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Urodynamics and laser prostatectomy

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Summary. A total of 81 patients with symptomatic bladder-outlet obstruction (BOO) due to benign prostatic hyperplasia (BPH) underwent visual laser ablation of the prostate (VLAP) using a right-angled firing neodynium: YAG laser. The mean pre-operative prostatic volume was 48.5 ml. All patients were discharged on the 1st post-operative day with an indwelling catheter. Two patients underwent a transurethral prostatectomy (TURP) after failing a trial without catheter on two occasions. Of the remaining 79 patients, 75 were evaluated 6 months post-operatively. Mean symptom scores (I-PSS) decreased from 20.9 to 5.8, the mean maximal urinary flow rate increased from 7.9 to 16.4 ml/s and the mean residual volume decreased from 88.1 to 15.6 ml. Several different methods of evaluating BOO from pressure-flow measurements were used and all showed improvement. All the above-mentioned parameters showed a highly significant improvement ($P < 0.01$) at 6 months.

Transurethral resection of the prostate (TURP) is currently the optimal treatment for patients with lower-urinary-tract symptoms and proven bladder-outlet obstruction (BOO) secondary to benign prostatic hyperplasia (BPH). However, it has a significant morbidity and mortality [4, 10] and up to a quarter of patients have a less than satisfactory outcome [11, 17]. There is therefore scope for safer and more effective methods of treatment of BPH.

Visual laser ablation of the prostate (VLAP) is being rapidly introduced as a new treatment for BOO due to BPH but needs proper evaluation prior to its widespread use. Although short-term studies are encouraging, enabling a short in-patient stay and low peri-operative blood loss [3, 7, 9], the long-term results are not yet known. It is well documented that patients found to be obstructed on pressure-flow studies do better after TURP than unobstructed patients [12]. As laser prostatectomy aims to remove obstructing prostatic tissue in a manner similar to that of TURP, this study aimed to evaluate the objective outcome of VLAP using pressure-flow studies.

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Patients and methods

Between December 1992 and December 1993, 81 patients undergoing VLAP in 2 European centres were studied. All patients were over 50 years of age and considered suitable for elective prostatectomy. The prostatic volume was measured pre-operatively by transrectal ultrasound. VLAP was performed using a neodynium: YAG laser with right-angled laser fibre (Urolase or Ultraline). For the Urolase fiber a 40-W power setting with continuous firing for 60–90 s to four quadrants was used. The Ultraline fiber was used in a 60-W power setting with "painting" of the prostate. Laser energy was applied for a total of 90 s to four quadrants. Post-operatively, 20 patients underwent transurethral catheterisation and 61 patients underwent suprapubic catheterisation. All patients were discharged on the 1st post-operative day. The group with urethral catheters underwent a trial without catheter 7–10 days later, but the suprapubic group kept their catheters until they were voiding satisfactorily with a small post-void residual urinary volume (mean, 18 days).

All patients underwent subjective assessment pre-operatively and 6 months post-operatively with the International Prostate Symptom Score (I-PSS) questionnaire. This comprises 7 questions with a maximal score of 5 per question, depending on the severity of the urinary symptoms; thus, a maximal total score of 35 is possible for the most severe symptoms.

Objective assessment pre-operatively and 6 months post-operatively included measurement of maximal urinary flow rates and residual urinary volume by ultrasound and pressure-flow studies. Pressure-flow studies were performed using a rectal and a urethral catheter. Filling of the bladder through the urethral line was performed with the patient in the lying or standing position, and voiding was done in the standing position. From the recordings the maximal flow rate (Qmax) and detrusor pressure at maximal flow (P_{det} Qmax) were noted. The degree of bladder-outlet obstruction was evaluated using the Abrams-Griffiths (AG) nomogram [1], Griffiths' urethral resistance factor (URA) [5], the parameters from passive urethral resistance relation (PURR) analysis [13] A_{theo} (theoretical cross-sectional area of the urethra during voiding) and P_{muo} (minimal detrusor pressure with ongoing flow), Schafer's grade of obstruction (LPURR) [14], and the AG number [8] (P_{det} Qmax–2Qmax). Statistical analysis was performed using the Wilcoxon matched-pairs signed-rank test.

