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Photovaporization of the prostate with Greenlight HPS laser as outpatient major surgery

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A B S T R A C T

Objective: To assess the efficacy and safety of photovaporization of the prostate with Greenlight HPS laser as major outpatient surgery.

Materials and methods: A prospective study was conducted of a cohort of 50 patients with lower urinary tract symptoms secondary to benign prostatic hyperplasia who underwent photovaporization with Greenlight HPS laser (120 W) as major outpatient surgery from May 2008 to February 2009.

Inclusion criteria were moderate to severe obstructive lower urinary tract symptoms (IPSS of 10 or more and flowmetry with Qmax of 10 ml/sec or less due to benign prostatic hyperplasia with prostate volume less than 80 ml.

Preoperative assessment included IPSS; flowmetry; physical examination; ultrasound examination of the kidney, bladder, and prostate (retropubic and transrectal); and measurement of postvoid residue and PSA levels. Surgical data were assessed (vaporization time, operating time, joules, complications during and after surgery). Patients were followed up 1 and 3 months after surgery (PSA, flow rate, IPSS questionnaire).

Results: No patient admission or readmission was required, and bladder catheter was successfully removed from all patients within 24 hours of surgery. Mean patient age was 66.75 years. Mean prostate volume was 44.5 ml (SD +/-21). Twenty patients (40%) had prior catheterization. Qmax and postvoid values significantly improved. Major complications at follow-up included voiding syndrome-urgency in 6 patients (12%) and mild transient hematuria in 3 patients (6%).

Conclusions: Photovaporization of the prostate with Greenlight HPS laser may be safely and successfully performed as a major outpatient surgical procedure, which undoubtedly represents a change in care, for surgical treatment of patients with lower urinary tract symptoms secondary to benign prostatic hyperplasia.

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Fotovaporización prostática láser Greenlight HPS en régimen de cirugía mayor ambulatoria

Palabras clave:
Hiperplasia prostática
Cirugía láser
RTU de próstata
Cirugía mayor ambulatoria

RESUMEN

Objetivo: valorar la eficacia y seguridad de realización del procedimiento fotovaporización láser Greenlight HPS en régimen de cirugía mayor ambulatoria.

Material y métodos: estudio prospectivo de una cohorte de 50 pacientes con sintomatología de tracto urinario inferior secundaria a hiperplasia benigna de próstata, a los que se realizó fotovaporización láser Greenlight HPS (120 W) en régimen de cirugía mayor ambulatoria entre mayo de 2008 y febrero de 2009.

Los criterios de inclusión eran moderada o severa sintomatología obstructiva de tracto urinario inferior (IPSS ≥ 10 y flujometría con Qmáx ≤ 10 ml/seg) por hiperplasia benigna de próstata con volumen de próstata menor de 80 cc.

Evaluación preoperatoria con IPSS, flujometría, exploración física, ecografía renal vesico-prostática (retropúbica y transrectal) con medición de residuo postmiccional y antígeno prostático específico (PSA). Se valoraron los datos operatorios (tiempo de vaporización, tiempo de cirugía, julios, complicaciones intra- y postquirúrgicas). Se efectuó revisión postquirúrgica al mes y a los tres meses (PSA, flujo, cuestionario IPSS).

Resultados: no se requirió ingreso ni reingreso en ningún paciente, retirándose con éxito la sonda vesical en todos los sujetos antes de las 24 horas postquirúrgica. La edad media de nuestros pacientes fue de 66,75 años con un volumen prostático medio de 44,5 cc (desviación estándar: ± 21). Veinte pacientes (40%) presentaban sondaje previo. Se apreció una mejoría significativa de valores Qmáx y RPM. Las principales complicaciones en el seguimiento fueron: síndrome miccional-urgencia en el 12% (6 pacientes) y hematuria leve transitoria en el 6% (tres pacientes).

Conclusiones: el procedimiento de fotovaporización láser Greenlight HPS puede realizarse de manera segura y satisfactoria en régimen de cirugía mayor ambulatoria, lo que sin duda representa un cambio asistencial en el tratamiento quirúrgico de los pacientes con sintomatología de tracto urinario inferior secundaria a hiperplasia benigna de próstata.

