Training of robotic-assisted radical prostatectomy, experiences of 100 cases

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Keyword:
Cancer of prostate; Robotic-assisted radical prostatectomy

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Receiving date: 31/8/2018
Approving date: 06/9/2018
Publishing permission date: 10/9/2018

Abstract

Introduction: The application of robotics in endoscopic techniques becomes commonly in Vietnam. The transition from conventional surgery and laparoscopy to robotic-assisted endoscopy has its own difficulties and advantages. We summarize the experiences of training this procedure through 100 prostate cancers treated by robotic-assisted laparoscopic surgery in the Urology Department, Binh Dan Hospital, from December 2016 to June 2018.

Material and Methods: This was a clinical comparative and vertical study. 100 patients diagnosed prostate cancer, staged T1 to T3 were performed robotic-assisted radical prostatectomy (RARP), with or without nerve sparing and local pelvic lymph nodes dissection. The comparison of 5 groups of surgeons, two phases with 50 cases each was conducted.

Research variables: Stages of cancer, pre and postoperative PSA levels, Gleason score, lymph node metastases, estimated blood loss, surgery duration, urinary incontinence, hospitalization stay and complications are enrolled .

Results: Five surgeons A, B, C, D, E had 38,22,18,14 and 6 cases respectively. The mean age, PSA and cancer stage were statistically similar (p> 0,3). The surgery duration were 176.81, 274.77, 231.88, 286.92 and 272.50 minutes, respectively, which was statistically different (p <0.01). Mean blood loss were 404.62, 476.64, 370, 244.62, 462.50 ml, which was statistically different (p <0.01). 15 cases needed blood transfusion. Hospitalization was 5.42, 11.14, 4.94, 6.31, 7 days, which was not statistically similar among groups (p <0.05), but had a statistically significant relationship with drainage duration and complication rate of each group (p <0.01). The second phase of the study significantly improved in surgery duration from 270 to 214.65 minutes compared to the first phase. Mean blood loss increased from 361.60 to 427.44 ml although the average PSA decreased from 42.84 to 35.72 ng/ml. Lymphadectomy in the first half was 22/50 and in the second half was 29/50. The learning curve of the operation duration reached after 20 cases, however there was little improvement afterwards. More members of surgical team had, more standard deviation of surgical duration was.

Conclusion: By studying the training of robotic-assisted radical prostatectomy at Binh Dan Hospital we found that surgery could be safely with acceptable complications. Optimal learning curve for surgical duration was achieved at the first 20 cases. Training needed to have a procedure in place to replicate the number of surgeons without compromising the overall outcome.

1. Introduction

The application of robotics in endoscopic techniques becomes commonly in Vietnam in recent years. The transition from open surgery and laparoscopy to robotic-assisted endoscopy has its own difficulties and advantages. We summarize our experiences of training of this procedure through 100 prostate cancers treated by robotic-assisted laparoscopic surgery in the Urology Department, Binh Dan Hospital, from December 2016 to June 2018.

2. Materials and methodology :

This was a clinical and vertical comparative study. There are 100 patients diagnosed with prostate cancer, clinically at staged T1 to T3, underwent robotic-assisted radical prostatectomy (RARP), with or without nerve sparing and local pelvic lymph nodes dissection. The comparison was based on 5 groups of surgeons, two phases with 50 cases each.

Research variables: Stages of cancer, pre and postoperative PSA levels, Gleason score, lymph node metastases, estimated blood loss, surgery duration, hospitalization stay and complications including the urinary incontinence

3. Results

100 patients in total were operated. Five surgeons A, B, C, D, and E had 38,24,18,14 and 6 cases respectively.