Results

Of the original 81 patients, 2 underwent a TURP following 2 failed trials without catheter. Both of these patients were in the group that received urethral catheters post-op-

Table 1. Pre-operative characteristics

Total number of patients	75
Mean age	65.3 ± 6.7 years
Mean prostatic volume	48.5 ± 17.2 ml
Mean in-patient stay	2 days
Trial without catheter	7–18 days
Laser used	Side-firing Nd:YAG

eratively. One patient refused follow-up pressure-flow studies at 6 months, although symptomatically he was much improved, and the pressure-flow data were inadequate for analysis in three patients. Thus, 75 patients were further analysed 6 months post-operatively. Their characteristics and treatment are shown in Table 1.

Pre- and post-operative symptom scores and urodynamic measurements are shown in Table 2. The mean values for each of the seven pre-operative IPSS questions were found to decrease significantly post-operatively. Free maximal urinary flow rates (Qmax) and mean post-void residual urinary volume (PVR), measured using ultrasound, improved significantly ($P < 0.01$). During pressure-flow studies the maximal cystometric capacity (MCC), maximal urinary flow rate (QmaxPF), and detrusor pressure at maximal flow ($P_{det}Qmax$) improved significantly when pre- and post-operative values were compared ($P < 0.01$).

The results of the other methods of assessing outlet obstruction pre- and post-operatively are summarised in Table 3. All showed a statistically significant improvement ($P < 0.01$).

Figure 1 shows the results of all 75 patients plotted onto the AG nomogram. This shows a general trend from the obstructed region pre-operatively towards the unobstructed region post-operatively, although some patients remain obstructed. For comparison of the urodynamic changes found after VLAP with those seen in patients who were treated with TURP in a non-randomised fashion, a comparable number of patients from Bristol were evaluated before and after TURP (Fig. 2). This shows a similar shift towards the unobstructed region post-operatively.

Discussion

Although previous studies [3, 7, 9] have shown good subjective outcomes following VLAP, the objective assessments have relied on uroflowmetry. Previous studies have

Table 2. Pre- and post-operative symptom scores and urodynamic data: mean values and standard deviations

Weeks	I-PSS	Qmax (ml/s)	PVR (ml)	MCC (ml)	QmaxPF (ml/s)	$P_{det}Qmax$ (cmH_2O)
0	20.9 ± 5.8	7.9 ± 2.9	88.1 ± 87.9	195.8 ± 103.8	6.0 ± 2.8	79.8 ± 28.4
26	5.8 ± 4.4	16.4 ± 5.8	15.6 ± 31.7	338.2 ± 155.1	13.7 ± 5.6	40.1 ± 20.3

Table 3. Pre- and post-operative measurements of outlet obstruction: mean values and range of results

Weeks	URA (cm H_2O)	LPURR	A_{theo} (mm^2)	P_{muo} (cm H_2O)	AG number
0	49.5 (23.0–113.0)	3.7 (1.0–6.0)	2.25 (0.5–5.1)	42.2 (12–100)	68.0 (21.4–144.6)
26	18.8 (6.0–56.2)	1.1 (0–5.0)	7.5 (2.0–18.1)	17.6 (0–50)	10.9 (–44.0–+101.0)