Introduction

For decades, transurethral resection (TUR) of the prostate gland has been regarded as the treatment of choice in patients with a prostate volume of between 30-80 ml; accordingly, it is the technique against which all new surgical management modalities are to be compared in patients of this kind.

In recent years new surgical techniques have been developed to compete with TUR. All of them are characterized by seeking less morbidity (minimally invasive techniques), such as the interstitial laser (ILC), TMT, transurethral needle ablation (TUNA), or the different forms of prostate laser ablation (holmium, Greenlight, diode, etc.).

In its day, TUR of the prostate gland replaced retropubic adenomectomy as the treatment of choice, since it substantially lowered morbidity-mortality compared with the open technique, particularly as regards bleeding.

Over time and with the evident technological improvements, TUR of the prostate has improved its results. In this context, the data recently published by Reich[1] have become the current reference regarding the morbidity-mortality associated with the technique – replacing the historical study by Mebust[2] when it comes to assessing data or comparing the results with the new emerging surgical techniques.

However, despite substantial improvement in terms of morbidity, Reich reports a mean hospital stay of 8 days for TUR of the prostate gland[1].

One of the main advantages of any emerging procedure should be a drastic reduction in hospital stay, seeking even the possibility of performing the operation on an outpatient basis, with a view to combining optimized costs with the best possible clinical results.

Isolated studies have evaluated the possibility of performing TUR of the prostate (TURP) on an outpatient basis in highly selected individuals[3]. However, the results have not been sufficiently optimum to allow the generalization of outpatient TUR, despite the new technological advances (bipolar TUR or bipolar vaporization). In contrast, extensive and positive experience has been gained with Greenlight photovaporization, which is differentiated from the rest of techniques precisely by the fact that it can be carried out on an outpatient basis.

Most of the studies published by Services of Urology in the United States perform the technique without patient

admission (defined as a stay of less than 23 hours). In contrast, the European or Spanish series perform the technique in patients admitted to hospital – though a clear decrease in mean stay is still observed compared with the rest of surgical techniques.

Undoubtedly, the special characteristics of the Greenlight HPS laser make it technically possible to perform the operation on an ambulatory or outpatient major surgery basis. However, to date there are no studies demonstrating the viability of the technique on an outpatient basis (involving a hospital stay of under 8 hours) in our particular setting.

Accordingly, the present study has been carried out to assess the efficacy and safety of the Greenlight HPS laser technique performed on an outpatient surgery basis.

Material and methods

Patient selection

We designed a prospective study of patients with lower urinary tract symptoms due to benign prostate hyperplasia subjected to Greenlight HPS photovaporization on an outpatient basis (involving a hospital stay of under 8 hours) in our hospital. The study was carried out between May 2008 and February 2009, and included the first 50 operated patients.

The inclusion and exclusion criteria were as follows:

1. Inclusion criteria: moderate or severe lower urinary tract obstructive symptoms (IPSS ≥ 10 and flowmetry with Qmax ≤ 10 ml/sec; micturition volume > 100 ml), with or without significant postvoid residue due to benign prostate hyperplasia with a gland volume of under 80 ml (as determined by abdominal ultrasound).
2. Exclusion criteria: patients with urethral stenosis, a history of prostate surgery (including minimally invasive procedures), associated bladder lithiasis, and patients with prostate carcinoma (in subjects with prostate-specific antigen [PSA] > 4 ng/ml or with suspect rectal digital findings, a prior ultrasound-guided prostate biopsy was obtained).

The preoperative workup included the patient medical history (with special emphasis on lower urinary tract symptoms), IPSS questionnaire, physical examination (including rectal digital exam), flowmetry (Qmax) and abdominal renal, bladder and prostate ultrasound with the measurement of prostate size and postvoid residue (the preoperative ultrasound study being completed with transrectal prostate ultrasound to again measure the prostate volume). Blood tests were requested, including complete blood count, PSA, urea and creatinine, together with urine culture and analysis / sediment.

Surgical procedure

All the patients were admitted to the Major Outpatient Surgery Unit of our hospital one hour before the estimated time of the operation.

