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ORIGINAL ARTICLE

Prostate Cancer

# HoLEP does not affect the overall sexual function of BPH patients: a prospective study

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We aimed to prospectively evaluate the influence of holmium laser enucleation of the prostate (HoLEP) on the overall postoperative sexual function of benign prostatic hyperplasia (BPH) patients with lower urinary tract symptoms (LUTS) and to explore the relationship between sexual function and LUTS. From January 2010 to December 2011, sixty sexually active consecutive patients with BPH who underwent HoLEP were prospectively enrolled in the study. All patients filled out the Male Sexual Health Questionnaire (MSHQ) for evaluation of their overall sexual function and the International Prostatic Symptom Score (IPSS) for pre- and post-operative 6 months evaluation of their voiding symptoms. The LUTS and sexual function changes were statistically analyzed. The preoperative and 6 months postoperative status of the patients was compared using uroflowmetry and IPSS questionnaires. The analysis revealed significant improvements following HoLEP. Among the sub-domains of the MSHQ, postoperative sexual function, including erection, ejaculation, sexual satisfaction, anxiety or sexual desire, did not significantly change after HoLEP ( $P > 0.05$ ), whereas satisfaction scores decreased slightly due to retrograde ejaculation in 38 patients (63.3%). Sexual satisfaction improved significantly and was correlated with the improvements of all LUTS and the quality-of-life (QoL) domains in IPSS after surgery (QoL; relative risk [RR]:  $-0.293$ ; total symptoms, RR:  $-0.411$ ;  $P < 0.05$ ). The nocturia score was associated with the erectile function score (odds ratio 0.318,  $P = 0.029$ ). The change in ejaculatory scores did not show significant association with IPSS scores. HoLEP did not influence overall sexual function, including erectile function. In addition, sexual satisfaction improved in proportion with the improvement of LUTS.

*Asian Journal of Andrology* (2014) 16, 873–877; doi: 10.4103/1008-682X.132469; published online: 27 June 2014

**Keywords:** benign prostatic hyperplasia; ejaculation; erectile dysfunction; lasers; prostatectomy; sex disorders

## INTRODUCTION

The effects of minimally invasive surgery (MIS) on sexual function in patients with benign prostatic hyperplasia (BPH) have been researched extensively, particularly for techniques such as transurethral resection of the prostate (TURP) and photoselective vaporization of the prostate potassium-titanyl-phosphate (KTP).<sup>1,2</sup> These techniques have been proven to negatively influence sexual function due to postoperative retrograde ejaculation, among other problems.<sup>2–4</sup> Holmium laser enucleation of the prostate (HoLEP) is another established MIS method for BPH patients,<sup>5,6</sup> and its effects on sexual function are of interest due to its unique surgical principle of using a laser instrument to completely enucleate the prostatic nodule adjacent to the prostatic capsule.<sup>5–7</sup>

International Index of Erectile Function (IIEF) questionnaires have shown that HoLEP postoperatively decreases sexual function, including erection and ejaculation, by up to 76%.<sup>7–10</sup> However, the IIEF is limited in terms of the evaluation of overall sexual function, particularly retrograde ejaculation and its effect on the quality-of-life (QoL).<sup>11,12</sup> Therefore, it is necessary to evaluate diverse and detailed aspects of overall sexual function that include ejaculation, erection, and sexual satisfaction. In addition, the relationship between sexual function with improvements in lower urinary tract symptoms (LUTS) due to surgery should be analyzed. In this study, we

investigated the influence of HoLEP on overall sexual function using the Male Sexual Health Questionnaire (MSHQ) and also explored the relationship between sexual function and LUTS in patients with BPH.

## MATERIALS AND METHODS

### Ethical statements

The Institutional Review Board approved this study (No. H1212-116-454), and written informed consent was obtained from each participant.