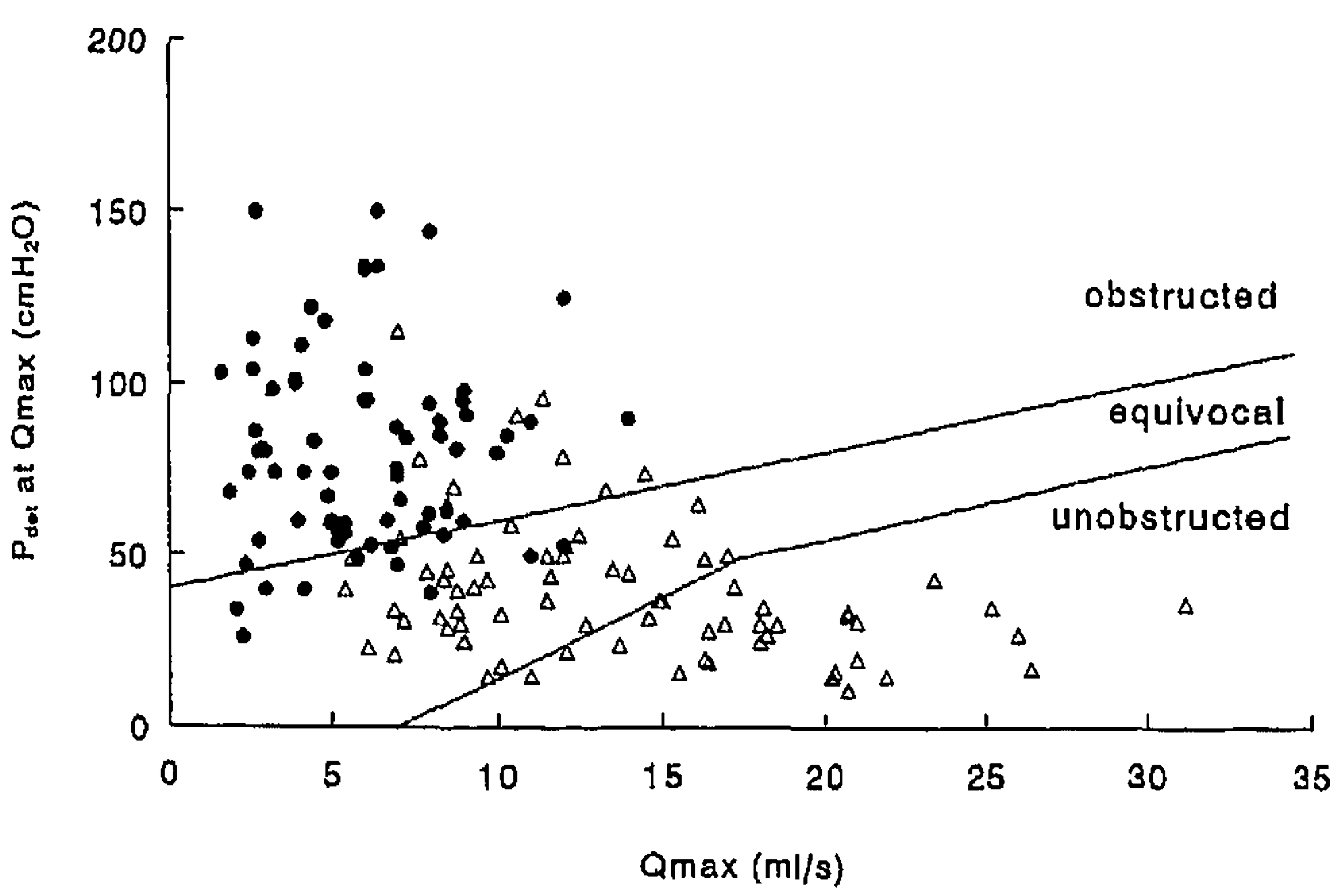

Fig. 1. Abrams-Griffiths nomogram of pre- and post-operative pressure versus flow values of patients undergoing VLAP; ● baseline; Δ 6 months