Except for the first three patients who were operated upon by an expert surgeon, all the procedures were carried out by two surgeons of the Service (JBG and FD-C) with extensive experience in transurethral prostate surgery, but with no prior experience with lasers.

A Greenlight HPS 120 W laser was used, with cystoscope fiber insertion (22.5 Ch), using physiological saline as irrigating fluid.

Prostate tissue vaporization was carried out after cystoscopy, special emphasis being placed on identification of the ureteral orifices.

The surgical procedure was carried out following the technical recommendations of the IGLU[4] group (vaporization starting from the neck to the apex of the prostate, initially creating an irrigation canal, followed by the lateral lobes and apical zone, and ending with vaporization of the middle lobe).

Upon concluding the procedure, a triple-lumen Foley bladder catheter (20 Ch) was placed, with continuous irrigation (suspended 4-6 hours after the operation).

In the absence of precluding postoperative complications, discharge from the Major Outpatient Surgery Unit took place after 8 hours, with removal of the bladder catheter on the following day in the Urology outpatient clinic (within less than 24 hours after the end of the operation).

Follow-up

Follow-up after hospital discharge took place in the Urology outpatient clinic (on the first day after surgery, and again after one and three months), with special attention to possible complications after the procedure, IPSS, ultrasound with the measurement of postvoid residue, flowmetry and PSA levels.

Results

Between May 2008 and February 2009, a total of 50 males with lower urinary tract symptoms due to benign prostate hyperplasia were subjected to Greenlight HPS 120 W photovaporization on an outpatient basis (involving a hospital stay of under 8 hours) in our hospital.

The mean patient age was 66.75 years (range 55-85).

The mean prostate volume was 44.5 ml (standard deviation [SD]: ± 21; measurement by abdominal ultrasound) and 46 ml (SD: ± 22; measurement by transrectal ultrasound).

In 6 patients the postvoid residue was over 100 ml, and 20 patients (40%) carried a bladder catheter for at least one month before the operation.

The preoperative mean peak flow in those patients in which the parameter was determined (those without a bladder catheter) was 7.05 ml/sec (SD: ± 3.2), while the preoperative mean IPSS score was 19.3 (SD: ± 6.1).

The preoperative mean PSA concentration was 3.5 ng/ml.

According to the staging criteria of the American Society of Anesthesiologists, 8 patients corresponded to ASA I, 33 to ASA II and 9 to ASA III.

The mean duration of the surgical operation was 45.2 minutes (SD: ± 21.3), with a mean vaporization time of 31 minutes (SD: ± 20.5).

The mean energy used was 201,000 J (SD: ± 51.8), with the use of a single fiber in all cases (275,000 J maximum energy).

One patient (2%) developed intraoperative hematuria requiring resection loop coagulation due to bleeding that proved difficult to control, working in laser fiber coagulation mode. Three patients (6%) developed mild intraoperative hematuria that was satisfactorily controlled in laser coagulation mode.

The technique was carried out on an outpatient basis in all cases (100% of outpatient procedures, involving a mean stay of 8 hours in the Major Outpatient Surgery Unit). No patient developed postoperative bleeding requiring irrigation for more than four hours, and there were no clinical or surgical complications requiring readmission. Likewise, no patients reported to the Emergency Service due to postoperative complications.

No patient presented significant hematuria in the immediate postoperative period requiring blood transfusion or precluding early withdrawal of the irrigating system (in the first 4 hours) or bladder catheter (in the first 24 hours).

The bladder catheter was successfully removed in all patients on the day after the operation, in the Urology outpatient clinic (none of the subjects presented postoperative urinary retention requiring bladder catheter replacement).

At the postoperative control one month after surgery, clear improvement was observed in the peak flow values (20.1 ml/sec on average). These results were maintained after three months (mean 19.5 ml/sec), and a reduction was moreover observed in the IPSS scores (mean 10.1 and 11.2 after one and three months, respectively).

The PSA levels decreased after surgery to 1.7 ng/ml after one month (52% reduction) and 1.9 ng/ml after three months (48% reduction).

