World J Urol (2015) 33:599–607
DOI 10.1007/s00345-015-1490-y

INVITED REVIEW

Safety, efficacy and reliability of 180-W GreenLight laser technology for prostate vaporization: review of the literature

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Received: 11 November 2014 / Accepted: 9 January 2015 / Published online: 3 February 2015

Abstract
Purpose The aim of this study is to investigate the efficacy and safety of 180-W XPS GreenLight laser technology for photoselective prostate vaporization.
Patients and methods A systematic search of the electronic databases was performed. Inclusion criteria were: full-text peer-reviewed journal article, with original data analysis that evaluates the feasibility and the outcome only of 180-W XPS GL laser system. Data at baseline and during follow-up have been taken into account. Intra-operative and postoperative (functional results and complications) data were collected and analyzed.
Results We found 165 articles in our research, among which only nine articles were selected (total 991 patients). A certain grade of variability is present in all the studies in terms of scientific design, sample size and methods of reporting functional results and complications. Nevertheless, a homogenous benefit for patients in terms of symptom score improvement, post-void residual volume reduction and urinary max flow rate improvement was shown. According to Clavien–Dindo classification, 292 (83.7 %) adverse events were recorded ≤ grade 2. Adverse events ≥ grade 3 were 57 (16.3 %), among which bleeding, urinary retention and residual obstructive tissue represented the wide majority. No mortality was reported. Male sexual function was poorly investigated.
Conclusions The 180-W XPS GL laser technique is feasible and safe, with a remarkable clinical benefit. Long-term evidence on outcomes and complications are suitable even in the sphere of male sexuality.

Keywords Photoselective vaporization of the prostate · Laser prostatectomy · Outcomes · Complications · GreenLight laser 180-W XPS · Moxy fibers

Abbreviations

LUTS	Lower urinary tract symptoms
BOO	Bladder outlet obstruction
BPE	Benign prostate enlargement
BPO	Benign prostate obstruction
TURP	Transurethral resection of the prostate
PVP	Photoselective vaporization of the prostate
PSA	Prostate-specific antigen
IPSS	International Prostate Symptom Score
Qmax	Maximum urinary flow rate
ASA	American Society of Anesthesiologists
QoL	Quality of life
IIEF-5	International Index of Erectile Function

Introduction

Lower urinary tract symptoms (LUTS) are often related to bladder outlet obstruction (BOO) as a result of benign prostate obstruction (BPO) and enlargement (BPE) [1]. The natural history of untreated BOO includes long-term complications like: detrusor failure, renal failure, recurrent urinary tract infections, urinary retention, bladder diverticula and bladder stones [2]. In patients with

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moderate-to-severe LUTS secondary to BPO/BPE and indication for surgery, the most widely adopted option is the transurethral resection of the prostate (TURP): today the guidelines support, for the treatment of BPO and BPE, the use of different laser systems and applications [3]. Recent advancements in laser technology, together with the increasing demand for a minimally invasive procedure to alleviate LUTS more safely and efficaciously than TURP, have led to the introduction of photoselective vaporization of the prostate (PVP) using the "GreenLight" laser (GL laser) [4]. In 2000, American Medical Systems (Minnetonka, Minnesota, USA) launched the "PV System" (80-W KTP laser) introduced by LaserScope and then in 2006, the "HPS System" (120 W). More recently, in 2011, the same company released the "GreenLight XPS," a higher powered 180-W system accompanied by significant fiber design changes [5]. The purpose of this review is to evaluate the efficacy and safety of the "GreenLight XPS 180-W laser" (180-W XPS GL laser) system in the treatment of BOO due to BPO/BPE.