Patients data were presented in Table 1

Table 1: Demographic data

	Age	PSA	Gleason	Number of cases	Stage
General information	65,67±8,13 (46 – 89)	39,70±32,40 (4,5 – 100)	≤3+4 : 49 4+3 : 20 ≥4+4 : 31	≤ 1/3 : 29 ≤ 2/3 : 44 >2/3 : 27	1 : 8 2 : 42 3 : 50
50 cases phase 1	66,16±7,62 (49 – 80)	42,84±31,45 (4,5 – 100)	≤3+4 : 26 4+3 : 6 ≥4+4 : 18	≤ 1/3 : 16 ≤ 2/3 : 19 >2/3 : 15	1 : 8 2 : 17 3 : 25
50 cases phase 2	65,10±8,75 (46 – 89)	35,72±33,56 (4,8 – 100)	≤3+4 : 23 4+3 : 14 ≥4+4 : 13	≤ 1/3 : 13 ≤ 2/3 : 25 >2/3 : 12	1 : 0 2 : 25 3 : 25
Surgeon A 38 cases	66,28±7,23 (55 – 80)	39,05±34,55 (6 – 100)	≤3+4 : 17 4+3 : 9 ≥4+4 : 12	≤ 1/3 : 12 ≤ 2/3 : 13 >2/3 : 13	1 : 2 2 : 19 3 : 17
Surgeon B 22 cases	64,62±7,98 (50 – 79)	39,81±25,75 (13 – 100)	≤3+4 : 14 4+3 : 1 ≥4+4 : 9	≤ 1/3 : 9 ≤ 2/3 : 9 >2/3 : 6	1 : 2 2 : 5 3 : 17
Surgeon C 18 cases	63,81±10,03 (46 – 89)	48,90±37,05 (13 – 100)	≤3+4 : 10 4+3 : 6 ≥4+4 : 2	≤ 1/3 : 2 ≤ 2/3 : 10 >2/3 : 6	1 : 2 2 : 7 3 : 9
Surgeon D 14 cases	68,46±8,17 (53 – 80)	18,41±12,03 (5 – 50)	≤3+4 : 7 4+3 : 2 ≥4+4 : 5	≤ 1/3 : 5 ≤ 2/3 : 7 >2/3 : 2	1 : 2 2 : 8 3 : 4
Surgeon E 6 cases	68,25±3,86 (63 – 72)	96,35±6,32 (89 – 100)	≤3+4 : 1 4+3 : 2 ≥4+4 : 3	≤ 1/3 : 1 ≤ 2/3 : 5 >2/3 : 0	1 : 0 2 : 3 3 : 3

Comments: Patients age were similar between general and small groups. PSA before surgery was similar between general and group A, B. PSA of the first phase cases was higher than the second phase cases. Surgeon D group had the patient with lowest PSA. PSA of surgeon E group was too high, however the data was not able analyzed. The mean score of positive samples was similar between groups. Most groups had high rates of stage 3.

Surgical details are presented in Table 2.

Table 2: Data surgery

	Set-up Time	Surgery duration	Blood loss	Drainage days	Hospitalization days	Nodes/Edge
General information	27,37±10,82 (15 – 60)	229,19±78,00 (105 – 480)	392,04±423,03 (50 – 2800)	5,15±3,31 (1 – 35)	6,8 2±3,53 (2 – 38)	50%
50 cases phase 1	29,40±12,27 (15 – 60)	241,70±77,35 (105 – 480)	361,60±217,42 (80 – 1400)	5,90±4,08 (1 – 35)	7,64±4,54 (2 – 38)	44%
50 cases phase 2	25±8,38 (15 – 45)	214,65±77.09 (115 – 420)	427,44±479,21 (50 – 2800)	4,28±2,94 (1 – 20)	5,86±3,02 (2 – 20)	56%
Surgeon A 38 cases	25,14±10,45 (15 – 60)	176,81±46,23 (115 – 270)	406,94±336,61 (100 – 1500)	4,17±2,05 (1 – 8)	5,42±2,18 (2 – 11)	55,26%
Surgeon B 22 cases	30,68±9,79 (15 – 60)	274,77±93,45 (115 – 480)	478,64±603,71 (50 – 2800)	8,45±7,67 (3 – 35)	11,14±7,88 (5 – 38)	33,33%
Surgeon C 18 cases	26,25±15,97 (15 – 60)	231,88±54,28 (150 – 315)	370±245,98 (100 – 800)	3,31±2,30 (1 – 11)	4,94±2,14 (3 – 11)	38,89%
Surgeon D 14 cases	30±5,40 (20 – 45)	286,92±59,78 (210 – 420)	244,62±202,8 (50 – 700)	5,15±1,63 (3 – 8)	6,31±1,55 (4 – 10)	71,43%
Surgeon E 6 cases	27,5±5 (20 – 30)	272,50±25 (240 – 300)	462,50±110,87 (350 – 600)	5±1,41 (3 – 6)	7±2,94 (4 – 10)	66,67%