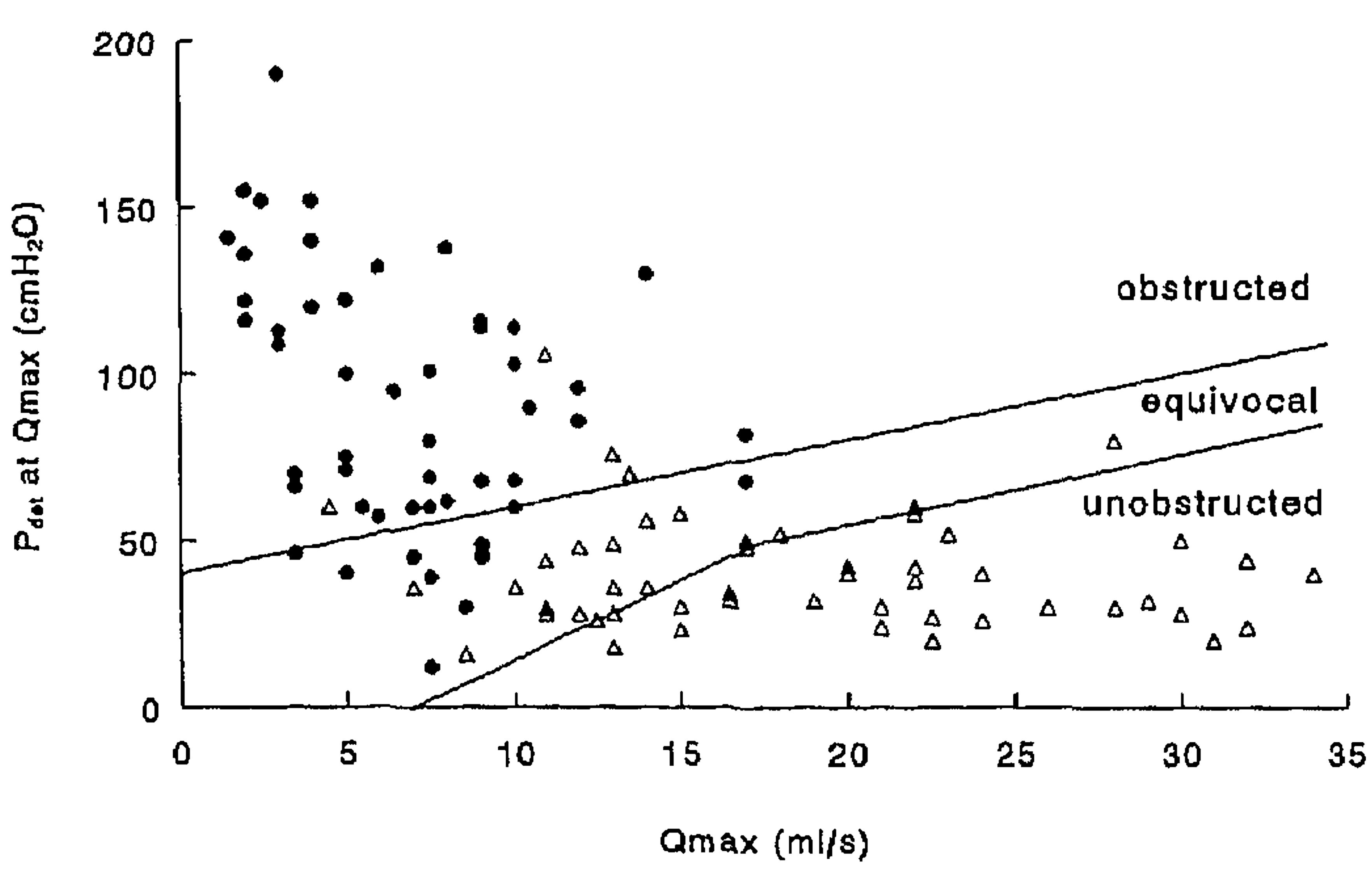

Fig. 2. Abrams-Griffiths nomogram of pre- and post-operative pressure versus flow values of patients undergoing TURP; ● baseline; Δ 6 months

questioned the reliability of uroflowmetry alone in the diagnosis of outlet obstruction. Schäfer et al. [15] found that only 74% of patients classified as obstructed on uroflowmetry were also obstructed on pressure-flow studies, and Chancellor et al. [2] concluded that bladder-outlet obstruction and detrusor underactivity could not be distinguished on the basis of uroflowmetry. The uroflowmetry parameters are associated with obstructive voiding, not with the grade of obstruction. Pressure-flow studies are therefore essential in the objective assessment of any new treatment aimed at relieving outlet obstruction.

Studies evaluating urodynamic changes in pressure-flow parameters in alternative BPH treatments are sparse. The available data suggest minimal urodynamic changes incomparable with results seen after TURP [6, 16]. The results of the present study suggest that VLAP is an effective method in the treatment of bladder-outlet obstruction as determined by pressure-flow studies. Figures 1 and 2 show there is little difference between the improvement seen with the "gold standard" TURP and that experienced by the VLAP study. However, the ability of VLAP to relieve obstruction as compared with TURP can be determined only in a randomised prospective manner.

The majority of the patients in the present study were urodynamically obstructed pre-operatively. The small group of non-obstructed patients were also successfully treated with laser treatment, showing both good symptomatic and good objective improvement. However, for these patients, other less invasive therapies, e.g. medical treatment or thermotherapy, should be considered.

Long-term subjective and objective follow-up as well as comparative studies with conventional therapy are necessary for adequate assessment of this new technique. The results of large multicentre trials, currently under way, comparing TURP with VLAP and "watchful waiting" are awaited.

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