Materials and methods

Searching strategy

All the studies were identified by searching the electronic databases of MEDLINE (PubMed), Cochrane Library, Science Direct and Google Scholar. The medical subject headings and keywords used included: PVP, Photoselective vaporization of the prostate; 180-W GreenLight laser; BPH; prostate; and Moxy fibers. Additional references were obtained from the reference list of full-text manuscripts. For MEDLINE search, we used the following filters: Languages (English), Species (Humans), Text availability (full-text availability). There was no filter applied for the date of publication. The search strategy was modified as required for each electronic database. Three independent reviewers performed all aspects of the search strategy and reviewed the full-text articles in details resolving eventually discrepancies by consensus.

Selection of studies

Inclusion and exclusion criteria were defined before the literature search. To be included, the articles had to (1) evaluate the feasibility and the outcomes of 180-W XPS GL laser system, (2) be from a full-text peer-reviewed journal and (3) contain an original data analysis. Articles were excluded if the study (1) was not in English, (2) did not exclusively show data of patients treated with the 180-W XPS GL laser PVP, and (3) had not a prospective design. Figure 1 resumes selection of study process.

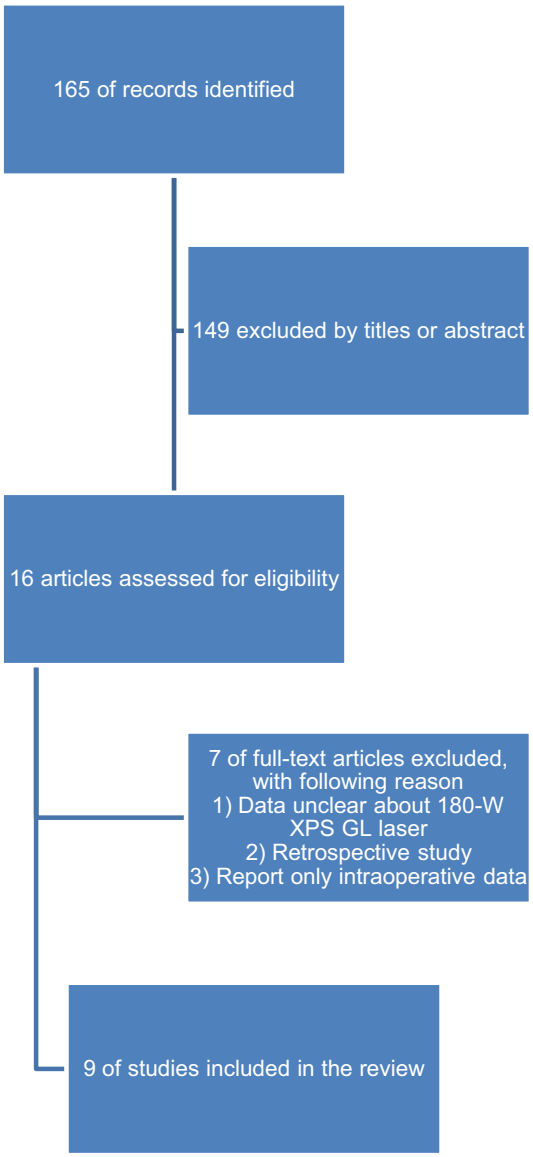

Fig. 1 Selection of studies

Patient characteristics

Data about age, PSA, International Prostate Symptom Score (IPSS), quality of life (IPSS-QoL), maximal flow rate (Qmax), post-void residual (PVR), prostate volume, American Society of Anesthesiologists Score (ASA score) and/or Charlson comorbidity index (CCI), history of catheterization or acute urinary retention and history of anticoagulants or antiaggregant assumption were collected.

Results

Studies and Patient characteristics

Our research identified 165 articles, among which nine fulfilled the inclusion criteria. Among these, two articles were referred to the same study (GOLIATH), which was the only prospective randomized controlled trial [6, 7]. Table 1 shows the baseline characteristics of the selected studies. A total of 991 patients underwent surgery. All men undergoing surgery were placed between the fifth and tenth decade of life (range 43–93). Two hundred and ninety-five patients (29.7 %) had history of catheterization or acute urinary retention, and 361 (36.4 %) patients were under anticoagulants or antiaggregants. Men in urinary retention could not have baseline flow data and symptom scores recorded.

