Robotic surgery at Binh Dan Hospital: 3 years experiences

Tran Vinh Hung
Binh Dan Hospital

Keyword:
Robotic surgery, low anterior resection (LAR), abdominoperineal resection (APR), radical gastrectomy, radical prostatectomy, radical cystectomy, radical nephrectomy.

Contact:
Tran Vinh Hung
Binh Dan Hospital
371 Dien Bien Phu, Ward 4,
District 3, Ho Chi Minh City
Mobile: 0903 744 565
Email:
hungsurgeon2021@yahoo.com

Received: Sep, 30, 2020
Accepted: Oct, 24, 2020
Published: Oct, 29, 2020

Abstract

Objectives: Since November 2016 the Robotic surgery has been initially applied on adult patients for the first time in Vietnam. The aim of the study was to evaluate the outcomes of application of the da Vinci Si™ robot in General Surgery and Urology at Binh Dan Hospital in over 03 years.

Materials and Methods: From November 2016 to July 2020, the prospective case-series study for 1030 cases including: 324 cases in General Surgery + Thoracic Surgery cases and 706 cases in Urology are operated by the da Vinci Si™ robot system. We evaluated the short-term outcomes.

Results: In 324 cases of General Surgery: 134 rectal cancer cases, 92 colon cancer cases, 50 hepatobiliary surgery cases, 34 gastric cancer cases, 09 thoracic surgery cases, 04 esophageal surgery cases, 01 hiatus hernia case. In 706 cases of Urology: 264 cases of prostate cancer, 214 cases of adrenal and kidney tumors, 160 cases of bladder tumor, 30 cases of ureteropelvic junction obstruction cases, 20 cases of upper tract transitional cell tumor, 09 cases of genital prolapse, 05 cases of retroperitoneal tumor, 02 cases of tumors beside the seminal vesicles, 01 case of patent urachus cancer, 01 case of urethra cancer.

Conclusions: Robotic surgery, with many advantages than conventional laparoscopic surgery thanks to technological innovations (3D-HD monitor and optical system, the robotic arms with wrists, the comfortable console table, precise surgical...) has helped the surgeons to perform the sophisticated procedures in the narrow space easily with shorter learning curves. Our initial series of 1030 cases operated by this system have achieved encouraging outcomes.

Introduction

Robotic surgery is the most modern minimally invasive techniques of major surgical centers in developed countries [1], [6], [15]. In 2000, the da Vinci surgical system was FDA approved for minimally invasive surgery. The da Vinci standard system is developed through S and Si systems until the newest product launched, da Vinci Xi was released in 2014. The robotic system is high technology, artificial intelligence and virtual reality. The robotic system has changed concept in the field of surgery. Currently, there are nearly 6000 systems worldwide, 65% in the US. Robotic surgery, with many advantages comparing to standard laparoscopic surgery, thanks to technological innovations: (1) 3D-HD vision and superior optical system with 12x magnification than normal; (2) flexible robotic arms can be performed in the narrow space [3]. In the

end of 2016, it was the first time that robotic surgery was applied on adult patients in Vietnam. This study reported 1030 adult cases of general surgery, thoracic surgery and urological departments at Binh Dan Hospital. All of which were operated by da Vinci Si™ robot system in 3 years.

Objective and methodology

Objective

Adult patients have been examined and operated of General Surgery, Thoracic Surgery and Urological departments at Binh Dan Hospital, which were performed by the da Vinci Si™ robotic system in 3 years, from 11/2016 to 07/2020. We evaluated the short-term outcomes.

Methodology

The prospective case-series study

Variables

Variables including: aging, genders, clinical characteristics (depending on diseases), para-clinical manifestations (depending on diseases), operation time, intra-operative complications, post-operative length of stay, post-operative complications.

Surgical equipments

The da Vinci Si™ robotic system includes three parts:

Patient cart (Figure 1): includes 3 instrument arms and 1 optical holding arm which set beside the patient bed.

Surgeon console (Figure 1): This is the place where the surgeon sits comfortably controls robotic arms via Endo Wrist system, while looking at a screen which displays the exaggerative and high definition 3D image. The surgeon controls the instruments and 3D endoscope with his/her hands, using two mastered controllers and with his/her feet, using foot pedals (monopolar or bipolar) at the console.

Vision cart (Figure 1): assistant surgeons watch at this 2D screen which displays the surgical site.