### Study population

Sixty consecutive patients with diagnoses of LUTS/BPH who received HoLEP between January 2010 and December 2011 were prospectively enrolled in this study. These patients had LUTS that were refractory to medication and were in sexually stable relationships with heterosexual partners. Potential subjects were excluded for the following conditions: five-alpha reductase inhibitor use, maintenance of a urinary catheter, a previous history of prostatic/pelvic surgery, urethral stricture, prostate cancer, and neurogenic bladder. In addition, other conditions impairing sexual function, including uncontrolled diabetes, cerebrovascular accidents, cardiovascular disease, spinal disease, hepatic dysfunction, and alcoholism, and drug addiction were included in the exclusion criteria.

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Received: 10 August 2013; Revised: 30 November 2013; Accepted: 25 February 2014

### Study design and materials

Medical records were prospectively recorded according to a preplanned protocol. All patients underwent a baseline evaluation that included the following: a general standard evaluation that included histories of comorbidities such as diabetes and hypertension, a physical examination that included a digital rectal examination, International Prostatic Symptom Score (IPSS) questionnaire evaluation, and laboratory exams that included urinalysis, serum creatinine, serum prostate-specific antigen (PSA), transrectal ultrasonography (TRUS), and multichannel urodynamic study (MMS UD-2000, Medical Measurement System, Enschede, The Netherlands). This baseline evaluation helped to distinguish the obstruction and overactive bladder components of the LUTS. TRUS-guided prostate biopsies were performed on patients suspected to have prostate cancer, and positive prostate diagnoses resulted in exclusion from the evaluations. Sexual function was assessed preoperatively and 6 months postoperatively via the administration of the MSHQ (the creation of a Korean version of the MSHQ was permitted by the MAPI Research Trust Group, Lyon, France), and the patients' LUTS and QoL were assessed with the IPSS. In addition, the MSHQ is a validated and self-assessed questionnaire that measures overall sexual function and satisfaction in older men. This questionnaire consists of five major components of sexual function (i.e., ejaculation, erection, satisfaction, sexual activity, and sexual desire), and includes three broader domains of ejaculation, erection, and satisfaction. The MSHQ also contains questions regarding with sexual orgasms, retrograde ejaculation, ejaculatory pain, and satisfaction in the three domains of emotion, sex, and relationships with sexual partners.<sup>12</sup>

### Holmium laser enucleation of the prostate procedures and postoperative management

All surgical procedures were performed in a routine manner by one urologist (SJO) with the experience of performing more than 100 HoLEP operations as described in detail in previous studies.<sup>13,14</sup> First, a 26 Fr resectoscope (Karl Storz GmbH and Co., Tuttlingen, Germany) was inserted into the prostate and bladder. Normal saline was irrigated continuously during enucleation and morcellation. Enucleation of the prostate was performed using a 550- $\mu$ m end-firing laser fiber (SlimLine, Lumenis Ltd., Yokneam, Israel) and an 80 W holmium neodymium: yttrium-aluminum-garnet laser (VersaPulse Power-Suite, Lumenis Ltd.). Second, tissue morcellation was performed with a VersaCut morcellator (Lumenis Ltd.) through a 0° rectangular nephroscope (Karl Storz GmbH and Co.). At the end of morcellation, a 22 Fr 3-way urethral catheter was inserted into the bladder, and normal saline was connected to the catheter for continuous irrigation.

The urethral catheter was generally removed on the 1<sup>st</sup> or 2<sup>nd</sup> postoperative day. The patients were discharged if they were able to void without problems and had postvoid residual urine volumes of <50 ml. The pre- and post-operative data, including the parameters of energy used, operative time, duration of hospital stay, intra- and post-operative complications, and duration of urethral catheterization were assessed.