There were isolated and intermittent episodes of mild transient hematuria in three subjects (6%), requiring no secondary instrumentation. Likewise, at posterior follow-up, 6 patients (12%) reported urge syndrome, with a negative urine microbiological study in the first month, that improved with medical treatment.

Two patients (4%) presented lower urinary tract infection (positive urine culture) that improved with antibiotic treatment prescribed according to the antibiogram findings.

No patient suffered postoperative erectile dysfunction, postoperative urinary incontinence, or urethral stenosis secondary to the laser treatment.

One patient (2%) has undergone repeat surgery due to cell sclerosis evidenced by control cystoscopy 6 months after the operation (patient with a small prostate), that was successfully treated with endoscopic cervicotomy.

Discussion

Transurethral resection (TUR) of the prostate gland is still considered by many authors, though its preponderant position is now threatened by the good clinical results obtained with the laser techniques, which are considered to be the option of choice in patients with lower urinary tract symptoms attributable to prostate glands under 80 ml in size.

In the last 15 years attempts have been made to develop "minimally invasive" techniques capable of displacing TURP, though without the expected positive results. Nevertheless, this situation is now changing, thanks to the introduction of laser procedures or the advances afforded by bipolar TUR.

On comparing any novel surgical technique with TURP, consideration is now required of the data recently published by Reich[1], which provide an updated reference on the morbidity-mortality associated with TUR.

The analysis of these data confirms minimum mortality following TUR (0.10%), as well as a transfusion rate of 2.9%, a postoperative acute urinary retention rate of 5.8%, a revision surgery rate of 5.6%, a lower urinary tract infection rate of 3.6%, and a reabsorption syndrome rate of 1.4%. However, an observation of note in this multicenter study is the long duration of hospital stay (mean 8.0 ± 6.1 days).

These are clearly good results, similar to those reported for Greenlight photovaporization as regards the postoperative acute urinary retention and lower urinary tract infection rates – though there are no doubts as to the advantages of Greenlight photovaporization in terms of lessened bleeding risk, early catheter withdrawal and early hospital discharge.

Except in rare cases and in highly selected patients in which outpatient TURP has shown acceptable results[3], TURP has been performed on a conventional basis in hospitalized patients, and involving mean stays significantly longer than in the case of Greenlight Photovaporization.

One of the great advantages of the laser techniques, and specifically of Greenlight photovaporization, is the possibility of performing the operation on an outpatient basis, thanks to the great clinical safety and minimum morbidity associated with the procedure - as was already confirmed by the early studies[5] and in posterior publications in the United States[6], where the procedure is usually performed on an outpatient basis (defined as hospital admission for under 23 hours). This fact, and the existence of a healthcare system different from our own, make it difficult to establish comparisons.

In contrast, in Europe and in the studies reported in Spain with either the HPS 120 W generator[7] or KTP 80 W system[8], the technique is usually carried out in patients admitted to hospital – though with a clearly shortened stay compared with other procedures.

In our opinion, this possibility of performing the technique on an outpatient basis represents one of the greatest advantages differentiating it from other procedures such as TUR / bipolar vaporization, which shorten hospital stay compared with conventional TUR, but which are performed under conditions of hospital admission according to the data published in our setting[9] - no significant differences being observed in reference to hospital stay – or in international series[10,11].

In the international literature, the operation is likewise not carried out on an outpatient basis[12,13] using the holmium laser. Specifically, according to the data published by the groups with the greatest experience in holmium laser enucleation in Spain, the mean stays range from 1.8 days[14] to 1.25 days[15]. These results are similar to those obtained by other authors even in selected patients with prostate volumes of under 60 ml[16], though in the case of patients with glands under 40 ml in size there have been descriptions of the technique performed on an outpatient basis[17].

One of the main disadvantages of the KTP laser photovaporization technique has always been the excessive duration of the procedure, as well as its high cost attributable to the generator and fibers used.

With the new Greenlight 120 HPS generator, the duration of the procedure has been considerably shortened, with surgery times similar or comparable to those associated with TUR in application to prostate glands of similar size[18].

The cost issue is more controversial, however, and is largely dependent upon the healthcare system involved. In a study[19] comparing TUR and Greenlight HPS photovaporization, the costs were found to be similar – with the logical higher material costs of the laser system, but with lower costs associated to hospital stay.

