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DISCUSSION PAPER

Bladder outlet obstruction index, bladder contractility index and bladder voiding efficiency: three simple indices to define bladder voiding function

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Introduction

The consultations sponsored by the WHO have indicated the confirmed value of urodynamics for the precise definition of lower urinary tract dysfunction in men [1]. In the older man it is generally accepted that the outcome of outlet tract surgery (e.g. TURP) is improved if patients with BOO are selected by urodynamic studies [2].

Most analytical work has concentrated on defining BOO from pressure-flow studies of voiding, and three well-known nomograms have been used to categorize patients as obstructed, equivocal (or slightly obstructed) and unobstructed [3–5]. The categories described in these nomograms were based on observations of patients who underwent surgery for LUTS, mainly by TURP; the detrusor pressure at maximum flow rate ($pdetQ_{max}$) was reduced in the obstructed group, was reduced unpredictably in the equivocal group and was unchanged in the unobstructed group. Lim and Abrams [6] showed that all patients were identically classified by the Abrams-Griffiths (AG) nomogram and the Schäfer nomogram, and that there was only a 6% discrepancy in diagnosis between these nomograms and the URA nomogram. They also described the use of a number, the AG number, derived from the equation for the slope of the line dividing obstructed from equivocal in the AG nomogram, and the same line dividing obstructed (III) from slightly obstructed (II) in the Schäfer nomogram:

$$\text{AG no. (BOOI, see below)} = pdetQ_{max} - 2Q_{max} \quad (1)$$

Subsequently, Griffiths *et al.* [7] published the provisional ICS nomogram, which is now that recommended for use in older men with LUTS suggestive of benign prostatic obstruction (BPO) [2] (Fig. 1). Using this nomogram, men can be divided into three groups according to their BOO index (BOOI). It is no longer appropriate to use the term AG number, as we now use the new ICS nomogram. Therefore, from eqn 1, patients are obstructed if the BOOI is >40, equivocal if the BOOI is 20–40, and unobstructed if the BOOI is <20 (Fig. 1).

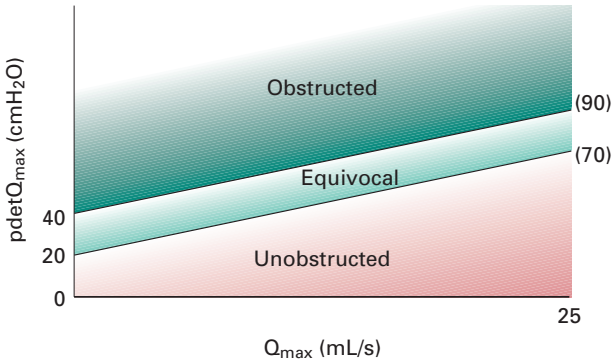

Fig. 1. The provisional ICS nomogram for the analysis of voiding; patients are divided into three classes, according to the BOO index ($pdetQ_{max}$–$2Q_{max}$). Green, obstructed (BOOI $\geqslant 40$); light green, equivocal (BOOI = 20–40); light red, unobstructed (BOOI $\leqslant 20$).

Less effort has been devoted to examining bladder contractility during voiding, although the ICS has defined normal contractility and detrusor under-activity, where the bladder contraction is either of low amplitude and/or of inadequate duration to empty the bladder at the normal rate [8]. An index for bladder contractility can be derived from the contractility groups that Schäfer described [9], i.e. strong, normal, weak and very weak. The slope of Schäfer's lines is given by the formula:

$$\text{(BCI, see below)}\ pdetQ_{max} + 5Q_{max} \quad (2)$$

It is suggested that the same formula is used to derive the bladder contractility index (BCI), such that a strong contractility is a BCI of >150, normal contractility a BCI of 100–150 and weak contractility a BCI of <100.

Bladder voiding efficiency (BVE) is a product of bladder contractility against urethral resistance and is measured

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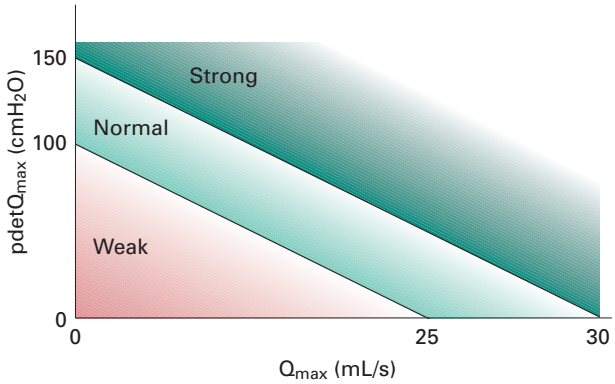

Fig. 2. The bladder contractility nomogram, dividing patients into three categories according to the bladder contractility index ($pdetQ_{max} + 5Q_{max}$). From Schäfer [9]. Green, strong (BCI $\geqslant$150); light green, normal (BCI = 100–150); light red, weak (BCI $\leqslant$100).

according to the degree of bladder emptying. The BVE can be defined as a percentage (3);

$$BVE = (\text{voided volume/total bladder capacity}) \times 100$$

Therefore, if a patient voids 300 mL leaving a postvoid residual volume of 100 mL (total bladder capacity 400 mL), then he has a BVE of 75%.

The BOOI and BCI can be calculated from a simple formula with or without a nomogram (Fig. 3). Using this nomogram, any group of men can be categorized into nine classes (Fig. 3), according to three obstruction categories and three categories of bladder contractility. There is a spectrum of patients, ranging from Group 1 (no obstruction and good contractility) to Group 9 (obstruction with weak contractility). Using this scheme, a group of patients can be described accurately, allowing comparisons among different studies. If the BVE is added, then the description of both an individual patient's

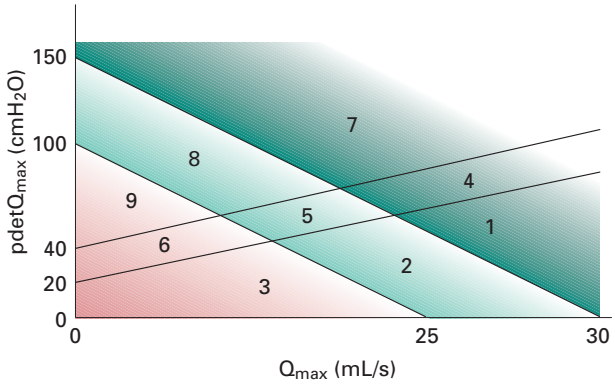

Fig. 3. A composite nomogram allowing categorization of patients into nine zones and therefore six groups, according to the BOOI and the BCI.

voiding function, or that of a group of men, becomes even more precise.

In summary, these indices provide an easy to use and precise way of defining an individual's voiding function that could be used to describe a group of patients in a trial of drug or surgical treatment for men with LUTS suggestive of BPO.

Note added in preparation:
Since this paper was accepted the author has been made aware of an unpublished 'read by title' abstract, in which Schäfer describes the variable 'DECO', calculated using the same formula as that used for BCI (Abstract Book, ICS Sydney, 1995).

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