### Statistical methods

Statistical analyses of the results of the questionnaires and clinical parameters that included demographics were performed using the Wilcoxon signed rank test, the Pearson chi-square test, Student's *t*-test, and Fisher's exact test. Multivariate analysis using logistic regression was used to identify any factors that showed correlation with sexual

function, including erection, ejaculation, and sexual satisfaction. The relationships between patients with and without sexual dysfunction before and after the HoLEP were analyzed. Sexual dysfunction (for both ejaculatory and satisfaction dysfunction) was defined by ejaculatory, and sexual satisfaction domain item scores in the MSHQ <1 for any item at the final assessment or decreases of  $\geq 3$  points compared with the initial assessment. Patients with erectile domain scores <6 or scores <2 on any item were defined as having erectile dysfunction.<sup>15</sup> SPSS version 18.0 (SPSS, Inc., an IBM Company, Chicago, IL, USA) was used for the statistical analyses. The null hypotheses of no differences were rejected when the  $P < 0.05$ .

### RESULTS

The median age of the patients was 68.5 (range: 55–86) years old, and the average body mass index (BMI) was 23.8 (20.0–32.7) kg m<sup>-2</sup>. The median PSA was 2.5 (0.6–17.1) ng dl<sup>-1</sup>, and the average prostate volume was 64.0 (22.0–201.0) ml. The median enucleation time was 35.0 (15.0–80.0) min, and the median morcellation time was 15.0 (10.0–60.0) min, which resulted in a median total operative time of 50.0 (25.0–140.0) min. The median total removed prostatic volume was 15.0 (5–74.5) ml (**Table 1**). No major complications of HoLEP, including arterial bleeding or bladder perforation requiring a secondary operation, were observed. The patients exhibited both symptomatic and functional improvements in perioperative IPSSs and uroflowmetry after HoLEP ( $P < 0.01$ , **Table 2**).

Regarding the MSHQs, the overall sexual scores, including the anxiety and bother scores, were not significantly different before and after the HoLEP (the  $P$  values were between 0.071 and 0.822 for all of the parameters of the MSHQ, **Table 2**). None of the sub-domains of erection, ejaculation, sexual satisfaction, sexual activity, or sexual desire were significantly affected by HoLEP (**Table 2**). The pre- and post-operative scores in the erection domain ( $6.8 \pm 2.9$  and  $7.0 \pm 2.9$ , respectively,  $P = 0.731$ ) and sexual activity domain ( $6.3 \pm 2.5$  and  $6.8 \pm 2.4$ , respectively,  $P = 0.400$ ) exhibited slight improvements

**Table 1: Demographics of the 60 BPH patients**

	Median	Range
Age (year)	68.5	55–86
BMI (kg m <sup>-2</sup> )	23.8	20.0–32.7
Diabetes ( <i>n</i> , %)	11 (18.3)	
Hypertension ( <i>n</i> , %)	30 (50)	
ASA score ( <i>n</i> , %)		
1	21 (35.0)	
2	28 (46.7)	
3	11 (18.3)	
Prostate volume (ml)	64.0	22–201
TZ volume (ml)	33.5	17–130
PSA (mg dl <sup>-1</sup> )	2.5	0.6–17.1
Creatinine (mg dl <sup>-1</sup> )	0.98	0.6–1.7
Operative parameters		
Total operative time (min)	50.0	25–140
Enucleation	35.0	15–80
Morcellation	15.0	10–60
Total energy used (kJ)	72.2	33.8–159.0
Total removed prostatic volume (g)	15.0	5–74.5
Energy/prostate volume (kJ ml <sup>-1</sup> )*	1.5	0.8–3.3

\*Energy used to prostate volume ratio = total energy used/preoperative prostate volume measured by transrectal ultrasonography. TZ: transitional zone of prostate; ASA: American Society of Anesthesiologists; kJ: kilojoules; BPH: benign prostatic hyperplasia; BMI: body mass index; PSA: prostate-specific antigen

following HoLEP. However, the ejaculation domain scores decreased from  $19.0 \pm 8.2$  to  $16.6 \pm 8.8$  ( $P = 0.179$ ), satisfaction decreased from  $18.7 \pm 5.6$  to  $17.0 \pm 5.2$  ( $P = 0.071$ ) and sexual urge/desire decreased from  $7.4 \pm 2.2$  to  $7.2 \pm 2.4$  ( $P = 0.822$ , **Table 2**), but none of these changes were statistically significant ( $P > 0.05$ ). Postoperative retrograde ejaculation was reported by 38 patients (63.3%, data not shown).