Comments: The set-up time was not much different among groups. Mean surgery duration, mean drainage days, mean hospitalization days and rates of lymphadenectomy were improved in the second phase. However, the indicators above mentioned were different among groups of surgeons.

Complications: It was presented in Table 3.

Table 3: Complications

	Complications	Convert to open surgery	Re-operated	Nodes, edge
General information	23/100	1/100	4/23	8/50
50 cases phase 1	14/50		2/14	1/22
50 cases phase 2	9/50	1/50	2/9	7/28
Surgeon A 38 cases	6/38			1/21
Surgeon B 22 cases	10/24	1/24	4/10	4/8
Surgeon C 18 cases	4/18			1/7
Surgeon D 14 cases	1/14			0/10
Surgeon E 6 cases	2/6			2/4

Comments: The rate of complication was improved in the second phase. The indicators above were different among groups.

Accumulated mean of surgery duration, blood loss, draining time, hospitalization of the general group are presented in charts A, B, C and D.

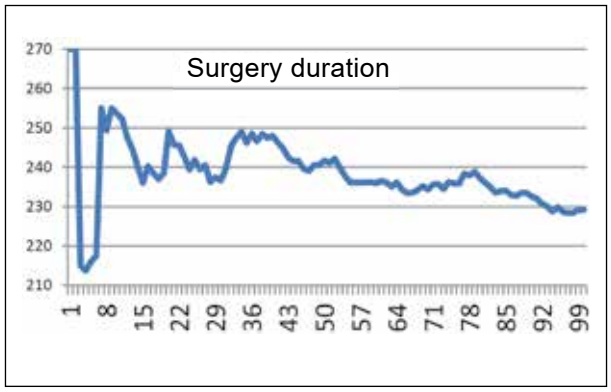


Diagram A: Accumulated mean of surgery time