Figure 1: The da Vinci Si™ robot system

Special instruments for robotic surgery

Hot Shears™ Monopolar Curved Scissors: dissection and monopolar coagulation.

Maryland bipolar forceps: grasping, retraction, dissection, and bipolar coagulation of tissue. Use in bladder and prostate surgeries.

ProGrasp™ Forceps: Non-energized instruments have the same characteristics as Force Bipolar with DualGrip.

Bipolar forceps: grasping, retraction, dissection, and bipolar coagulation of tissue, using in kidney and upper urinary tract surgeries.

Large Needle Holder: enables suturing in Urethra – bladder plasty, bladder neck plasty, close

peritoneal, intestinal anastomosis...

Patient's position and trocars insertion

Patient's position and trocars insertion depend on diseases of patients and play an important role because it is hard to change the robotic arms location and it takes a long time to change it. We present 2 cases in 2 groups which underwent Robotic surgery: rectal cancer, prostate cancer.

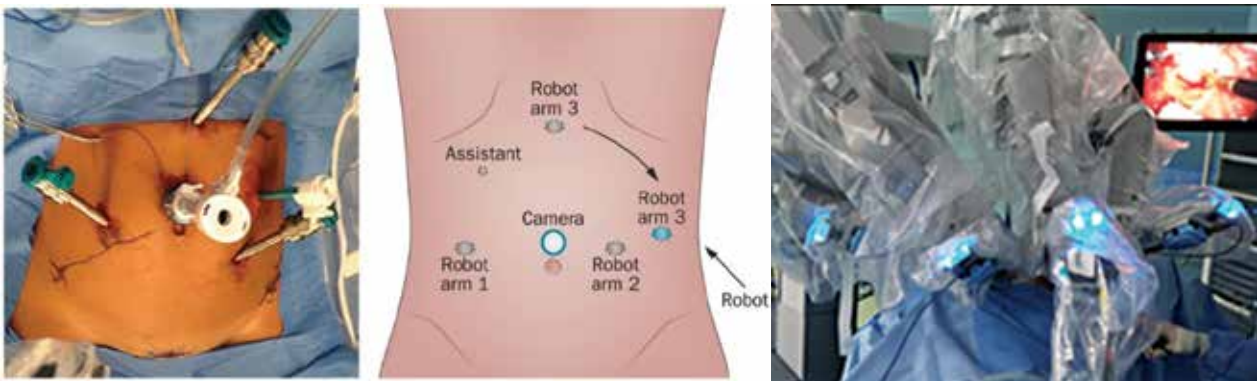

Figure 2: Trocars location in rectal cancer (Binh Dan Hospital 2018)

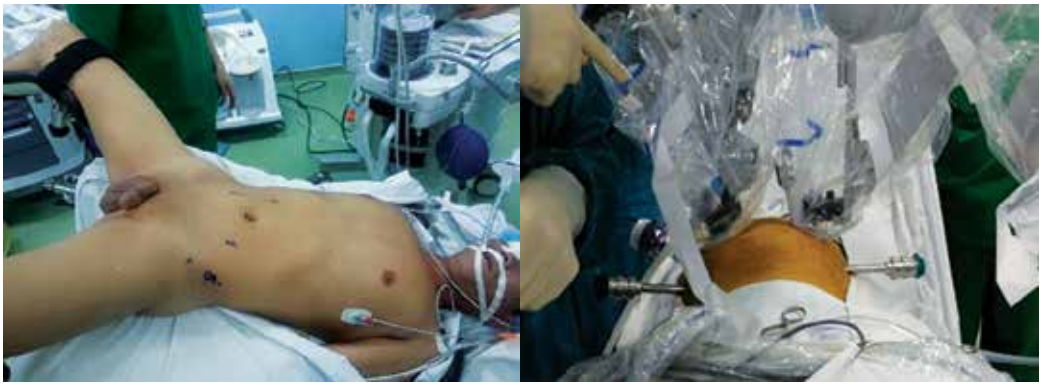

Figure 3: Trocars location in radical prostatectomy (Binh Dan Hospital 2018)

Results

From 11/2016 to 07/2020, we have operated 1030 robotic surgery cases including 324 General Surgery + Thoracic Surgery cases and 706 Urology cases.