Based on the classifications of LUTS severity, there were tendencies towards correlations between increasing preoperative LUTS severity (mild, moderate, and severe IPSS) and decreases in postoperative LUTS severity (mild relative risk (RR): 0.801, moderate 1.502, and severe 1.801,  $P < 0.05$ , data not shown) and sexual function in term of erection, ejaculation and satisfaction increase after HoLEP. however, these associations were not statistically significant ( $P > 0.10$ ) (**Table 3**). Additionally, regarding the relationships between each domain of the MSHQ and the IPSS categories, the postoperative improvements in erectile function and nocturia showed significant correlation (RR: 0.318,  $P = 0.029$ ). The perioperative change in the ejaculatory category and voiding symptom scores were not significantly correlated ( $P$  values between 0.613 and 0.927). The postoperative changes in sexual satisfaction scores were significantly and negatively correlated with improvements in total IPSS scores (RR:  $-0.411$ ,  $P = 0.003$ ) and QoL scores (RR:  $-0.293$ ,  $P = 0.046$ ) (**Table 3**).

A multivariate logistic regression analysis revealed that, in the erectile ( $n = 14$ , 12.3% *vs*  $n = 46$ , 87.7%), ejaculatory ( $n = 23$ , 38.3% *vs*  $n = 37$ , 61.7%), and satisfaction ( $n = 22$ , 36.7% *vs*  $n = 38$ , 63.3%) domains, hypertension, total energy used, and resected total removed prostatic volume were significantly correlated with erection. The transitional zone volume of the prostate, the total energy used, and the total removed prostatic volume showed significant correlation with ejaculation. The transitional zone volume of the prostate and the total prostate volume were significantly correlated with sexual satisfaction ( $P < 0.05$ , **Table 4**).

**Table 2: Comparison of uroflowmetry, IPSS and MSHQ measures before and after HoLEP**

	Preoperative	Postoperative 6 months	P
Uroflowmetry			
Peak flow rate (ms <sup>-1</sup> )	8.6±4.3	21.1±10.1	<0.010
Voided volume (ml)	154.8±106.6	230.9±118.7	<0.010
PVR volume (ml)	60.4±67.9	17.6±24.3	<0.010
IPSS score			
Storage symptom	7.9±3.8	2.9±2.2	<0.010
Voiding symptom	12.1±5.2	3.2±3.1	<0.010
Total symptom score	19.1±8.5	6.2±5.1	<0.010
Nocturia score	2.4±1.3	1.3±0.9	<0.010
Quality-of-life score	4.5±1.2	1.2±1.0	<0.010
MSHQ scale score			
Erection	6.8±2.9	7.0±2.9	0.731
Ejaculation	19.0±8.2	16.6±8.8	0.179
Satisfaction	18.7±5.6	17.0±5.2	0.071
Sexual activity	6.3±2.5	6.8±2.4	0.400
Sexual urge/desire	7.4±2.2	7.2±2.4	0.787
MSHQ bothersome			
Erection bother	3.4±1.1	3.6±1.0	0.510
Ejaculation bother	3.4±1.3	3.4±1.0	0.684
Sexual activity	3.6±1.2	3.4±1.1	0.390
Sexual urge/desire	3.3±1.2	3.3±1.2	0.822

PVR: postvoid residual; IPSS: International Prostatic Symptom Score; MSHQ: Male Sexual Health Questionnaire; HoLEP: holmium laser enucleation of the prostate

## DISCUSSION

Similar to TURP and KTP, HoLEP has been reported to negatively affect sexual function, including retrograde ejaculation.<sup>7,9,13</sup> These similarities are due to the similarities of indicated patients and the transurethral surgical routes for prostatectomy for the relief of obstruction due to BPH.<sup>1-3</sup> However, the effects of minimally invasive operations on the prostate on postoperative sexual function are still under debate.<sup>8,16</sup> Postoperative retrograde ejaculation is a common complication that is believed to decrease postoperative sexual satisfaction.<sup>2,4,16,17</sup>