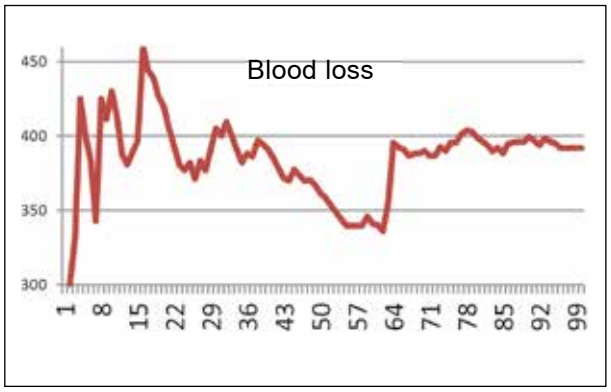


Diagram B: Accumulated mean of blood loss

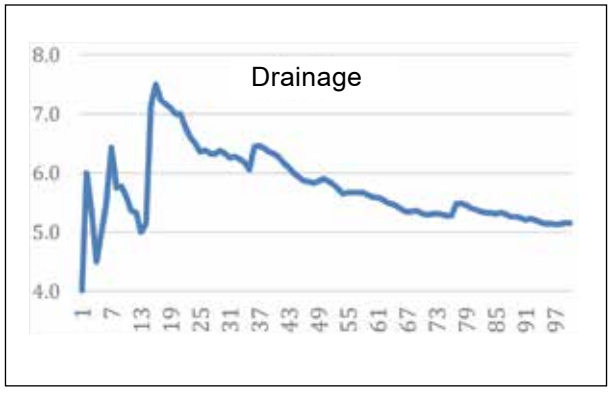


Diagram C: Accumulated mean of drainage time

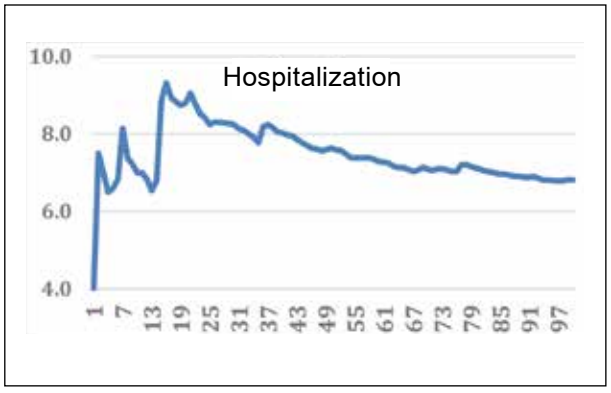


Diagram D: Accumulated mean of hospitalization time

Accumulated mean of surgery duration, drainage time, hospitalization of B group (22 cases) are shown in diagrams E, F and G

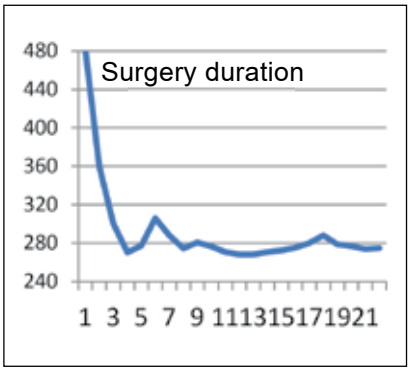


Diagram E

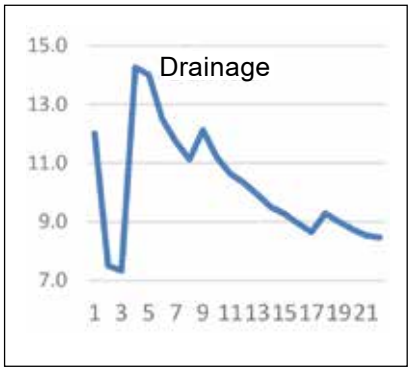


Diagram F

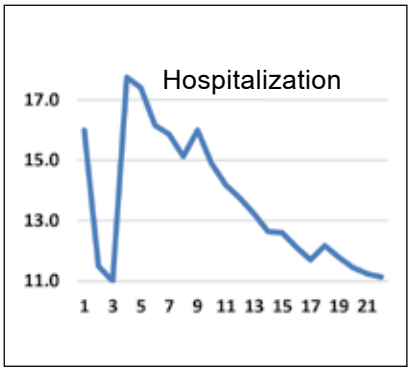


Diagram G

Accumulated mean of surgery duration, drainage duration, hospitalization of A group (38 cases) were shown in diagrams H, I and J

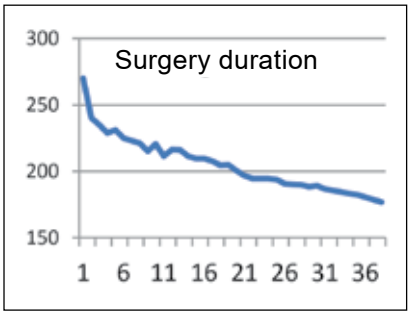


Diagram H

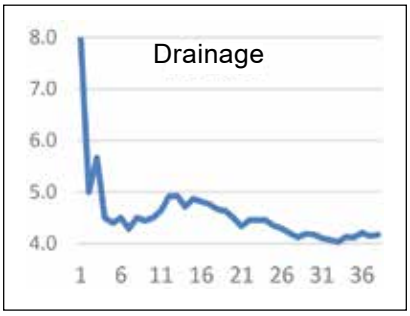


Diagram I

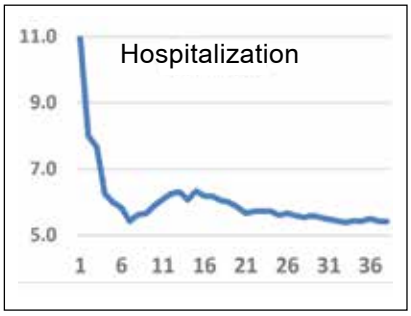


Diagram J

Comments: The operative duration, drainage and hospitalization stay were stable after 22 cases (surgeon B), but not much improved thereafter (surgeon A)

