Factors Affecting Robotic Surgery and the Learning Curve

Robotik Cerrahiyi ve Öğrenme Eğrisini Etkileyen Faktörler

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ABSTRACT Objective: Robotic surgery is a method that has been increasingly performed recently and provides a lot of convenience for the surgeon. Thirty-four prostatectomy cases performed between 2011-2013 were evaluated to share the experiences of our center related to the factors affecting robotic surgery and the evaluation of the learning curve. **Material and Methods:** The cases were divided into five groups, namely: the first fifteen (Group 1a) and the last fifteen (Group 1b) cases; cases with a history of laparotomy (Group 2a, n:22) and those without history of laparotomy (Group 2b, n:12), cases with no postoperative drainage (Group 3a, n:27) and those with postoperative drainage (Group 3b, n:7); those with single operative assistant port (Group 4a, n:26) and those with double operative assistant port (Group 4b, n:8); cases with body mass index (BMI) of over 25 (overweight-obese) (Group 5a, n:27) and those with BMI of under 25 (normal weight, Group 5b, n:7); first seven (Group 6a), second seven (Group 6b), third seven (Group 6c) and last seven (Group 6d). The groups were evaluated according to the trocar time, docking time, console time, bleeding amount, specimen weight, comorbidity, incontinence and surgical margin parameters. **Results:** In our study, it was determined that the learning curve began to build up after case fifteen, and that comorbidities, previous laparotomy, size of the prostate and obesity did not negatively affect the operation, and placing a drainage tube was not beneficial. **Conclusion:** Obesity was determined to be an increasing factor for the bleeding during robotic surgery.

Key Words: Robotics; learning curve; prostatic neoplasms

ÖZET Amaç: Robotik cerrahi gün geçtikçe kullanımı artan, cerraha birçok kolaylık sağlayan bir yöntemdir. Robotik cerrahiyi etkileyen faktörler ve öğrenme eğrisinin değerlendirilmesi yönünden merkezimizin tecrübelerini paylaşmak için, 2011-2014 yılları arasında yaptığımız otuzdört prostatektomi olguları değerlendirilmiştir. **Gereç ve Yöntemler:** Olgular beş gruba ayrılmış olup, ilk onbeş (Grup 1a) ve son onbeş (Grup 1b) olgular; özgeçmişinde laparotomi olmayan (Grup 2a, n:22) ve laparotomisi olan (Grup 2b, n:12); ameliyat sonunda dren konmayan (Grup 3a, n:27) ve konan (Grup 3b, n:7); asistan portu olarak tek (Grup 4a, n:26) ve çift port kullanılan (Grup 4b n:8); beden kitle indeksi 25 in üzerinde (kilolu-obez) olan (Grup 5a, n:27) ve altında olan (normal kilolu, Grup 5b, n:7); ilk yedi (Grup 6a), ikinci yedi (Grup 6b), üçüncü yedi (Grup 6c) ve son yedi (Grup 6d) olarak altı gruba ayrılmıştır. Gruplar trokar süresi, docking süresi, konsol süresi, kanama miktarı, spesmen ağırlığı, komorbidite, inkontinans ve cerrahi sınır parametreleri ile değerlendirilmiştir. **Bulgular:** Çalışmamızda öğrenme eğrisinin, onbeşinci vakadan sonra oluşmaya başladığı, komorbiditenin, geçirilmiş laparotominin, prostat büyüklüğünün ve obezitenin cerrahiye olumsuz katkısının olmadığı, dren koymanın faydasının olmadığı saptanmıştır. **Sonuç:** Robotik cerrahide obezitenin, kanamayı artıcı bir rol oynadığı tespit edilmiştir.

Anahtar Kelimeler: Robotiks; öğrenme eğrisi; prostat tümörleri

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Minimally invasive surgery is the technique that aims to obtain an operative result with minimum damage to the patient (pain, fast recovery, return to work and scar). Besides the benefits of laparoscopy for the patients, the rise of robotics surgery has become faster caused by the restrictions of laparoscopy such 6 as loss of three-dimensional image, impaired sense of touch, and decreased discretion caused by the long instruments. Robotics surgery is a method that has been increasingly performed recently and provides a lot of convenience for the surgeon.