Surgical procedures and operating parameters

Five of the eight studies [5, 6, 8–10] were conducted following the surgical technique described by the International GreenLight Users (IGLU) group or by Zorn et al. [10–12]. The technique can be schematically resumed in eight-phase procedure like the IGLU group: introduction of the cystoscope looking at the anterior urethra; careful cystoscopy is conducted to visualize the ureteral orifices and rule out bladder tumors; creation of the working space; clearance of the lateral lobes and of the apex; the middle lobe can be approached in different ways; proceed to the treatment of the bladder neck; check that no major lumps protrude into the lumen and that there is no active bleeding; the patency of the cavity also to empty bladder [11]. Campbell et al. [9] proceeded creating a working channel at 80 W power setting, and this was immediately increased to 120 W power once there was sufficient working space; therefore, power was increased further from 120 to 180 W as soon as there was sufficient space. Misrai et al. followed the technique previously described by Malek et al. [13, 14]. Altay et al. [15] performed the procedure in a TURP-like manner. Median lobe, bladder neck, lateral lobes and apical portion of adenoma were vaporized in order to create a good cavity. Energy was applied by using a non-contact, sweeping motion technique. Emara et al. [16] used a modified technique, originally developed with the 120-W HPS generator. They go from the middle of the gland through the lateral lobes going from distal to the proximal and removing the bladder neck and any middle lobe at the end of the procedure. A "bug bee" coagulation electrode was sometimes used to control any bleeding.

Perioperative data (surgical procedure, operative time, laser time, laser time per gram prostate, laser energy, laser energy per gram prostate, duration indwelling catheter (IDC) and postoperative stay) are shown in Table 2.

Functional results and efficiency parameters

The baseline characteristics and the longest follow-up data are shown in Table 3. PSA serum values, IPSS, IPSS-QoL, Qmax, PVR and prostate volume (PV) were examined. We found a significant change in the functional values in all the examined studies [5–10, 13, 15, 16]. PSA, IPSS, IPSS-QOL score, PVR and PV decreased over time [6], whereas the Qmax significantly increased in all studies.

Patients with chronic urinary retention were able to void after the catheter removal, as reported by Campbell [9]. Bachmann demonstrated that the chronic retention did not have negative impact on outcome after 180-W XPS GL laser [10]. The long-term (12 months) results, available only for two studies, are presented in Fig. 2 [7, 15].

Data about erectile function (IIEF-5 at 3, 6 and 12 months) are shown in Table 4. In all series, the IIEF-5 score decreased during the follow-up although not significant to cause a change of class [7, 9, 10, 15]. The GOLIATH study and Altay reported that retrograde ejaculation rate was reported as 41 and 65 %, respectively [6, 15].

Complications

Main complications (reported according to Clavien–Dindo classification for surgical complications) are reported in the Table 5. A total of 292 (83.7 %) adverse events were graded Clavien ≤ 2. Adverse events Clavien grade ≥ 3 were 57 (16.3 %), among which bleeding, urinary retention, residual obstructive tissue represented the wide majority. No mortality was reported. Capsule perforation was reported in 1.8 % of the cases (18/991). Urinary incontinence occurred in 41 patients. In the GOLIATH study, at 12 months urinary leakage of any degree was observed only in four patients [7]. The reintervention rate was 1.81 %, due, in most cases, to bladder neck obstruction, hematuria, obstruction secondary to residual tissue, urethral stricture, urinary frequency or retention as shown by the GOLIATH study at 12-month follow-up [7].