In this study, we present the results of 2 main group disease: rectal cancer and prostate cancer. Other disease outcome will be reported in other studies.

General Surgery + Thoracic Surgery cases

324 General Surgery + Thoracic Surgery cases: 134 rectal cancer cases, 92 colon cancer cases, 34 gastric cancer cases, 09 thoracic surgery cases, 04 esophagectomy, 01 diaphragmatic hernia.

Table 1: Classification of disease in General Surgery + Thoracic Surgery

Disease	Surgery	Patients
Rectal cancer (134)	Low anterior resection	109
	Abdominal perineal resection	25
Colon cancer (92)	Right partial colectomy	25
	Left partial colectomy	13
	Sigmoid colectomy	54

Liver-Biliary tract-pancreas (50)	Hepatectomy for cancer	17
	Pancreatectomy	13
	Pancreaticoduodenectomy	10
	Choledochal cyst	08
	Choledocholithiasis	02
Stomach (34)	Partial gastrectomy	29
	Total gastrectomy	05
Thorac (9)	Lung lobectomy	07
	Mediastinum tumor	02
Esophagus	Esophagectomy	04
Hiatus hernia	Diaphragm plasty	01

Table 2: Detail results in rectal cancer cases (134 cases)

Time	Variable	Results	Unit
Pre-operation	Male/female	2/1	
	Mean age	62	
Intra-Operation	Docking - time	21,9 ± 7,5	Minute
	Consoling - time	145 ± 62	Minute
	Total operative time	212 ± 59	Minute
	Mean lymp nodes harvested	10,86 ± 6,84	Node
Post-operation	Time of oral feeding	2,84 ± 0,86	Day
	Hospitalization time	8,26 ± 2,08	Day
	Metastatic node	0,84 ± 2,65	Node
	Post-operation complications	11	Case

Urology cases

706 Urology cases: 264 cases of prostate cancer, 214 cases of adrenal and kidney tumors, 160 cases of bladder cancer, 30 cases of ureteropelvic junction obstruction cases, 20 cases of upper tract transitional cell tumor, 09 cases of genital prolapse, 05 cases of retroperitoneal tumor, 02 cases of tumors beside the seminal vesicles were distributed.

Table 3: Classification of Urology cases

Disease	Type of surgery	Patients
Prostate cancer	Radical prostatectomy	264
Bladder cancer	Radical cystectomy with ileal conduit	160
Adrenal and kidney tumors Kidney dysfunction (214)	Radical nephrectomy due to big tumor	75
	Partial nephrectomy due to small tumor	70
	Nephrectomy due to kidney dysfunction	28
	Adrenalectomy due to tumor	41
Ureteropelvic junction obstruction	Pyeloplasty	30
Upper tract transitional cell tumor	Nephroureterectomy	20
Genital prolapse	Bladder neck suspension	09
Retroperitoneal tumor	Total tumorectomy	05
Tumors beside the seminal vesicles	Total tumorectomy	02
Patent urachus cancer	Total tumorectomy	01
Urethra cancer	Total tumorectomy	01

Table 4: Detail results of radical prostatectomy (264 cases)

Variable	Results	Unit
Mean age	66(49-80)	
Tumor size	33,36(20-60)	ml
PSA	41,5(4,5-100)	ng/ml
Operative time	237 ± 69	minute
Blood loss	346 ± 205	ml
Drainage time	4,56 ± 4,05	day
Hospitalization time	7,33 ± 4,33	day
General complications	16	case
Urinary incontinence	27	case

Discussion

Advantages of the da Vinci Si™ robotic system [15]

For Surgeons

Robotic surgery increases dexterity, precision of surgery, range of movement and comfort for surgeons, reduce hand shaking. The da Vinci Si™ robotic system displays the exaggerative and high definition 3D image, reducing eyestrain. Main surgeon controls an optical holding arm and 2 - 3 instrument arms. EndoWrist® technology of da Vinci Si™ provides instruments with 7 free degrees. Instruments movement is controlled by surgeons' fingers, hands, wrists make it more familiar with laparotomy than laparoscopy.

The role of laparoscopy had been proved. However, this method still has some disadvantages, especially in narrow space like pelvic area, thus, the learning curve extends. Surgeons are not able to feel the depth of surgical site, hands may vibrate. Besides, main surgeon needs a professional and experienced assistant. Especially, when the operation time is long. In the other hand, robotic surgery could erase these disadvantages and offer the clearer vision of surgical site. All superior characteristics of robotic surgery bring a better short-term outcome. However, recent studies reveal that long-term oncological outcomes are similar to laparoscopic surgery.

