Intravesical Prostatic Protrusion in Men in Olmsted County, Minnesota

Michael M. Lieber, Debra J. Jacobson, Michaela E. McGree, Jennifer L. St. Sauver,* Cynthia J. Girman† and Steven J. Jacobsen‡

From the Department of Urology (MML), Division of Biomedical Statistics and Informatics (DJJ, MEM) and the Division of Epidemiology (JLS, CJG, SJJ), Department of Health Sciences Research, College of Medicine, Mayo Clinic, Rochester, Minnesota; Merck Research Laboratories, West Point, Pennsylvania (CJG); and Southern California Permanente Medical Group, Pasadena, California (SJJ)

Purpose: Ultrasonically measured intravesical prostatic protrusion may be a promising noninvasive method of assessing bladder outlet obstruction. Previous investigations of this technique focused on patients with acute urinary retention and symptomatic men identified in urology clinics, which may not reflect the distribution of intravesical prostatic protrusion in community dwelling men.

Materials and Methods: In 2006 a total of 322 white men residing in Olmsted County, Minnesota underwent transrectal ultrasound examination which permitted direct measurement of intravesical prostatic protrusion. Cross-sectional associations between lower urinary tract symptoms/benign prostatic enlargement and intravesical prostatic protrusion were measured. Rapid increases in lower urinary tract symptoms/benign prostatic enlargement measures as predictors of severe intravesical prostatic protrusion were also assessed.

Results: Overall 10% of these men had an intravesical prostatic protrusion of 10 mm or greater. Greater intravesical prostatic protrusion was weakly correlated with greater prostate volume ($r_s = 0.28$), higher obstructive symptoms ($r_s = 0.18$) and lower peak urinary flow rate ($r_s = -0.18$). Men with the most rapidly growing prostate before intravesical prostatic protrusion measurement were 3 times more likely to have an intravesical prostatic protrusion of 10 mm or greater. Men with an intravesical prostatic protrusion of 10 mm or greater were more likely to use medications for lower urinary tract symptoms/benign prostatic enlargement compared to those with an intravesical prostatic protrusion less than 10 mm (adjusted OR 2.95, 95% CI 1.23–7.06).

Conclusions: These population based data provide reference ranges for future studies of intravesical prostatic protrusion as a predictor of adverse urological outcomes. Intravesical prostatic protrusion is significantly correlated with greater prostate volume, higher obstructive symptoms and lower peak urinary flow rate, suggesting that it may have clinical usefulness in predicting the need for treatment.

Key Words: urinary tract, prostate, urinary retention, organ size, prostatic hyperplasia

Abbreviations and Acronyms

AUR = acute urinary retention

BOO = bladder outlet obstruction

BPE = benign prostatic enlargement

IPP = intravesical prostatic protrusion

LUTS = lower urinary tract symptoms

PSA = prostate specific antigen

TWOC = trial without catheter

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Study received institutional review board approval.

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* Correspondence: Department of Health Sciences Research, Mayo Clinic, 200 First St. SW, Rochester, Minnesota 55905 (telephone: 507-538-1460; FAX: 507-284-1516; e-mail: stsauver.jennifer@mayo.edu).

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BENIGN prostatic enlargement is a common problem for aging men[1] that has been associated with increased risk of LUTS,[2] AUR,[3] and medical and surgical treatment.[4] Several studies have suggested that it is not BPE alone that causes LUTS, but rather the extent to which the prostate protrudes into the bladder. These studies suggest that ultrasonically measured IPP is correlated with BPE,[5,6] and that it may be a useful, noninvasive predic-

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tor of urodynamically ascertained BOO[5,7–9] as well as a predictor of TWOC success for men with AUR.[6,10] Chia et al found that 75% of men with significant BOO had IPP greater than 10 mm, whereas only 8% of men with nonsignificant BOO had IPP greater than 10 mm.[7] Lim[5] and Nose[9] et al found correlations between IPP and BOO of 0.51 and 0.62, respectively. In a series of 100 consecutive men with an initial episode of AUR only 33% of men with an IPP greater than 10 mm had a successful TWOC, while 64% of men with IPP from 1 to 5 mm had a successful TWOC.[10]

While these studies provide initial support for the use of ultrasonic IPP measurement in managing BOO and successful TWOC, they have been limited to clinical series of patients, and do not reflect the full spectrum of BPE and IPP. Studying only a limited range of disease may overestimate sensitivity and specificity.[11] To more fully understand the usefulness of IPP measurement it is necessary to investigate the distribution of IPP and associations with urological outcomes in the general community. Therefore, data from the Olmsted County Study of Urinary Symptoms and Health Status Among Men were used to describe IPP in a population based sample of men, and to assess associations between IPP and LUTS, prostate volume, post-void residual and peak urinary flow rate.