HoLEP has gained popularity as one of the standard surgical treatments for BPH patients after Tan and Gilling<sup>17,18</sup> introduced the procedure in 1998. However, few studies<sup>7,9</sup> have discussed the postoperative changes in sexual function following HoLEP in detail using objective parameters. Some previous studies have reported decreases in sexual function following HoLEP that include erectile dysfunction and retrograde ejaculation, but these studies were often limited by small sample and retrospective designs.<sup>7,13,19</sup> Another recent study<sup>20</sup> of HoLEP with IIEF reported no influence of HoLEP on overall sexual function, including erection and satisfaction.

Most of the previous studies have assessed sexual function with the popular IIEF questionnaire. However, the IIEF and other sexual function-related questionnaires are inadequate for the assessment of the diversity of the domains of sexual function and satisfaction following MIS of BPH patients. The reasons are insufficient assessments of ejaculation or orgasm and limited evaluations of sexual and relationship satisfaction. Therefore, the IIEF cannot be used to evaluate disorders such as retrograde ejaculation and cannot be used to accurately classify pleasure or loss of sensation during ejaculation.<sup>11,21,22</sup>

This study focused on the effects of HoLEP on overall sexual function using the MSHQ self-assessed questionnaire. To the best of our knowledge, this is the first prospective study of HoLEP using the MSHQ to be published in the literature. The MSHQ not only evaluates sexual function (erection and ejaculation), but also evaluates the emotional aspects of sexual activity, including desire, depression, satisfaction, and bother. Therefore, the MSHQ is adequate for the evaluation of overall sexual function.<sup>12,23,24</sup>

Rosen *et al.*<sup>12</sup> have reported on the scale development and psychometric validation of the MSHQ for use in comparing normal and patient groups. These authors also reported on the erection scores (patient group *vs* control group,  $6.6 \pm 3.5$  *vs*  $8.3 \pm 2.9$ , respectively), ejaculation scores ( $13.9 \pm 5.4$  *vs*  $16.9 \pm 4.1$ ), satisfaction scores ( $21.0 \pm 5.6$  *vs*  $24.2 \pm 4.5$ ) and evaluated the discriminant validity of the MSHQ. We compared the MSHQ scores of our patients with those of Rosen's patients as evaluated according to the MSHQ

**Table 3: Correlations of the changes in the scores of the IPSS and MSHQ**

	MSHQ		
	Erection	Ejaculation	Satisfaction
IPSS			
Mild (0-7) ( $n=9$ ) <sup>a</sup>	0.292 (0.530)	0.162 (0.742)	0.372 (0.421)*
Moderate (8-19) ( $n=23$ ) <sup>a</sup>	-0.021 (0.924)	-0.103 (0.664)	0.061 (0.802)*
Severe (20-35) ( $n=28$ ) <sup>a</sup>	-0.371 (0.133)	-0.175 (0.510)	-0.314 (0.214)*
Nocturia	0.318 (0.029)	-0.014 (0.927)	0.022 (0.883)*
Total symptoms	-0.186 (0.200)	-0.074 (0.613)	-0.411 (0.003)**
Quality-of-life	-0.015 (0.918)	0.066 (0.658)	-0.293 (0.046)*

All of the numbers are expressed as Pearson relative coefficient values ( $P$  value).  
<sup>a</sup>Preoperative IPSS severities were divided according to their LUTS severity; RR was significant at 0.05 (both); \*\*RR was significant at 0.01 (both). IPSS: International Prostatic Symptom Score; MSHQ: Male Sexual Health Questionnaire; \*RR: relative risk; LUTS: lower urinary tract symptoms