Accumulated mean of operative duration of 5 surgeons are presented in diagram K for comparison

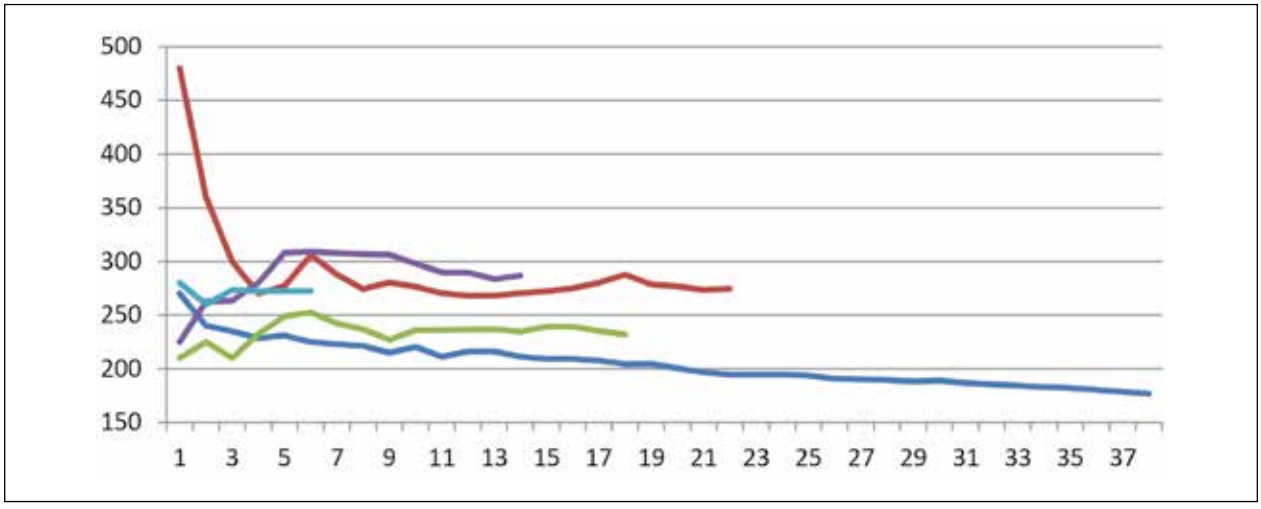


Chart K

Comments: Most surgeons had improved in accumulated operative duration.

4. Discussions

Radical prostatectomy is considered as a gold standard in the treatment of localized prostate cancer, to remove entire prostate block between urethra and bladder and two seminal vesicles, indicated for the healthy patients and life expectancy expected over 10 years. This was also the common urology surgery today [10] [11].

Open radical prostatectomy to treat prostate cancer had been done in Binh Dan hospital for a long time although the number of cases was not much. At the end of 2004, we began performing laparoscopic surgery to remove the prostate. After many years, we had performed over 200 cases and had published many researches both in home and international on

surgical techniques, stitching techniques, quality of life, values of the prognostic factors [1] [2] [3]

As the robotic-assisted surgery was introduced, these disadvantages above mentioned have been fixed, the patients and urologists are strong supporting for this type of surgery. More patients were referred this procedure than radiotherapy as before.

The concept of learning curve was an important issue in surgery and was also one of the less mentioned aspects. Abboudi et al. [1] presented an interesting article evaluating the concept of learning curve in urology procedures. Specifically, the authors undertook a unified approach to systematically evaluate materials focused on the learning curve of some urology procedures, mostly consisting of radical prostatectomy, partial nephrectomy.