Robotics surgery is an excellent solution for the restrictions of laparoscopy as the surgical field is deep in the pelvis for prostatectomy, movement of flexion of the wrist not being possible with laparoscopy, and placing sutures being very hard in the narrow male pelvis. Robotic radical prostatectomy with adequate experience had been shown in various studies to be effective and safe for prostatic neoplasms.[1-3] In United States, approximately 85% of radical prostatectomy operation are performed with robotics.[1,4]

There is a minimal number of operations that have to be performed for certain techniques during the surgical training. Surgical experience continues to increase during the training by observing the damages inflicted on the patients. Learning curves are emphasized to be vertical and each operation has a remarkable mortality and morbidity. In most surgical training programs, there are no clues about minimally invasive surgery. Robotics technologies provide suitable solutions for the update of our surgical training and improving the results of patient care. There are publications stating the recommended number of cases for the learning curve of robotic radical prostatectomy as 50[1] furthermore, there are other studies stating the number as 15-30 under the supervision of a mentor.[2] It is known that the training duration of robotics surgery is much shorter and easier than the laparoscopic surgery. Experience in laparoscopic surgery is the strongest indicator of performance in robotic surgery.[5]

The aim of this study was to evaluate this nonstandard situation about the learning-curve over the cases, maintain standardization, and to evaluate the factors affecting robotics surgery and to contribute to the literature.

MATERIAL AND METHODS

Thirty-four successive cases that had undergone robotics radical prostatectomy between 2011-2013 at the Johns Hopkins Anatolian Health Center hospital were included in the study. In robotic radical prostatectomy, non-slipping spread is placed between the patient and the operating table for preventing the patient from slipping and silicon pillow shields are put between the shoulders. Patient is taken into lithotomy position and maximum trendelenburg (30 degrees) is applied. Following appropriate covering, a three way foley catheter is inserted into the bladder. 8 mm robotic trocars are used for the instruments that will be attached to arms 1, 2 and 3; 12 mm trocar is used for the camera in arm 4; and 12 mm trocar is used for the assistant. Camera port is placed after building 12 mmHg pneumoperitoneum with the guidance of veres at the midline, 2 cm above the umbilicus. Drawing an arc with its open side facing pelvis, working trocars are placed on this arc as two 8 mm trocars placed laterally to left with a minimum of 7 cm distance in between, and one 8 mm trocar placed laterally to right. Assistant port is placed laterally to right between camera and working ports. Robot is brought to the operation area between the legs. Camera connection is made at first. Then, using the guidance of camera, connections of the working tools are made, and docking is completed. The console surgeon was a urology professor who had experience of laparoscopic and open radical prostatectomy surgery for over hundred cases, and had robotic surgery certificate. The first assistant was a general surgeon who has a robotics surgery certificate; the operation nurse was a nurse who had completed her training on robotic surgery and the circulating nurse was a nurse who had completed her robotic surgery recording the timing of the operation.

The cases were divided into five groups, namely: the first fifteen (Group 1a) and the last fifteen (Group 1b) cases; cases with a history of laparotomy (Group 2a, n:22) and those without history of laparotomy (Group 2b, n:12), cases with no postoperative drainage (Group 3a, n:27) and those with postoperative drainage (Group 3b, n:7); those with single operative assistant port (Group 4a, n:26) and those with double operative assistant port (Group 4b, n:8); cases with BMI of over 25 (overweight-obese) (Group 5a, n:27) and those with body mass index (BMI) of under 25 (normal weight, Group 5b, n:7); first seven (Group 6a), second seven (Group 6b), third seven (Group 6c) and last seven (Group 6d). The groups were evaluated according to the trocar time, docking time, console time, bleeding amount, specimen weight, comorbidity, incontinence and surgical margin parameters. The trocar time was begun with the insertion of the first trocar and ended upon removal of the last trocar. The docking time was started with the da Vinci robot approaching the patient and ended with the docking of the last trocar. The console time was begun with the console surgeon starting the operation and ended upon completion of anastomosis and bleeding control. The specimen weight was acquired from the pathology reports. The comorbidity number was obtained by the adding the number of known diseases. Patients were asked 28 questions according to Urinary Incontinence Wagner's Quality of Life (QOL) scale. Each of the questions were answered as “no, mild, moderate, and very”. The answers were scored as 0, 1, 2, and 3 points respectively, and the total score was determined for each patient. According to the total score, evaluations were made as 0= no incontinence, 1-28= mild incontinence, 29-56= moderate incontinence, and 57-84= marked incontinence.[6] Surgical margin was evaluated pathologically.