Discussion

180-W XPS GL was introduced to enhance the efficiency, durability and effectiveness of surgical treatment in patients suffering from BPH, especially in patients with large prostates [5]. The recent XPS laser system (laser generator and specific laser fibers) represents a significant improvement over previous systems (80-W KTP GL and 120-W HPS GL) maintaining high level of safety allowing to obtain a higher rate of vaporization [10, 17]. In fact, the properties of the fibers Moxy, thanks to the continuous saline flow around the fiber (active cooling cap technology), steel-tip

Table 1 Baseline patients variables

	Study design	No.	Age	PSA (ng/mL)	IPSS	Qmax (mL/s)	PVR (mL)	Prostate volume (mL)	ASA score or CCI	Urinary retention	Anticoagulant/ antiaggregant
Campbell[a]	Non-RCT SC	50	66.5 (60–71.8)	3.55 (1.7–7.3)	20 (14–25)	9 (6.2–12.2)	143 (63–260)	68 (45.5–94.0)	2.0 (2.0–2.0)	7	/
Bachmann[b]	Non-RCT MC	201	70.7 ± 9.2 (43–93)	5.5 ± 6.9 (0.2–77)	19.6 ± 7.7 (2–35)	8.4 ± 3.7 (4.1–14.8)	190 ± 355 (n.m. −2,600)	67.6 ± 42.1 (6–340)		51 CBS 70 H-AUR	89
GOLIATH[c]	RCT MC	136	65.9 (6.8) (44.0, 66.0, 80.0)	2.7 (2.1) (0.1, 2.1, 9.6)	21.2 (5.9) (8.0, 21.0, 35.0)	9.5 (3.0) (3.0, 9.5, 16.1)	110.1 (88.5) (0.0, 91.9, 361.0)	48.6 (19.2) (17.3, 45.4, 105.0)	0.4 (0.6) (0.0, 0.0, 2.0)		33
Tal Ben-Zvi[d]	Non-RCT SC	120	67.9 (50–85)	4.2 (0.3–19)	24.2 (16–34)	7 (2–13)	308 (51–1350)	79.1 (31–229)	2.2 (1–4)	57	64
Misrai[a]	Non-RCT SC	200	70 (64–77)	2.5 (1.57–4.3)	18 (15–21)	7 (5.3–8.8)	0 (0–140)	50 (40–70)	4 (3–6) 1 = 13 2 = 130 3 = 57	37 CBS 13 H-AUR	90
Altay[b]	Non-RCT SC	68	71.1 ± 9.8 (49–85)	7.4 ± 8.1 (0.4–33)	19.9 ± 9.5 (8–32)	7.6 ± 5.4 (2.1–14.3)	165 ± 182 (32–388)	104.3 ± 29.7 (81–185)	/	8	/
Chung[a]	Non-RCT MC	85	70 (65–75)	NA	25 (18–29)	7.7 (5–10)	147 (54–270)	51 (35–96)	/	23	37
Emara[d]	Non-RCT SC	131	72.6 (49–92)	3.83 (0.3–30)	18 (4–30)	9.82 (3.8–16)	169.7 (24–1,000)	66.23	2 (1–3)	29	48

MC multicenter, *SC* single center, *No.* number of patients, *PSA* prostatic-specific antigen, *PVR* post-void residual, *ASA* American Society of Anesthesiologists, *CCI* Charlson comorbidity index, *CBS* catheterization before surgery, *H-AUR* history of acute urinary retention, *NA* not available

[a] Values are presented as median (interquartile range)

[b] Mean plus or minus standard deviation values (range)

[c] Values shown represent mean (standard deviation)(minimum, median and maximum), unless otherwise noted

[d] Mean values (range)

