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The role of laparoscopic experience on the learning curve of HoLEP surgery: A questionnaire-based study

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ABSTRACT

Objective: Holmium laser enucleation of the prostate (HoLEP) is an established method for treating benign prostatic obstruction. Nonetheless, its steep learning curve limits its wide distribution. The purpose of the present study was to demonstrate the impact of laparoscopic experience on HoLEP learning curve by evaluating the association between learning curves of surgeons performing both laparoscopy and HoLEP surgery.

Material and methods: A questionnaire was prepared to identify surgeon's experience on laparoscopy and HoLEP, as well as their learning curves. This questionnaire was then distributed via e-mail to 110 urologists who are actively involved in endourology/laparoscopy.

Results: Of the 110 urologists, 80 (72.7%) responded and completed the questionnaire. Of the 80 surgeons, 47 (58.8%) reported that they had completed the HoLEP learning curve with <20 cases. Moreover, 33 (41.2%) reported that they were able to complete the learning curve by performing >20 cases. Completion of the HoLEP learning curve in <20 cases was reached at 1.3%, 13.8%, and 43.8% by beginner, moderate skilled, and experienced laparoscopists, respectively (p<0.001).

Conclusion: Laparoscopic experience appears to be beneficial for surgeons while learning HoLEP. Highly experienced laparoscopic surgeons have a shorter HoLEP learning curve.

Keywords: Benign prostate hyperplasia; experience; HoLEP; laparoscopy; learning curve.

Introduction

Endoscopic prostate resection with holmium laser was first described by Gilling et al. in 1995. Several years later, this resection technique evolved to "enucleation" of the prostate, namely the holmium laser enucleation of the prostate (HoLEP).[1] Recent studies have demonstrated many advantages of HoLEP against other minimally invasive surgical treatments for benign prostatic obstruction, in that way, increasing its popularity.[2-4] However, despite the high efficacy of HoLEP, its wide distribution was delayed, probably due to its steep learning curve.[5] More specifically, the learning curve of HoLEP can be reached after completion of approximately 20-70 cases.[6]

HoLEP surgery is based on the principle of cutting the plane between the prostatic capsule and the adenoma tissue, using the holmium laser, and separating the adenoma by blunt dissection. Tissue resistance can be felt by the surgeon, and the dissection is performed with the aid of this tactile sensation. During the procedure, the three-dimensional (3D) configuration of the prostatic tissues should be cognitively elaborated and applied to a two-dimensional (2D) monitor, requiring an optimal hand-eye coordination. In these respect, HoLEP surgery follows similar principles as laparoscopic surgery.[7] Therefore, we tested the hypothesis that senior laparoscopic surgeons could be able to perform a safe and comprehensive HoLEP by performing blunt dissection without disruption of the anatomic planes. In the present study, expert urologists who perform both laparoscopy and HoLEP surgery were identified, and the effect of laparoscopy experience on the HoLEP learning curve was investigated.

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Material and methods

The study was approved by the Scientific Research Ethics Committee of Gazi University (protocol no. 2017-297). Recruited surgeons were urologists with at least one published original article related to HoLEP learning curve and laparoscopy, as determined on the PubMed medical database. PubMed database was searched for observational studies to May 2018. The search term used was "learning curve in HoLEP." A total of 48 studies were found in the search. The authors of these studies were searched, and 110 urologists who had an article on laparoscopic surgery were identified. These authors were reached via e-mail and asked to fill out the questionnaire.

Creation of the questionnaire and data collection

Considering that there was no reliable and valid form to define laparoscopy experience, a working group of experienced urological surgeons (LT, BKS, and ASG) created a suitable data collection form for the present study. The questionnaire was based on items regarding the surgeon's laparoscopic experience and the effect of this experience on the learning curve of HoLEP surgery. These items were prepared in the simplest form to be most comprehensible. The questionnaire was divided into two sections with a total of four items and could be easily accessed and completed via the "Google Forms" internet platform. The first section aimed to determine the laparoscopic experience level of the surgeon, before starting HoLEP surgery, and consisted of three items. The second section includes one more item to determine the HoLEP learning curve.

In the first section, the participant was initially asked how long he/she has been performing laparoscopy before starting HoLEP surgery (item 1). This item allowed the surgeons to select 1 out of 5 options indicating the years of laparoscopy experience: (1) 1-12 months, (2) 1-3 years, (3) 4-6 years, (4) 7-10 years, and (5) >11 years. The participant was then asked to assess the number of laparoscopic cases performed by himself/herself before starting HoLEP surgery (item 2), offering 5 options: (1) 1-9 cases, (2) 10-29 cases, (3) 30-49 cases, (4) 50-99 cases, and (5) >100 cases. The kind of laparoscopic experience the respondent had before starting HoLEP surgery was also assessed (item 3). Five options were given, and the surgeons were instructed to indicate all relevant answers from the following list: (1) undescended testes (diagnostic and therapeutic) or varicocelectomy or renal cortical cyst excision, (2) renal parapelvic cyst excision or ureterolithotomy, (3) nephrectomy (benign), nephroureterectomy (urothelial cancer) or adrenalectomy (>6 cm) or pyeloplasty, (4) radical nephrectomy or partial nephrectomy (malignant) or retroperitoneal lymph node dissection (staging), and (5) donor nephrectomy or retroperitoneal lymph node dissection (after chemotherapy) or radical prostatectomy. These five options were ranked in ascending difficulty order according to the level of laparoscopy experience, as already reported.[8] In the second section, the questionnaire assessed the number of HoLEP cases that the surgeon had to perform to reach the learning curve. Two options were given: (1) ≤20 and (2) >20 (see Appendix-https://doi.org/10.5152/tud.2019.19102). The questionnaires were distributed via e-mail to a total of 110 urologists from 17 different countries that practice endourology/laparoscopy and have been involved in at least one original article related to HoLEP and one to laparoscopic urologic surgery. In case of non-response, the form was sent three times at different time intervals.