STATISTICAL METHOD

Average, standard deviation, median, minimum-maximum (min-max) rate and frequency values were used for the definitive statistics of the data. The ANOVA (Tukey test), the independent sample t test, and the Mann-Whitney U test were used for analysis of the quantitative data. The Chi square test was used for analysis of the qualitative data. The SPSS 22.0 program was used for the analysis.

RESULTS

The trocar time, docking time, bleeding amount, prostate weight, and the comorbidity rates were not statistically significantly different ($p>0.005$) among groups that compried fifteen cases. The console time of group 1 was significantly longer than that of group 2 ($p<0.05$). Incontinence rate was significantly higher in group 1a compared to group 1b ($p<0.05$). Ratio of patients with positive surgical margin was higher in group 1a compared to group 1b ($p<0.05$) (Table 1).

There was no statistically significant difference between the trocar time, the console time, the bleeding amount, the prostate weight incontinence

TABLE 1: Evaluation of the first and the last fifteen cases.

	Group 1a		Group 1b		
First and last 15 cases	**Mean ± SD/n-%**	**Med (Min-Max)**	**Mean ± SD/n-%**	**Med (Min-Max)**	**p**
Trocar time(min)	9.3 ± 3.4	8 (4-16)	7.3 ± 2.8	7 (3-11)	0.080
Docking time(min)	5.8 ± 2.9	5 (1-12)	4.9 ± 2.3	4 (2-10)	0.340
Console time(min)	178.3 ± 42.7	164 (127-265)	140.1 ± 28.6	130 (100-208)	***0.008***
Bleeding amount (ml)	336.7 ± 591.1	200 (0-2300)	153.3 ± 191.3	100 (0-500)	0.427
Prostate weight (g)	51.0 ± 19.8	50 (15-85)	52.2 ± 13.1)	55 (33-80)	0.933
Comorbidity	12/80.0%		7/46.7%		0.058
Incontinence	6/85.7%		1/14.3%		***0.031***
Surgical margin (+)	6/85.7%		1/14.3%		***0.031***

Independent sample t test / Mann-whitney U test/Chi-square test.

TABLE 2: Evaluation of the cases according to previous laparotomy.

	Laparotomy negative (n:12)		Laparotomy pozitive (n:22)		
	Mean±SD/n-%	Med (Min-Max)	Mean±SD/n-%	Med (Min-Max)	p
Trocar time(min)	8.4 ± 3.5	8 (3-16)	7.7 ± 3.2	8 (2-12)	0.573
Docking time(min)	5.6 ± 2.8	5 (2-12)	3.7 ± 2.1	4 (1-8)	***0.041***
Console time(min)	163.3 ± 43.8	153 (100-265)	140.6 ± 28.1	134 (98-195)	0.116
Bleeding amount(ml)	261.4 ± 505.2	100 (0-2300)	162.5 ± 183.6	100 (0-500)	0.986
Prostate weight (g)	51.3 ± 16.5	50 (15-85)	49.9 ± 16.0	52 (25-80)	0.816
Comorbidity	17/77.3%		4/33.3%		***0.012***
Incontinence	5/71.4%		2/28.6%		0.676
Surgical margin (+)	5/71.4%		2/28.6%		0.676

Independent sample t test / Mann-whitney U test / Chi-square test.

and surgical margin positivity of patients who had previously undergone laparotomy and those who had not (p>0.05). The docking time and the comorbidity rates of group 2a were significantly higher than those of group 2b (p<0.05) (Table 2).

There was no statistically significant difference between the trocar time, the docking time, the console time, the bleeding amount, the prostate weights and incontinence of group 3a and group 3b, which were patients in whom drain was placed, and not placed, respectively (p>0.05). In the group in which drain was placed, ratio of patients with positive surgical margin was significantly higher than the group in which drain was not placed (p<0.05) (Table 3).

The trocar time was significantly longer in Group 4b (p<0.005) when the cases were evaluated according to the assistant port being single (group 4a) or double group 4b). The console time was significantly higher in group 4b (p<0.05). Surgical margin positivity was significantly higher in group 4a (Table 4).

When group 5a and group 5b, which were grouped according to BMIs were evaluated, there was no significant difference between groups 5a and 5b with regard to the trocar time, docking time, console time, prostate weight, comorbidity rates, incontinence and surgical margin positivity (p>0.005). The bleeding amount was statistically significantly higher in group 5b (p<0.05) (Table 5).