Table 2 Perioperative data

	Surgical procedure	Total OT (min)	Laser time (min)	Laser time per gram prostate (min/mL)	Laser energy (kJ)	Laser energy per gram prostate (kJ/g)	Duration IDC (h) (day)	Postoperative stay (h) (day)
Campbell[a]	PVP IGLU-standard	56 (46–78.5)	45 (33–63)	0.67 (0.52–0.79)	400 (301.8–601)	6.1 (4.8–7.6)	12 (11–14.8)	18 (16.3–20.8)
Bachmann[b]	PVP IGLU-standard	NA	NA	NA	324 (±187; 50–1.378)	5.3 (±2.3)	49.5 ± 15.6 (Germany) 20.4 ± 27.2 (other centers)	NA
GOLIATH[c]	PVP IGLU-standard	49.6 (21.8) (15.0–46.0–160.0)	44.5 (21.2) (14.0–41.0–144.0)	NA	232.5 (129.5) (43.6–206.6–789.6)	NA	40.8 (71.5) (0.0–22.0–624.8)	65.5 (63.3) (5.5–49.3–524.6)
Tal Ben-Zvi	PVP IGLU-standard	43 (15–118)	22 (7–52)	NA	226 (20–495)	NA	0.7 (0–4) (days)	0.3 (0–2) (days)
Misrai	PVP Malek et al.	50 (IQR 35–67)	30 (IQR 22–45)	NA	231.3 (IQR 161–362.4)	4.77 (IQR 3.62–5.78)	NA	NA
Altay[d]	PVP TUR-P like	65.5 ± 29.6 (38–124)	44.7 ± 39.2 (29–109)	NA	398 ± 169 (39–523)	NA	20.8 ± 1.9 (6–92)	27.3 ± 8.7 (12–80)
Chung[a]	PVP IGLU-standard	46 (35–59.5)	27 (20–36)	NA	211 (130–321)	NA	15 (13–19)	22 (18–26)
Emara[d]	PVP Modified technique	39.6 (10–105)	25.45 (3.26–73.04)	NA	238.28 (45.13–75)	3.6	32.4 (18–78)	22.3 (4–72)

IGLU International GreenLight Users Group, *OT* operation time, *IDC* indwelling catheter, *NA* not available, *IQR* interquartile range

[a] Values are presented as median

[b] Data on energy applied are available for 191 patients

[c] Values shown represent mean (standard deviation) (minimum, median, maximum)

[d] Mean ± SD (range)

Table 3 Pre- and postoperative functional standard parameters after 180-W XPS GreenLight laser therapy

	Baseline					3 months					6 months				
	IPSS	Qmax (mL/s)	PVR (mL)	QoL	PSA (ng/mL)	IPSS	Qmax (mL/s)	PVR (mL)	QoL	PSA (ng/mL)	IPSS	Qmax (mL/s)	PVR (mL)	QoL	PSA (ng/mL)
Campbell[a]	20 (14–25)	9 (6.2–12.2)	143 (63–260)	4 (4–5)	3.55 (1.7–7.3)	7 (4–14)	26 (20.2–36)	32 (0–60)	2 (1.3)	1.4 (0.82–2.70)					
Bachmann[b]	19.6 ± 7.7	8.4 ± 3.7	190 ± 355	3.9 ± 1.1	5.5 ± 6.9	8.5 ± 6.2	18.8 ± 9.3	51 ± 89	1.6 ± 1.4	2.6 ± 3.4	9.4 ± 6.8	21 ± 1.6	35 ± 67	1.4 ± 1.5	2.0 ± 1.2
GOLIATH[c]	21.2	9.5	110.1	4.6	2.7	8.1	23.9	33.3	1.8		6.8	23.3	38.4	1.5	1.4
Tal Ben-Zvi	24.2 (16–34)	7 (2–13)	308 (51–1.350)	4.5 (3–6)	4.2 (0.3–13)	9.8 (3–21)	19.3 (14–31)	21 (0–105)	1.9 (0–5)	/	6.4 (3–16)	23.2 (14–32)	5 (0–30)	1.3 (0–5)	0.9 (0.5–1.2)
Misrai[d]	18 (15–21)	7 (5.3–8.8)	0 (0–140)	4 (4–5)	2.5 (1.5–4.3)	−11.5 to −14	+7 to +9	0–14	−3 to −4	−0.8 to −1.6					
Altay[b]	19.9 ± 9.5 (8–32)	7.6 ± 5.4 (2.1–14.3)	165 ± 182 (32–388)	/	7.4 ± 8.1 (0.4–33)	11 ± 6.6 (5–30)	17.1 ± 6.3 (11–32)	55.6 ± 43.8 (0–210)	/	3.5 ± 2.8 (0.1–18)	8.4 ± 7.2 (3–18)	16.7 ± 5.5 (8–27)	47.0 ± 39.9 (15–180)	/	4.0 ± 3.7 (0.3–12)
Chung[a]	25 (18–29)	7.7 (5–10)	147 (54–270)	5 (4–5)	NA	7 (4–11)	18.4 (14–24)	38 (9–73)	2 (1–2)	NA					
Emara[e]	18.5 ± 0.8	9.8 ± 0.4	169.7 ± 20.5	4	3.8 (0.3–30)	8.5 ± 0.7	20.1 ± 1.5	76.8 ± 12.3	2	NA					