**Table 4: Significant risk factors for erection, ejaculation and sexual satisfaction**

	OR (95% CI)	P
Erection		
BMI	1.271 (1.024–1.578)	0.030
Hypertension	6.710 (1.794–56.711)	0.030
Total removed prostatic volume	0.780 (0.638–0.953)	0.015
Total energy used	1.075 (1.015–1.1139)	0.014
Ejaculation		0.366
TZ	1.129 (1.004–1.268)	0.042
Total removed prostatic volume	1.312 (1.012–1.732)	0.050
Total energy used	0.952 (0.905–1.000)	0.042
Sexual satisfaction		
Total prostate volume	0.89 (0.80–0.99)	0.031
TZ	1.16 (1.03–1.31)	0.010

CI: confidence interval; OR: odds ratio; TZ: transitional zone of prostate; BMI: body mass index

guidelines for dysfunction.<sup>24</sup> This comparison revealed that, at baseline, most of our enrolled patients had no problems with erection ( $6.8 \pm 2.9$ ), ejaculation ( $19.0 \pm 8.2$ ) or sexual satisfaction ( $18.7 \pm 5.6$ ) (Table 2); however, our patients perceived their sexual lives to be less satisfactory than did the patients enrolled in Rosen's study.<sup>12</sup>

Although 21 (35.0%) of our 60 patients had baseline erectile scores <6, and 5 (8.3%) patients had ejaculatory scores <3, all of our patients exhibited postoperative improvements of their scores in the erectile (from a mean value of 3.8–7.7) and ejaculatory domains (from a mean value of 13.6–17.6) (data not shown), and all of our enrolled patients were satisfied with their sexual lives. These findings were supported by scores >5 in the satisfaction domain of the MSHQ. Additionally, the overall changes in the mean scores of the MSHQ sub-domains after HoLEP involved decreases of <3 points (erection 0.2, ejaculation 2.4, and satisfaction 1.7, data not shown).

The present study revealed that the assumption that HoLEP has negative effects is misguided because neither sexual function nor satisfaction was affected by HoLEP based on the MSHQ results (Table 2). Furthermore, some of the patients ( $n = 7$ , 11.7%) actually exhibited improvements in sexual function following HoLEP that were proportionate to the degree of improvement of LUTS. These findings resemble those of previous studies.<sup>7,9,19</sup> One of the studies from Elshal *et al.*<sup>20</sup> have reported postoperative improvements in sexual function of 60.6% and improvements in LUTS. LUTS interferes with sexual function, and the improvement of LUTS is necessary to improve sexual function.

The improvements of sexual function in the erectile domain following HoLEP may have resulted from secondary positive effects caused by improvements in LUTS.<sup>25,26</sup> The IPSS results reflected all LUTS symptoms, QoL, and nocturia scores and exhibited a statistically significant relationship with erection and sexual satisfaction. After HoLEP, the LUTS and QoL improved, and sexual satisfaction improved due to reductions in nocturia and improvements in erectile function (Table 3). These results imply that decreases in nocturia can result in better sleep quality at night, which in turn results in increased oxygen supply to the penis. Thus, penile tumescence improves, and overall physical fatigue decreases, which leads to improved erections and increases in sexual desire observed in less fatigued people.<sup>25–28</sup>

As measured with the MSHQ, sexual activity and sexual urge/desire were not significantly affected by HoLEP (sexual activity,  $P = 0.390$ ; sexual urge/desire,  $P = 0.822$ ). However, it is important to note that the MSHQ scores of our sample ranged between approximately six and

eight and the total possible score for this scale is 15 points; thus, the enrolled patients were not sexually active despite their ages. This finding indicates the necessity of further studies of sexual function following HoLEP in sexually active patients. In such patients, classifications based on sexual function and sexual activities may be important.