When the cases were divided into groups of seven patients, there was no statistically significant difference among the groups with regard to the trocar time, docking time, prostate weight, bleeding amount, comorbidity rates, incontinence and surgical margin positivity (p>0.05) (Table 6). The

TABLE 3: Evaluation of the cases according to the postoperative drainage installation.

	Group 3a (n:27)		Group 3b (n:7)		
	Mean±SD/n-%	Med (Min-Max)	Mean±SD/n-%	Med (Min-Max)	p
Trocar time(min)	7.7 ± 3.3	8 (2-16)	9.7 ± 3.5	10 (5-14)	0.163
Docking time(min)	4.6 ± 2.5	4 (1-10)	6.4 ± 3.0	6 (3-12)	0.111
Console time(min)	149.1 ± 34.3	140 (98-225)	179.0 ± 53.8	157 (130-265)	0.125
Bleeding amount (ml)	137.0 ± 164.4	100 (0-500)	571.4 ± 822.0	200 (0-2300)	0.133
Prostate weight (g)	48.3 ± 15.7	50 (15-85)	60.6 ± 14.6	55 (40-80)	0.104
Comorbidity	16/59.3%		5/71.4%		0.555
Incontinence	4/57.1%		3/42.9%		0.135
Surgical margin (+)	3/42.9%		4/57.1%		***0.007***

Independent sample t test / Mann-whitney U test / Chi-square test.

TABLE 4: Evaluation of the cases according to installation of single or double port.

	Group 4a (n:26)		Group 4b (n:8t)		
Assistant port	**Mean±s.s./n-%**	**Med (Min-Max)**	**Mean±SD/n-%**	**Med(Min-Max)**	**p**
Trocar time(min)	7.3 ± 2.9	8 (2-12)	10.8 ± 3.6	11 (6-16)	***0.009***
Docking time(min)	4.8 ± 2.9	4 (1-12)	5.3 ± 2.1	5 (3-9)	0.459
Console time(min)	144.0 ± 30.7	137 (98-225)	191.8 ± 47.1	177 (137-265)	***0.005***
Bleeding amount	215.4 ± 453.2	100 (0-2300)	262.5 ± 306.8	200 (0-900)	0.411
Prostate weight (g)	49.9 ± 15.1	50 (25-85)	53.8 ± 19.8	55 (15-80)	0.558
Comorbidity	14/53.8%		7/87.5%		0.087
Incontinence	4/57.1%		3/42.9%		0.315
Surgical margin (+)	3/42.9%		4/57.1%		***0.037***

Independent sample t test / Mann-whitney U test / Chi-square test.

TABLE 5: Evaluation of the cases according to the BMI.

	Group 5a (n:27)		Group 5b (n:7)		
	Mean±SD/n-%	**Med (Min-Max)**	**Mean±SD/n-%**	**Med (Min-Max)**	**p**
Trocar time(min)	9.1 ± 1.2	10 (7-10)	7.9 ± 3.7	7(2-16)	0.248
Docking time(min)	5.1 ± 1.3	5 (3-7)	4.9 ± 3.0	4(1-12)	0.438
Console time(min)	141.3 ± 37.7	127 (118-225)	158.9 ± 40.5	154 (98-265)	0.084
Bleeding amount	28.6 ± 48.8	0 (0-100)	277.8 ± 457.7	200 (0-2300)	***0.024***
Prostate weight (g)	51.5 ± 17.4	50 (25-80)	50.6 ± 16.1	50 (15-85)	0.898
Comorbidity	3/42.9%		18/66.7%		0.248
Incontinence	1/14.3%		6/85.7%		1.000
Surgical margin (+)	0/0.0%		7/100%		0.300

Mann-whitney U test / Chi-square test.

TABLE 6: Evaluation of the cases according to 7-in each designated groups.