MATERIALS AND METHODS

Study Population

Many of the details of the study have been previously published.[12,13] A randomly sampled, population based group of white men 40 to 79 years old residing in Olmsted County, Minnesota in 1990 was identified through the Rochester Epidemiology Project.[14] Men who had a history of prostate or bladder surgery, urethral surgery or stricture, or medical or other neurological condition that could affect normal urinary function were excluded from study. After excluding men with preexisting conditions from analysis 3,874 were asked to join the study and 2,115 agreed to participate (55%). A comparison of medical records of participants and nonparticipants indicated few differences except for a history of urological diagnosis, with responders having a slightly greater prevalence of diagnosis of kidney stones, urinary tract infections or benign prostatic hyperplasia.[15]

Participants completed a previously validated baseline questionnaire that assessed lower urinary tract symptom severity from questions similar to the American Urological Association Symptom Index and associated bother. All participants also voided into a portable urometer to measure peak urinary flow rate. A 25% random subsample was invited to participate in a detailed in-clinic urological examination including transrectal sonographic imaging to determine prostate volume and serum PSA. Of 537 men 475 (88%) agreed to participate in this more intensive examination.

The cohort was actively followed on a biennial basis for 16 years using a protocol similar to that of the initial examination. During the second and third round of visits men who did not participate in the followup were replaced by 332 men randomly selected from the community after being screened for the exclusion criteria used at baseline. Of the replacement men 158 were added to the clinic subset. Since that time the study has been maintained as a closed cohort. However, in the 8th biennial round (2004) a random sample of 133 men who had previously been receiving questionnaires was added to the in-clinic subset. The study was reviewed and approved by the institutional review boards of Mayo Clinic and Olmsted Medical Center.

Measurement of IPP

IPP measurements were incorporated into the in-clinic examination during the 9th biennial round of the study (2006). IPP was measured from images of the prostate obtained from transrectal ultrasound using the midline sagittal image by drawing a line from the anterior to posterior intersections of the bladder base and tip of the intravesical prostatic protrusion (fig. 1). A cut point of IPP 10 mm or greater, which has been previously shown to be predictive of BOO and successful TWOC, was used for categorical analyses.[6,7,10] Other cut points were also examined.

Measurement of LUTS/BPE

Methods for determining prostate volume and LUTS measures have been previously described. Prostate volume was measured by transrectal ultrasound (type 8551 7.0 MHz endosonic multiplane transducer, Bruel and Kjaer, Naerum, Denmark).[3,16] LUTS and associated bother were measured by a previously validated questionnaire with questions similar to the American Urological Association Symptom Index.[13,17] Serum PSA was determined with the Tandem-R PSA assay (Hybritech Inc, San Diego, California). The serum samples were obtained before any prostatic manipulations including digital rectal examination and transrectal ultrasound.[18] Peak urinary flow rates were measured electronically using a Dantec 1000 urometer (Dantec Medical, Santa Clara, California).[19]

Measurement of Treatment

Information on the use of medical and surgical LUTS/BPE treatments and prostate cancer diagnoses was obtained

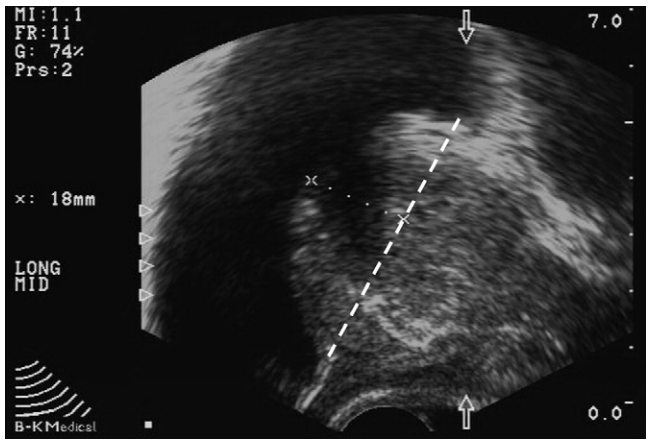

Figure 1. Measurement of IPP via transrectal ultrasonic imaging

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