Main Points:

- Despite the high efficacy of HoLEP, its wide distribution was delayed, probably due to its steep learning curve.
- HoLEP surgery follows similar principles as laparoscopic surgery.
- In the present study, surgeons who have previously mastered the main laparoscopic principles can adapt more easily and quickly to HoLEP surgery.

Evaluation of the questionnaire results and formation of the groups

A database was created according to the responses given to the three items in the first section, measuring laparoscopic experience. This was defined as a response of a=0 point, b=1 point, c=2 points, d=3 points, and e=4 points. By evaluating question 3, in which more than one response could be given, points were assigned to the highest scoring option. Finally, total points were obtained from the responses given, and on this basis, the surgeons were separated into groups according to laparoscopy experience (0-4 points: beginner (group 1), 5-8 points: moderate (group 2), and 9-12 points: advanced (group 3)). Two groups were created characterizing the HoLEP learning curves according to the responses given in the second section.

Statistical analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS Inc.; Chicago, IL, USA) version 15.0. The variables specified by counting descriptive findings are presented as numbers and percentages. The chi-square test and the Fisher's exact test were used to analyze the data. A p value <0.05 was considered significant.

Results

Of the 110 surgeons, 80 (72.7%) responded (Table 1). The laparoscopy experience levels of the responders were determined as beginner in 26 (32.5%), moderate in 18 (22.5%), and advanced in 36 (45%). Of the 80 surgeons, 47 (58.8%) stated that they had completed the HoLEP learning curve with <20 cases, and 33 (41.2%) stated that they had completed the HoLEP learn-

Table 1. Comparison of the HoLEP learning curve according to the laparoscopic experience

HoLEP learning curve	Laparoscopic experience				Between groups	
	Group 1, n (%)	Group 2, n (%)	Group 3, n (%)	Total, n (%)		p
<20 cases	1 (1.3)	11 (13.8)	35 (43.8)	47 (58.8)	Group 1&2	0.001
>20 cases	25 (31.3)	7 (8.8)	1 (1.3)	33 (41.2)	Group 2&3*	0.001
Total	26 (32.5)	18 (22.5)	36 (45)	80 (100)	Group 1&3*	0.001

*Statistically analyzed with Fisher's Exact test; Others analyzed with Chi - Square test. p<0.05 statistically significant. Group 1: Beginner, Group 2: Moderate, Group 3: Advanced

ing curve with >20 cases. There was a significant difference between the laparoscopic experience level and the HoLEP learning curve (p=0.001).

Additionally, the learning curve analysis among the different subgroups was examined separately (Table 1). Completion of the HoLEP learning curve with <20 cases was established in 3.8% of the surgeons at laparoscopy beginner level (group 1), in 61% of those with a moderate level (group 2), and in 97.2% of those with an advanced level (group 3).

Discussion

The learning curve is defined as "The time taken and/or the number of procedures that a surgeon needs to be able to perform a procedure independently with a reasonable outcome".[9] A reasonable outcome may reflect gaining confidence, reduced operating time and complication rates, and improved postoperative functional results.[10,11] The learning curve may depend on the manual dexterity of the surgeon, the background knowledge of surgical anatomy, the nature of the procedure, the frequency of the procedures performed in a specified period, and various patient factors, such as complex anatomy and varying case-mix.[10,11]

Although HoLEP is characterized by less morbidity and offers shorter hospitalization time than open prostatectomy and/or transurethral resection of the prostate, it is not widespread.[12] Previous published studies defined the HoLEP learning curve by using different parameters. One group evaluated the enucleation efficacy (weight of the enucleated tissue/duration of laser) and morcellation efficacy (enucleated tissue/morcellation duration), and a plateau was reached after 60 cases.[6] Another study that utilized the same parameters reported a learning curve ranging between 50 and 70 cases.[13] A subsequent article tested the association of the learning curve completion with the confidence gained to perform a HoLEP procedure unsupervised. According to the authors, at least 50 cases were deemed necessary to succeed this target.[14] Finally, El-Hakim et al.[7] compared the results of 27 cases performed by an inexperienced surgeon under the guidance of an experienced mentor, with the results of cases performed by another highly experienced surgeon. The authors concluded that a novice surgeon could adapt to the HoLEP technique after 20 cases. The lowest limit as the cutoff value was used by our group as to define the completion of the learning curve in our study. In the most recent review on HoLEP learning curve, 24 studies were included, and only 4 authors did not concur with the recommendations about the number of cases required to define the learning curve of HoLEP. Twenty studies recommended the number range from 20 to 60 cases. Therefore, HoLEP has an acceptable learning curve with a proposed figure approximating 25-50 cases.[15]