[a] Values are presented as median (interquartile range)

[b] Mean plus or minus standard deviation values

[c] Values are means and associated 95 % confidence intervals

[d] Values at 12 weeks are expressed as range of minimum and maximum difference between baseline characteristics and the outcome in different groups

[e] Values are presented as Mean ± SEM; Qol as median; PSA as mean (range)

cap and temperature sensor (fiber life), retard both devitrification and degradation allowing to produce more power while maintaining more consistent energy production (J/s) [5].

Although the system has been already launched about 4 years ago, until today, there was lack of evidence of scientific data. The data released from GOLIATH study with 1 year of follow-up and the growing success in the clinical setting have made available a collection of valid data on the use of 180-W XPS GL laser.

A certain grade of variability is present in all the studies in terms of scientific design, sample size and methods of reporting functional results and complications. Nevertheless, a homogenous benefit for patients in terms of symptom score improvement, post-void residual volume reduction and urinary max flow rate improvement was shown. Moreover, only four studies have collected data on male sexual function.

In the GOLIATH study, which was the only randomized clinical trial, authors compared 180-W XPS GL to TURP, concluding that the non-inferiority of the laser system. In fact, they found no differences between the two techniques in terms of primary outcome measurement: IPSS, Qmax, PSA, QoL and complications. Contrarily, they emphasize the superiority of 180-W XPS GL for the shorter period of hospitalization, catheterization and recovery of health. Moreover, the differences in storage symptoms noted at 6 months were resolved during the follow-up at 1 year, and more generally, all the results, already highlighted, remain constant [6, 7]. Taken together in all other studies, we appreciated relevant differences in terms of indication for surgery, prostate size pre-operative workup and management of perioperative anticoagulants/antiaggregants. Despite the above-mentioned differences and the differences in surgical technique performed, all the functional outcomes were satisfactory and the surgery-related adverse events were similar and relatively rare. The most commonly used surgical strategy was described by the IGLU group, in 3 on 8 studies different techniques were used, anyway these variations don't seem to impact on complications rate and functional results [13, 15, 16]. An important issue in the infancy of each new surgical technique is, of course, a proper evaluation of the learning curve. In this respect, Misrai et al. showed how important is the surgeon for the final results. The authors assessed the learning curves within multiple intra-operative parameters, showing that at least 120 procedures should be performed to reach an expert level of competence as defined by procedure duration and the effectiveness of volume reduction. Interestingly, they showed that the functional results (IPSS and PVR reduction and Qmax increase) were similar during the complete learning procedure, whereas the incidence of complications did not change during the learning curve [13]. Another very important issue