Unfortunately, as with other BPH surgical techniques, retrograde ejaculation was a common complication after HoLEP; the reported incidences of this complication are 8.3%–56.0% for KTP and 67.0%–73.8% for TURP.<sup>1,4,8,9</sup> Our data revealed that 38 patients (63.3%) experienced postoperative retrograde ejaculation, and this percentage is similar to or less than those of previous reports. Such retrograde ejaculation was easily observable via the ejaculatory domain of the MSHQ, and the mean scores decreased from  $19 \pm 8.2$  to  $16.6 \pm 8.8$ . This decrease was statistically insignificant prior to HoLEP ( $P = 0.175$ ) and did not have a significant influence on sexual satisfaction (preoperative  $18.7 \pm 5.6$  vs postoperative  $17.0 \pm 5.2$ ,  $P = 0.071$ ). This finding starkly contrasts with those of other studies of HoLEP that have utilized the IIEF questionnaire. The IIEF questionnaire does not evaluate ejaculation in relation to the satisfaction with sexual functioning.<sup>7,13</sup>

The reason that sexual function following HoLEP exhibited greater improvements compared to KTP may be due to the energy used in HoLEP (Table 2). The total energy used was less than that used for KTP, which resulted in decreased infiltration of energy into the adjacent tissues, including the erectile nerves. According to a the multivariate logistic regression analysis that was performed to identify the factors that influenced postoperative sexual function, along with the significant independent risk factors in the erectile, ejaculatory and satisfaction domains, total energy used during HoLEP was found to be significantly correlated with postoperative sexual function (erection odds ratio (OR) 1.08; ejaculation OR 0.94,  $P < 0.05$ ). This finding somewhat contrasts with previous speculations that the energy used in HoLEP does not affect erectile function.<sup>10,29</sup> However, this effect might be attributable to collinearity with other significant risk factors such as total removed prostatic volume. To remove greater volumes of the BPH nodules, much greater total energy levels are required during the operation. Elshal *et al.*<sup>20</sup> previously reported that the energy relative to prostate volume is a factor that significantly affects postoperative sexual function following HoLEP. Our results did not reveal any other significant effects of any of the other MSHQ sub-domains related to sexual function (data not shown).

Other significant risk factors were analyzed. BMI and hypertension were correlation with erection, the transitional zone volume of the prostate showed correlation with ejaculation and satisfaction, the total prostate volume was significantly correlated with satisfaction, and the total removed prostatic volume was related to erection and ejaculation. BMI and hypertension are well-known risk factors for sexual dysfunction because of the effects of the cardiovascular system on the penile vasculature and oxygen level.<sup>30</sup> Based on our results, we infer that the relief of obstruction that followed HoLEP improved both LUTS and sexual function.

This study is the first report to use the MSHQ to evaluate the effects of HoLEP on sexual function. The MSHQ enabled us to assess sexual function by assessing erectile function independently of ejaculatory function, by using using separate question items which could enable psychometric sexual evaluation. We also evaluated the relationship between improvements in LUTS and the amelioration of sexual satisfaction. And we sought to identify the independent risk factors for sexual dysfunction following HoLEP.

This study has some limitations. First, the small number of patients and the relatively short-term follow-up indicate that further

large-scale, prospective randomized controlled studies with long-term follow-up are needed. Second, sexual function is not solely an issue of self-satisfaction but is rather an issue that is interrelated with the satisfaction of the sexual partner. Perioperative sexual function should be evaluated with regard to the sexual partner to accurately assess physiological erectile and ejaculatory function.

## CONCLUSIONS

This study showed that HoLEP had no negative effects on sexual function. Furthermore, sexual satisfaction also improved in proportion to the improvement in LUTS.

## AUTHOR CONTRIBUTIONS

SHK collected the data, performed the statistical analyses, and wrote the manuscript. HKY performed the statistical analyses. HEL reviewed the English grammar and the results of the statistical analyses. JSP reviewed the manuscript and help to draft the manuscript. SJO participated in the design of this prospective HoLEP-study, provided data from his HoLEP surgical database, supervised the study, and reviewed the manuscript. All authors read and approved the final manuscript.

## COMPETING INTERESTS

The authors declare that they have no competing interests.

## ACKNOWLEDGMENTS

We thank Ms. Yu-Kyung Lee for her assistance in database management.

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**How to cite this article:** Kim SH, Yang HK, Lee HE, Paick JS, Oh SJ. HoLEP does not affect the overall sexual function of BPH patients: a prospective study. *Asian J Androl* 27 June 2014. doi: 10.4103/1008-682X.132469. [Epub ahead of print]