Laparoscopy offers a plethora of benefits to the patient and the surgeon, mainly due to its minimally invasive nature. However, its main limitation remains the 2D view of a 3D surgical field. Its basic and salient principle is the separation of the different anatomic planes by applying traction and blunt dissection, thus revealing the different anatomic landmarks. During these maneuvers, tissue resistance can be felt through the instruments by the hand of the surgeon. The degree of traction and tissue dissection is then defined, applied mechanically based on the tissue resistance that is being felt. During this process, an optimal eye-hand coordination appears to be of utmost importance. On the other hand, HoLEP surgery is based on the principle of cutting the plane between the prostatic capsule and the adenoma, utilizing the holmium laser, as well as separating the two structures with blunt dissection. Nevertheless, similar to laparoscopy, the tedious process of a cognitive processing and conversion of the 3D prostatic anatomy to a 2D view often complicates the procedure. This main predicament dissuades a surgeon with no sufficient knowledge and mastery of the different anatomic planes. Different anatomic landmarks, such as the ureteral orifices and the verumontanum, should be defined as control points and accepted as guides during the procedure. More specifically, the ureteral orifices serve as a guide during the first incision, and the verumontanum constitutes the end point of the enucleation.[16]

In the present study, surgeons who have previously mastered the main laparoscopic principles can adapt more easily and quickly

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to HoLEP surgery. Our data demonstrate the significant impact of laparoscopic experience on the HoLEP learning curve; however, it does not interfere with functional results as it was previously discussed in the literature.[17]

Currently, only a few studies show a correlation between the experiences of a surgical procedure on the learning curve-related procedure. A typical example would be the relationship between conventional laparoscopic radical prostatectomy (LRP) and the learning curve of robot-assisted radical prostatectomy (RARP). Although there are several common features between the two techniques, robotic surgery provides a 3D image and more ergonomic setting.[18-20] Owing to these advantages, the learning curve for RARP appears to be shorter.[21,22] Nonetheless, it is considered that laparoscopic experience could have an effect on the RARP learning curve because of its involvement in common surgical steps. In one study, the results of RARP performed by an experienced LRP team were compared with RARP performed by surgeons with no laparoscopic experience. The authors suggested that laparoscopic experience could accelerate the RARP learning curve, mainly due to the common steps of the two procedures.[23]

Our study has some limitations. The subjectivity of a questionnaire appears to be its main limitation. Furthermore, the questionnaires were not previously validated, and the accuracy of the information could not be investigated with more detailed questions. By evaluating laparoscopic experience, the classifications made according to the responses given were not based on a validated scale. Nevertheless, no standardized scale to determine laparoscopy experience could be found in the current literature. Additionally, responders were not asked to define their perception of completing the learning curve nor questioning the possible complications (i.e., capsular perforation and hemorrhage) because of the fact that it could add a possible bias to our results. The number of 20 cases that was used to group the participants could have been defined using more objective data, but as the number of studies on this subject is unsatisfactory, the lowest reported number of needed cases was arbitrarily adopted.[7] Further clinical research is necessary to strengthen our outcomes and corroborate the impact of laparoscopic experience to the HoLEP learning curve.

In conclusion, to the best of our knowledge, this is the first study to evaluate the relationship between previous laparoscopy experience and the HoLEP learning curve. Highly experienced laparoscopists reported a shorter HoLEP learning process.

You can reach the questionnaire of this article at https://doi.org/10.5152/tud.2019.19102.

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Appendix

HoLEP Learning Curve Questionnaire

A. On first starting HoLEP surgery

1. How long have you been performing laparoscopic surgery?
a. 0-12 months
b. 1-3 years
c. 4-6 years
d. 7-10 years
e. ≥11 years

2. What was the total number of your laparoscopic cases?
a. 0-9 cases
b. 10-29 cases
c. 30-49 cases
d. 50-99 cases
e. ≥100 cases

3. What kind of cases were you able to operate on laparoscopically? (Tick all that apply)
a. Undescended testes (diagnostic and therapeutic) or varicocelectomy or renal cortical cyst excision
b. Renal parapelvic cyst excision or ureterolithotomy
c. Nephrectomy (benign), nephroureterectomy (urothelial cancer) or adrenalectomy (>6 cm) or pyeloplasty
d. Radical nephrectomy or partial nephrectomy (malignant) or retroperitoneal lymph node dissection (staging)
e. Donor nephrectomy or retroperitoneal lymph node dissection (after chemotherapy) or radical prostatectomy

B. After starting HoLEP surgery

4. How many cases did you complete during your HoLEP learning curve?
a. ≤20 cases
b. >20 cases