw a vertical line from the total points axis toward the "probability of relevant obstruction" axis to determine the patient BPO probability (BPO probability: 37%).

nomogram in a consecutive series of patients with LUTSs and BPE.

MATERIALS AND METHODS

Between January 2013 and September 2014, a consecutive series of patients with LUTSs and BPE aged ≥ 45 years, after signing a dedicated informed consent, underwent standardized PFSs in 2 Italian centers.

Patients with neurologic disorders, renal insufficiency, bladder stones, prostate cancer, urethral stricture, and previous pelvic surgery were excluded.

For all patients, we collected a detailed clinical history and performed physical examination including digital rectal examination. LUTSs were evaluated by the International Prostate Symptom Score (IPSS) including the quality of life question. All patients underwent free uroflowmetry, postvoiding residual urine, and PFSs. Finally, prostatic volume (PV) and transitional zone volume (TZV) were measured with a transrectal ultrasound (TRUS).

Ultrasound measurements were performed with a 3.5-MHz convex probe and a 7.5-MHz intracavitary probe for the TRUS (BK-Medical). The ellipsoid formula ($\pi/6 \times \text{width} \times \text{height} \times \text{depth}$ of prostate/prostate transitional zone) was used to calculate PV and TZV. A single operator for each center performed all ultrasound measurements.

All patients performed at least 2 free-flow tests to obtain a voided volume of ≥ 150 mL. The best voiding performance was then selected for statistical analysis. The maximum flow rate automatically given by the flowmeter was selected; however, if artifacts were present, the 2-second law was used to correct them. Thereafter, residual urine was measured by suprapubic ultrasound.

Transurethral pressure-flow study was performed in all patients according to the International Continence Society recommendations.¹³ PFS parameters included maximum flow rate (Qmax),

detrusor pressure at maximum flow rate (pdetQmax), opening detrusor pressure (PdetOp), and detrusor pressure at minimum flow (PdetVoidMin). PFS parameters were plotted on the 1993 version of the Schäfer nomogram¹⁴ to obtain the Schäfer class. PFSs were performed blind of any other clinical parameter. BPO was defined as the presence of a Schäfer Class ≥ 3 .

Qmax at uroflowmetry and TZV were plotted on the YAU nomogram to detect BPO nomogram probability. Figure 1 shows how to plot on the nomogram Qmax and TZV to detect BPO nomogram probability.

Statistical Analysis

All statistical tests were performed using the SPSS V. 12.0 software (SPSS, Chicago, IL). Evaluation of data distribution confirmed a non-normal distribution of the study data set. Differences between groups of patients in medians for quantitative variables and differences in distributions for categorical variables were tested with the Kruskal-Wallis one-way analysis of variance and chi-square test, respectively.

Receiver operating characteristic (ROC) curves were produced to evaluate the area under the curve (AUC) and the diagnostic performance of the YAU nomogram as a predictor of BOO. An AUC of 1.0 represents a complete prediction of obstruction, whereas an AUC of 0.5 represents a 50% probability of obstruction similar to a coin toss. The diagnostic performance of the YAU nomogram was also expressed by the calculation of sensitivity, specificity, positive predictive value (PPV), and negative predictive value. A *P* value of 5% was considered as the threshold for significance. Data are presented as median (range), mean $\pm$ standard deviation, and median with interquartile range (IQR).

RESULTS

Overall, 449 patients were enrolled. Patient's characteristics are shown on Table 1. In those, 163 patients

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