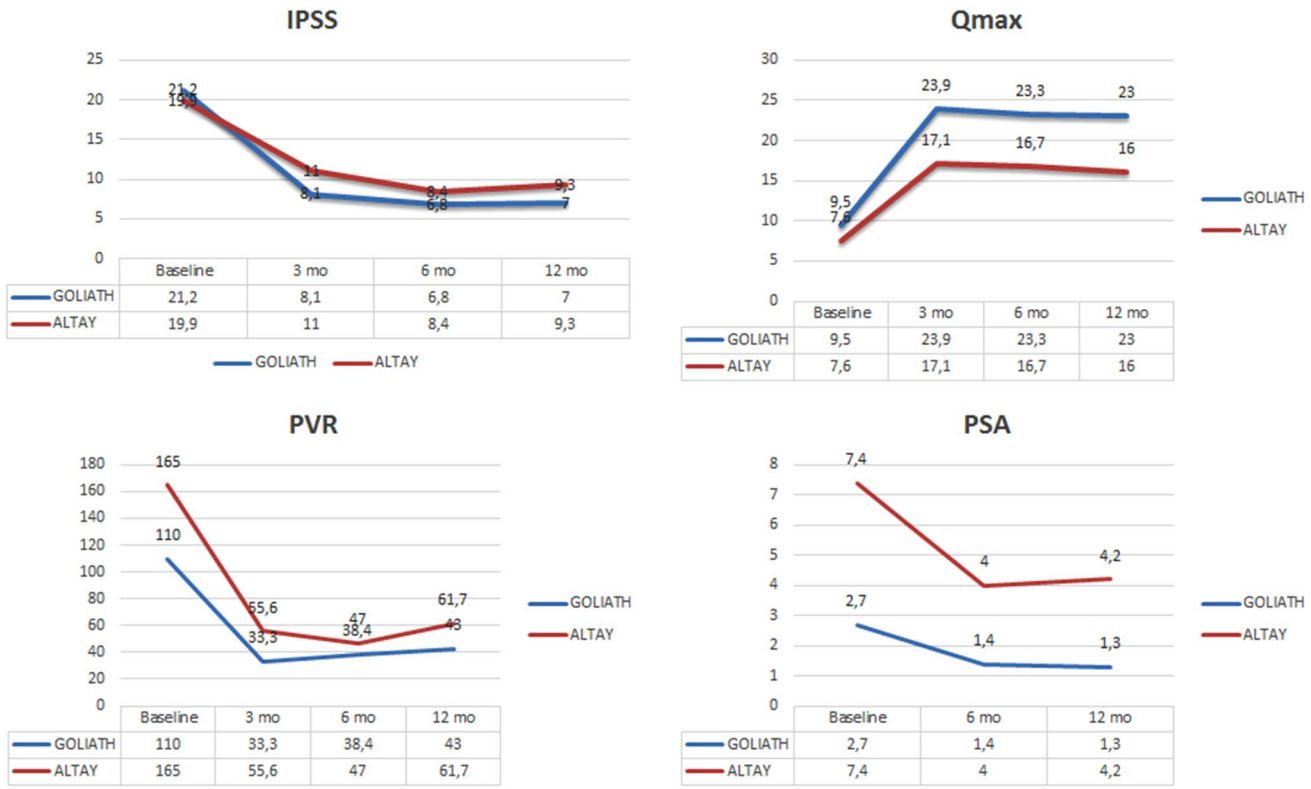

Fig. 2 Outcome following treatment with the 180-W XPS GreenLight at 3, 6 and 12 months (GOLIATH Study, Altay et al.). Data are expressed as mean values

Table 4 IIEF-5 (International Index of Erectile Function-5)

	Baseline	3 months	6 months	12 months
Campbell[a]	21.5 (16–24.8)	19 (15–24)	NA	NA
Bachmann	32.5 ± 21.4	23.4 ± 19.3	NA	NA
GOLIATH[b]	13.2 ± 7.6	NA	NA	12.8 ± 7.5
Altay[c]	14.8 ± 8.1 (6–28)	13.9 ± 7.8 (5–29)	14.2 ± 8.0 (7–24)	13.8 ± 9.5 (4–21)

NA not available

[a] Values are presented as median (interquartile range)

[b] Mean plus or minus standard deviation values

[c] Values are means and associated 95 % confidence intervals

in the evaluation of new surgical techniques is the cost-benefit analysis. In this respect, Benejam-Gual et al. compared TURP with 180-W XPS GL laser, in a retrospective study: They showed that there is a significant cost reduction in the postsurgical phase, characterized by shorter hospitalization times. This reduction offsets the increased costs associated with surgical stage in the purchase of the necessary equipment to perform the technique. In addition, the authors underline how this cost reduction is even more important given the increasing number of patients treated on an outpatient surgery [18].

