Holmium Laser Enucleation of the Prostate: Efficiency Gained by Experience and Operative Technique

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Purpose: Holmium laser enucleation of the prostate is highly effective for symptomatic benign prostatic hyperplasia. Despite its steep learning curve the procedure is an efficient treatment, especially for large prostate glands. We determined the change in enucleation efficiency with time with increased operative experience and improved technique.

Materials and Methods: We reviewed the records of all 949 consecutive men who underwent holmium laser enucleation of the prostate between 1999 and 2007. Patients were excluded from analysis when enucleated gm or time was not recorded and enucleated tissue was less than 5 gm. Efficiency was measured in gm enucleated prostate tissue per minute. Descriptive statistics on laser time, gland weight and efficiency were evaluated in an 8-year period.

Results: A total of 91 patients met study exclusion criteria, leaving 858 available for evaluation. Mean enucleation time was 94 minutes (range 12 to 485). Mean prostate specimen weight was 77 gm (range 5 to 376). Mean efficiency or enucleation rate was 0.55 vs 1.32 gm per minute in the first 4 vs the last 5 years. Further efficiency improvements were noted in the last 5 years with a mean of 1.57 gm per minute enucleated in the last 2 years.

Conclusions: As experience with holmium laser enucleation of the prostate grows, advances in operative technique have been made. Prostatic enucleation efficiency continues to improve, further strengthening the role of holmium laser enucleation of the prostate for benign prostatic hyperplasia of small and large prostate glands.

Key Words: prostatic; prostatic hyperplasia; lasers, solid-state; prostatectomy; transurethral resection of prostate

Abbreviations and Acronyms

BPH = benign prostatic hyperplasia

HoLEP = prostate holmium laser enucleation

TURP = transurethral prostate resection

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HOLMIUM laser enucleation of the prostate has emerged as an effective transurethral treatment option in patients with symptomatic BPH of any size.[1] Several single center and multicenter series have documented HoLEP efficacy and safety.[1–19] In the last 10 years this minimally invasive surgical technique has been the most rigorously studied of any BPH therapy with multiple randomized clinical trials comparing its efficacy to that of TURP[6–8,10–11,19] and open simple prostatectomy.[2,5,6,9,18] On urodynamic measures HoLEP is the only endourological procedure to date to provide relief of bladder outlet obstruction superior to that of TURP.[10] Sustained results have been observed up to 6 years postoperatively with a less than 2% re-treatment rate.[12]

Despite the benefits of HoLEP the procedure has been slow to gain widespread acceptance. HoLEP is per-

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ceived as having a steep learning curve that requires specialized training to overcome.[20] Others have reported that the procedure requires significant endoscopic skill and longer procedure time is common.[21] To minimize the learning curve associated with the procedure technical advancements, such as an easy to use mechanical morcellator[19] and alterations in surgical technique, have been introduced. As expected, procedure efficiency has improved with experience but we suggest that alterations in surgical technique have produced improvements greater than expected by experience alone. We present our 8-year experience with HoLEP and evaluate the efficiency of laser enucleation in varying gland sizes with time.

MATERIALS AND METHODS

After receiving institutional review board approval we retrospectively reviewed the records of 949 consecutive men who underwent HoLEP between January 1999 and October 2007 at Methodist Hospital of Indiana, as done by a single urologist (JEL) with associated residents and fellows. Patients without recorded tissue weight or enucleation time were excluded from analysis. To focus on the complete HoLEP procedure and exclude only partial enucleation or bladder neck incision we also excluded enucleated glands less than 5 gm. A total of 91 patients met exclusion criteria, leaving 858 available for review. The level of resident and fellow involvement varied by case. Thus, the learning curve of the urologist was also affected by the learning curve of each involved resident or fellow depending on the level of comfort with HoLEP. The amount of resident or fellow involvement was not controlled but remained consistent throughout the cohort.

The surgical technique used for HoLEP was previously described.[13] However, certain aspects of our technique have evolved with time. 1) The median prostate lobe was incorporated into one of the lateral lobe dissections in almost all cases, limiting posterior dissection to only 1 groove. 2) Dissection is now started at the apex lateral to the verumontanum where the plane between capsule and adenoma is prominent. 3) Dissection is carried around the lateral margin of the gland across the anterior surface to open a space that serves as a target at the time of division of the anterior commissure. 4) The apical mucosal strip is divided by encircling the adenoma with the endoscope and placing the tissue on stretch away from the sphincter. 5) For large adenomas that do not easily displace into the bladder we morcellate the tissue in the prostatic fossa before completing enucleation.

During each case enucleation time and prostate specimen weight were recorded. Enucleation time was recorded in minutes from the start of laser dissection to complete detachment of the adenoma from the prostatic capsule. This time did not include morcellation since this is linearly related to specimen weight.[22] Prostate specimen weight was recorded in gm as the final pathological weight provided by the pathologist. Efficiency was calculated in gm prostate enucleated per laser enucleation time in minutes, conforming to other efficiency studies using a specimen retrieved per time standard.[22]

Comparisons were made over the entire cohort and in stratified groups by gland size, including small—less than 50, medium—50 to 100 and large—greater than 100 gm. We also compared earlier (1999 to 2002) and later (2003 to 2007) years. Case number was used to represent experience with time with higher case numbers representing more recent cases. The first case in January 1999 was recorded as case 1.

Descriptive statistics, including the mean, median, minimum and maximum, were calculated across all cases for gland weight in gm, enucleation laser time in minutes and enucleation efficiency in gm per minute. The relationship between laser time and specimen weight during the case experience was explored by scatterplots and calculating Pearson correlation coefficients. Laser enucleation efficiency was shown graphically by year using box plots constructed with the values of quartiles 1 and 3, and median with whiskers with a maximum length of 1.5 IQR. Mean laser time was compared across subgroups, adjusting for gland weight using ANCOVA. Laser efficiency was compared between large and small/medium glands using the 2-sample Student t test with $p < 0.05$ considered significant. All statistical analysis was done with SPSS® for Windows® and R (2.4.1).

RESULTS

In the 858 patients studied mean age was 71 years (range 48 to 95). Mean estimated preoperative transrectal ultrasound prostate volume was 99 cc (range 5 to 309.5). Mean enucleated gland weight was 77 gm (median 68, range 5 to 376). Of the prostates 230 were larger than 100 gm, 352 were between 50 and 100 gm, and 276 were less than 50 gm. There were no major intraoperative complications but 2 men required perineal urethrostomy due to large prostate size and 1 required open cystotomy to remove the enucleated adenoma due to morcellator malfunction. Pathological evaluation of retrieved specimens revealed malignancy in 86 men (10%) and benign hyperplasia in 772 (90%).

In all procedures mean laser time was 94 minutes (median 85, range 12 to 485). Mean efficiency in all glands was 1.0 gm per minute (median 0.8, range 0.1 to 5.1). The table lists specimen weight, laser time and efficiency by year.

Scatterplots of gland weight and laser time by case number revealed how specimen weight, laser time and efficiency changed during the case experience (fig. 1). There was a small increase in gland weight with time but the correlation of gland weight with case number was weak ($r = 0.14$). A substantial decrease in laser time was evident over the case experience, as shown by a moderate negative correlation between laser time and case number ($r = -0.53$). Similarly a positive correlation was found between laser time efficiency and case num-