In contrast, when the procedure is carried out on an outpatient basis[20], a favorable cost balance has been reported for laser photovaporization versus TURP – this being a very important factor to be taken into account on assessing the costs of a surgical technique (in our setting the estimated global cost saving of performing the technique on an outpatient basis versus the same technique involving patient admission to hospital is in the order of 50%).

On the other hand, comparison has also been made of Greenlight photovaporization and TURP versus other minimally invasive procedures such as thermotherapy, TUNA or interstitial laser coagulation (ILC), with a duration of follow-up of at least two years after the initial intervention, assessing the initial costs of treatment and the secondary costs attributable to adverse effects and retreatment[21].

Greenlight photovaporization afforded better results in terms of IPSS score and peak flow, followed by TURP and ILC, and the cost per procedure performance was moreover better. Nevertheless, these results have not been confirmed by other studies[22] – this being due to the great variability among the different European healthcare systems, which makes comparison difficult or impossible.

We have followed the patient selection criteria described by Malek[5] in his initial experience with the Greenlight 80 W. Undoubtedly, with the new generator used in our study (120 W), we could expand the indications as regards prostate volume and operate on an outpatient basis. However, it must be taken into account that in our hospital planned long-duration surgery (over 90-120 minutes) on an outpatient basis still constitutes a relative anesthetic contraindication. This in principle would preclude such surgery on an outpatient basis in the case of prostate gland volumes of over 100 ml. Nevertheless, the screening criteria previously defined in the article cover approximately 80% of all patients amenable to surgery for prostate adenoma in our experience.

The cost-efficacy of any technique is largely dependent upon the different types of healthcare systems involved, though in our setting or system it is beyond doubt that performing the procedure on an outpatient basis reduces the associated costs and offers additional advantages at healthcare level (shortened stays, lessened nursing care burden [irrigating systems][23], resource optimization, simplification of the healthcare circuits, etc.). We therefore consider it very important to confirm the viability of the procedure in the context of a Major Outpatient Surgery Unit.

Taking into account the results obtained, it is seen that the technique can be safely performed on an outpatient basis. However, the clinical efficacy of this approach logically must be comparable to that of conventional TURP – the latter still being regarded as the technique of choice. In this sense, evaluation of the results must essentially consider the objective data such as flowmetry (peak or maximum flow, Qmax) or the estimation of prostate tissue reduction (reflected by the PSA levels) – in addition to the associated reoperation rates.

As regards the functional results (Qmax), different randomized comparative studies of TURP versus Greenlight KTP 80 W photovaporization have yielded similar findings, without significant differences[24]. In contrast, the PSA reductions are smaller with the Greenlight system (30-50% after 12 months)[25]. Nevertheless, these figures improve with the new 120 W generator, which offers a greater drop in PSA concentration that appears to indicate greater tissue vaporization.

As regards the reoperation rates (reported to be about 6.8% after a mean duration of follow-up of 30 months when using the 80 W generator)[26], the new and more powerful system will require a longer duration of follow-up in order to draw conclusions. Nevertheless, it should be remembered that the reoperations rate after TURP was found to be 2.9%, 5.8% and 7.4% after 1, 5 and 8 years, respectively[27] – though on including other secondary endourological maneuvers (urethrotomy, cervicotomy), this proportion increases to 14.7%[27].

Lastly, one of the unquestionable advantages of Greenlight photovaporization is the reproducibility of the technique, with a simple learning curve – particularly when compared with holmium laser enucleation, which is characterized by a longer learning curve in order to avoid or minimize surgical complications[28]. This has been confirmed by our own experience, since we have obtained optimum results without any prior experience with the technique.

Conclusions

Greenlight HPS photovaporization has been carried out safely (minimum complications) and efficiently (significant improvement in IPSS scores and peak flow, and marked reduction of PSA levels). This in turn probably results in an improved cost / efficacy ratio of the technique, allowing a more rational use of resources and simplifying the patient care processes. Finally, the technique is seen to be reproducible (minimum learning curve).

Conflicts of interest

The authors declare no conflicts of interest.

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