			Group 6a		**Group 6b**		**Group 6c**		**Group 6d**		**Group 6e**	**P**
Trocar time (min)	Mean±SD		11.3 ± 3.5		7.6 ± 2.6		7.9 ± 2.5		6.9 ± 2.8		6.8 ± 4.0	0.072
	Med (Min-Max)	12	6 - 16	8	4 - 12	8	3 - 10	6	3 - 11	7	2 - 12	
Docking time (min)	Mean±SD		5.4 ± 2.1		6.3 ± 3.8		5.3 ± 1.6		4.7 ± 3.0		2.7 ± 1.4	0.171
	Med (Min-Max)	5	3 - 9	7	1 - 12	5	3 - 8	3	2 - 10	3	1 - 5	
Console time(min)	Mean±SD		193 ± 51		168 ± 33		139 ± 32		144 ± 30		128 ± 16	***0.012***
	Med (Min-Max)	174	137 - 265	164	127 - 225	130	118 - 208	155	100 - 180	130	98 - 146	
Bleeding amount (ml)	Mean±SD		243 ± 326		436 ± 829		200 ± 231		150 ± 171		83 ± 121	0.632
	Med (Min-Max)	200	0 - 900	150	0 - 2300	100	0 - 500	100	0 - 400	25	0 - 300	
Prostate weight (g)	Mean±SD		53.6 ± 21.3		43.6 ± 14.1		62.3 ± 16.9		50.0 ± 10.4		43.6 ± 11.0	0.168
	Med (Min-Max)	55	15 - 80	50	25 - 60	60	41 - 85	55	35 - 65	42	33 - 60	
Comorbidity	n-%		7-100%		4-57%		4-57%		3-43%		3-50%	p>0.05
Incontinence	n-%		3-43%		3-43%		1-14%		0-0%		0-0%	p>0.05
Surgical margin (+)	n-%		4-57%		2-29%		0-0%		1-14%		0-0%	p>0.05

ANOVA (Tukey test) / Chi-Square Test.

TABLE 7: Intraoperative results.

Mean operative time (min)	210 (143-335)
Mean trocar time (min)	7.9 (2-13)
Mean docking time (min)	4.9 (1-12)
Mean consol time (min)	88 (36-190)
Mean estimated blood loss (mL)	226 (5-2300)
Conversion rate (n)	0
Blood transfusion rate (%)	2.6
Intraoperative complications (%)	2.6

TABLE 8: Oncological results.

Prostate weight (g)	50.8 (15-80)
Pathologic Stage (%)	
T2a	5
T2b	2.9
T2c	64.7
T3a	2.9
T3b	8.8
T4	0
Median Postoperative Gleason score	6
Postoperative Gleason score (%)	
6	58.8
7	17.6
8	20.5
9	2.9
Positive surgical margins by location (% of total positive margins)	
Apical	8.8
Base	0
Anterior	0
Posterior	0
Lateral	5.8
Seminal vesicle	17.7
Urethra	0
Positive surgical margin rate by stage (%)	
pT2a	2.9
pT2b	0
pT2c	5.8
pT3a	2.9
pT3b	11.7

console time was significantly higher in group 6a than groups 6c and 6d ($p<0.05$). There was no statistically significant difference with regard to the console time among other groups ($p>0.05$) (Table 6).

In addition, intraoperative and oncological data of the cases are summarized in Table 7 and Table 8. In Table 9, pt2 and pt3 cases whose tumor stages were evaluated pathologically are compared.

CONCLUSIONS

In our study, the console time was decreased empirically after case seven, although there was no statistical significance, and it was decreased significantly after case fifteen ($p<0.05$, Table 1). According to evaluations for surgical margin positivity and incontinence, which are the other parameters used for the evaluation of learning curve, there was no statistically significant difference in there parameters at the first fifteen cases. After fifteen cases, surgical margin positivity and incontinence score were lower.

In one study involving 64 cases with previous history of pelvic surgeries including rectum, sigmoid and colon, it was reported that robotic surgery could be safely performed.[7] The long docking time in our study can be explained by the time spent for opening the surgical adhesions that developed because of previous operations.

It was observed that installation of a drain was not beneficial, and that double assistant port

TABLE 9: Comparison of pt2-pt3 cases.

pt2(n:25)	pt3 (n:4)	
Trocar time (min)	7.88	8.25
Docking time (min)	5.04	5
Console time (min)	155.2	168
Bleeding amount (ml)	242	350
Prostate weight (Gr)	50.8	55
Positive surgical margin (%)	8.8	14.7
Incontinence score (n)		
Score 0	21	2
Score 1	3	1
Score 2	0	1
Score 3	1	0
PSA	10.3	13.1
Complication (n)	0	1

had no benefits, since besides shortening the console time, it prolongs the trocar time. Drain was preferred especially in difficult and bleeding cases. Significantly higher rates of surgical margin positivity in these cases could be explained by this.

In one study by Kwon et al. involving 2639 cases with robotic assisted laparoscopic prostatectomy, 186 cases with BMI over 30 who were diagnosed with metabolic syndrome were compared to cases who did not have metabolic syndrome or obesity; there was no difference in perioperative, histopathological and functional results. However, amount of bleeding was determined to be higher in obesity.[8] In our study, we had similar results, bleeding amount was higher in obesity.