The present study had several limitations that are mainly related to the overall quality of the studies examined, with the exception of the GOLIATH one. The follow-up was short, maximum 6 months for most of the studies and 12 months only in two cases; however, most adverse events should occur in this time frame. As each type of laser, the 180-W XPS GL is a powerful and potentially dangerous surgical instrument, and it must be handled with care, always bearing in mind that using these tools without proper training could lead to dangerous complications for patients and to discredit the technique

Table 5 Surgery-related complications

	No. of patients (number of adverse events)	Complication ≤ grade 2 Clavien	Complication ≥ grade 3 Clavien	Dysuria or irritative symptoms	Urethral stricture/injuries	Bladder neck contracture	Urinary incontinence	Urinary tract infection	Retention	Reintervention	Capsule perforation
Campbell	50	4	4/50	/	1/50	2/50	/	/	1/50	/	1/50
Bachmann[a]	201	17/76	2/75	9/76	1/75	/	4/75	3/74	2/75	1/201	7
		14/72	2/72	7/66	1/72		4/72	2/72	2/72		
GOLIATH	136 (117)	98	19	4	7/2	/	16	26	15	13	2
GOLIATH 12 months	136 (128)	107 (81)	21 (21)	34	8	6	17	28	18	16	/
Tal Ben-zvi	120	57	0	32	/	/	2	/	8	0	5
Misrai	200	37	3	/	6	/	5	2	6	/	/
Altay	68	17	11	7	4	0	5	1	10	0	3
Chung	85	32	7	/	/	/	3	10	13	1	/
Emara	131	7	7	/	2	1	1	4	3	/	/

[a] The first row is the follow-up at 1 month.; the second row is the follow-up from 1 to 3 months

[13, 19]. As reiterated by the guidelines of the European Association of Urology, a system for reporting complications after different urological procedures aimed at improving the quality of patient care and scientific publications is needed in all fields of urology, especially in new fields such as lasers and new technologies [20]. Even if the authors reported the complications in a standardized fashion (Table 5), unfortunately, the brevity of the follow-up hinders any firm conclusion on their true clinical value. The report of the sexual function after 180-W XPS GL was poorly reported. Only four studies were taken into consideration factors such as male sexual function and ejaculation [7, 9, 10, 15]; in the literature, there are conflicting data on the safety of photoselective vaporization of the prostate and male sexual function [21–23]. Standardized functional test like International Index of Erectile Function (IIEF-5) should be taken into account in any study that has as its objective to evaluate the efficacy and functional outcome in this field, but it is important to remember how hard is to assess erectile function in studies with short follow-up. These results are important for those young patients who decide to undergo these innovative techniques [21]. Other limitations are represented by (a) the paucity of data about prostate volume reduction in the studies comparing the 180 versus 120-W technologies; (b) the lack of data on patients at high risk of bleeding treated with the 180-W XPS GL; (c) the lack of specific data about the relation between anticoagulation and perioperative morbidity; (d) the significant differences existing between enucleating procedure [as holmium laser enucleation of the prostate (HoLEP), thulium laser enucleation of the prostate (TULEP) or GreenLight laser enucleation of the prostate (GreenLEP)] and the 180-W XPS pure vaporization.

Conclusion

The GL-180-W XPS technique is feasible and safe with a remarkable clinical efficacy comparable or superior to the techniques currently in use (including the gold standard TURP). In future, studies will need to pay more interest on the effects of these techniques on the sphere of male sexuality, and it will be necessary to lengthen the follow-up, currently insufficient to assess the long-term effects of the technique on continence and functional parameters.

Conflict of interest Castellan, Castellucci and Schips: none. Cindolo does surgical tutorship for AMS and received honoraria from GSK for presentations.

Ethical standard The manuscript does not contain clinical studies or patient data.

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