Most of the studies focused on prostatectomy, but available studies were poor on methodology, including a series of surgeries primarily evaluating a limited number of surgeons, selecting heterogeneous results to study the learning curve and focusing on short-term results.

In contrast, the documents on open surgery or laparoscopic prostatectomy had higher quality, including a number of large studies and application of sophisticated statistical methods; However, robotic-assisted surgery was still preferable. With these limitations, we concluded that the duration of robotic-assisted surgery was after 50 to 200 cases, the benefit of surgical margin was after 50 to 600 cases, urinary and erectile control was after 200 cases [6]. In one Australian research [21] evaluated the learning curve of an experienced open-surgery surgeon with more than 3,000 cases of prostatectomy before starting the robot. In this study, Thompson et al demonstrated that the effect of the robot overtook open surgery, after 100 cases of sexual function score and borderline incidence in pT2 cancer, while about 150 cases was necessary to achieve urinary function. In addition, the efficiency of the robot continued to be improved, with sexuality score increasing after 600-700 cases and urinary score increasing after 700-800 cases. Similarly, the positive edge ratio was stable after 400-500 cases in pT2 and 200-300 cases in pT3-4. However, there was no evidence that further improvement can be made.

Davis et al., when studying the learning curve of more than 71,000 cases of prostatectomy in 300 American hospitals between robotic-assisted laparoscopic and laparotomic prostatectomy, showed a longer surgery duration (4.4 vs 3.3 hours), shorter hospitalization (2.2 versus 3.2 days), lower complication rates (10.4% versus 15.8%) [7]

Other studies also showed that learning curve in robotic-assisted surgery improved as surgeons learning from robots as part of residency / scholarship [8] post-graduate training [15] and / or regular surgical simulation [14]. A study of a large number of patients and surgeons who underwent open and robotic-assisted prostatectomy demonstrated that robotic assisted one had lower complication rate, shorter hospitalization time, and reduced blood transfusion volume. The learning curve was also better, the robotic-assisted surgeries had been shown to be better when surgeons worked as a team rather than surgery experiences. In our previous study, we also found that the learning curve for surgery time was after 20 cases, and was difficult to further improve [5].

Training of robotic-assisted surgery was usually divided into three phases:

Getting to know the system: including (a) Learning theories and online tests for online certification (b) Practicing on simulation without living objects (c) Practicing on simulation with living objects in the da Vinci center for certification.

Surgical assist and surgery under the guidance of experienced surgeon

Self-trained and experience accumulation through personal cases of the surgeon

In the first two phases, the surgeons were trained at the same. In the last phase, the experience accumulation and technical sophistication will be different. The advantages in recent years in Binh Dan hospital included:

Binh Dan Hospital was a center of urology

laparoscopic surgery and had a training center for 10 years. Most surgeons had good experience in radical laparoscopic prostatectomy. Therefore, when moving to robotics, the learning curve would be better as these experiences were transferred to new techniques. Surgical assistant and screen observers also gained knowledge of the procedure.[4].

The hospital had numerous patients, then the surgical assistants had more opportunity to be trained step by step. They would place the trocar and install the machine. Then they took some of a surgerys phases before officially had their own cases. In the graph K, we found the surgeon of group E had only 6 cases, but the mean surgery duration was still among the middle, without initial difficulties as other surgeon.

The recording of all cases gave the surgeons more opportunity to review, and to learn from a large number of surgeons.

Surgeon who underwent frequent simulated practice would improve more.

However, having many surgical assistants sometimes had many drawbacks. We had to accept the results of prolonged operative duration for the assistants to practice (surgeon B).

5. Conclusions

Through this study of the robotic-assisted radical prostatectomy, we found that surgery could be performed safely with acceptable complications. Optimal learning curve for surgery time after over 20 cases. Training needed to have a procedure in place to replicate the number of surgeons without compromising the overall outcome

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