With all these findings, the learning-curve of robotics radical prostatectomy surgery was determined to start building up after case fifteen, and it was concluded that obesity had no negative effects on robotic radical prostatectomy surgery, Obesity was determined to be an increasing factor for the bleeding during robotics surgery.

According to evaluation of oncological data that were summarized in Table 8, mean prostate weight was 50.8 gr, most of the cases were in stage pt2c, postoperative Gleason score was 6, positive margin was most frequently located at seminal vesicle and apical region, and positive margin was most common in cases whose stage was pt3c. These results are consistent with the the results of the study by John et al. involving 700 cases with robotic assisted laparoscopic prostatectomy.[3] In addition, according to intraoperative data given in Table 7, there was one intraoperative complication, as one of our cases required transfusion due to excess bleeding. There was no case with gap. According to comparison of pt2 and pt3 cases given in Table 9, surgical margin positivity was higher in pt3 cases as expected. According to evaluations for incontinence, there was totally 4 cases with incontinence from pt2 cases; three of them had score 1 level, and had mild incontinence, whereas in one case the score was 3 and he had marked incontinence. Within pt3 cases, one case had mild (score 1), and one case had score 2 (moderate) incontinence, none of them had marked incontinence. There was no difference between the two groups regarding trocar time, docking time, console time, bleeding amount and prostate weight; PSA levels were higher in pt3 cases.

DISCUSSION

Robotics surgery or robot-assisted laparoscopic surgery, which was first used in 1985, is being widely performed in many fields of surgery nowadays. Robotics surgery clears away the shaking, which is a problem during laparoscopy, provides a three-dimensional image with double lenses, and provides possibility of placing sutures easily with the high ability of maneuverability.[3] It is possible to operate more carefully and delicately with the image quality and dexterity provided by the robot.[4] In a study by Lucian et al. involving transfer of laparoscopic skills to robotic surgery, it was determined that this was possible, and difficult skills especially like suturing were shown to be learned faster with robotic surgery.[9] In one study by Pauls et al. involving the learning curve with comparison of robotic surgery and laparoscopy, suturing and mastering skills were found to be faster with robotic surgery compared to laparoscopy.[10] In a study by Mohr et al. including 75 morbid obese cases, it was shown that learning curve was faster compared to laparoscopic operations in statistically significant ratio, and that learning curve was completed with 10-15 cases.[11] In several similar studies learning curve was found to be significantly shorter.[12,13]

The learning-curve terminology is contributed to the literature of Ramsay et al. during the 2000s.[14] Studies show that learning curve for robotic surgery is easier for the surgeons who have experience of laparoscopic surgery.[15] There is no standard data about the learning-curve for robotics surgery. In a study conducted by Barrie et al. including patients operated with laparoscopy and robot for colorectal cancer, the learning-curve for laparoscopy was 5-310, while the learning-curve for robotics surgery was 15-30 cases.[16] In the 250-case robotic-assisted radical prostatectomy prostatectomy study of Al-Hathal et al., the mean operation duration was 194±60.6 minutes, the estimated blood loss was 318±179 ml, the transfusion amount was 0.4%, the duration of hospitalization was 1.2 days, and the learning-curve was reported as 50 cases.[14]

In our study, with the evaluation of the console time, there was a significant decrease after the fifteenth case. In their study, Sgarbura et al. reported evaluating robotics surgery cases within five years, in which the docking time decreased about 11 minutes after 100 cases.[17] In this study, the learning-curve was reported as 20-50 cases and it was emphasized that the learning-curve of laparoscopy was 50-100 cases. In our study, although there was no statistical significance, the docking time was observed to decrease after fifteen cases. For the other parameters, which are incontinence score and surgical margin positivity, significant improvement was observed after fifteen cases. These results are consistent with the results reported in literature; learning curve in our series was determined as fifteen cases.

It takes much less time to learn robotic surgery than laparoscopic surgery.[18] Moreover, those who have experience in robotic surgery can learn laparoscopy much more faster. Open and laparoscopic radical prostatectomy experience of the surgeon influences the learning curve for robotic radical prostatectomy.[2] It should not be forgotten that the time required to learn robotics surgery is much shorter than traditional laparoscopy.[19] A freshly beginning surgeon can easily train and comfortably practice this technique in half of the time required to perform laparoscopy. Beside the learning pace and the level changing from person to person, generally 15 interventions are sufficient.

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