The limit of conventional laparoscopic surgery is the high rate of converting to open surgery. Using robot helps surgeons manage those above difficulties and reduce open-surgery converting rate. Therefore, it could be applied for many specialties such as Urology, Gastroenterology, Gynecology.

For Patients

Robotic surgery reduces blood loss, blood transfusion, hospitalization time, drainage time and complications, thus, organ function is better preserved. Other advantages are minimally invasive surgery which induce pain reducing and faster recovery time [6], [9], [12].

Robotic surgery in General Surgery

Using robot in colorectal surgery has many advantages: clear vision, precise suture, more flexible instrument maneuver. In recent years, Robotic surgery studies have increased [1], [3], [7]. In the first time, the surgeons used Robotic system in colorectal surgery. Ferrara [7] showed that Robotic surgery, with many advantages over standard laparoscopic surgery in gland nodes clearance. In 2002, Weber et al [16] was the first author who reported the result of Robotic surgery in rectal and Sigmoid tumors. Mean lymph nodes harvested was at least 12 nodes, in accordance with American Joint Committee on Cancer guidelines (AJCC). The da Vinci SiTM robotic system obtains outstanding accuracy over standard laparoscopic surgery. In early cases, the operation time of Robotic surgery in each case was longer than standard laparoscopic surgery because the surgeon did not get used to docking robotic arms and instruments, and the insertion of the trocars. When surgeons get used to operating, the time is shorter. In colorectal cancer first cases, docking time was 30 - 45 minutes, after 10 cases, docking time was 5 - 10 minutes.

In gastric cancer, Pugliese et al [13] reported Robotic surgery help removing lymph nodes easier, especially post-pyloric and pancreatic tail lymph nodes. This effect could due to some facts: camera stabilization, surgical magnification, and flexible robotic arms. Cianchi [5] reported Robotic surgery help removing more lymph nodes than standard laparoscopic surgery; there are no difference between two methods in short-term oncological outcomes. Kim [10] reported the results of gastrectomy using robot were better than open gastrectomy and laparoscopic gastrectomy in reducing blood loss and post-operative length of stay.

In left lobe hepatectomy, Robotic surgery was found easier to dissect Glissonean pedicle of left liver, liver segments 2 - 3, hepatic vein, short operation time, little blood loss. In distal pancreatic resection with large tumor, adhesions to the spleen veins and surrounding organs. Robotic surgery in

common bile duct cyst make it easy to create hepatic duct – jejunum anastomosis in narrow site and make a Roux-en-Y in abdomen.

Robotic surgery in Urology

Robotic surgery has many advantages over laparotomy surgery in pelvic region such as prostatectomy, cystectomy, bladder neck suspension, tumors beside the seminal vesicles, especially in nephrectomy [15]. Surgeries in pelvic area have a more constant map of the trocars distribution than kidney surgeries that vary with the patient's abdominal shape (flattened abdomen/ small abdomen). Therefore, in prostate surgery, docking phase is easier than in kidney surgery (susceptible to "trapping" robotic arms). In Robotic surgery, the fourth arm is especially important to use the ProGrasp™ tool to hold or lift tissue near the working area, to help it more shallowed or more clearly in the working area.

In the same disease, robot-assisted is easy to use flexible instruments. For example, in prostatectomy, it is faster to suture ureters – bladder neck anastomosis, using Rocco suture help watch clearly tissue, tie dorsal veins of the penis easier. In pyeloplasty, ureter anastomosis easier, faster, clearly, covered and cryptic. In anastomosis, using barbed suture (V-loc® or Stratafix®) make the surgery faster and more cryptic because of its tie surgical knots [2], [15].

The most common cases were prostate cancer which Robotic surgery has more superiority than laparotomy surgery and standard laparoscopy. In our study, we have suceed when using Robotic surgery in big tumor invade out ofprostate and/ or seminal vesicles. In standard laparoscopic surgery, it could be transferred to open surgery when the tumor invades.

In the first cases of bladder plasty inside abdomen, it seems to be extraordinary technique which we achieved despite of long operative time. After using robot-assisted surgery in treatment cancer, we thought that using robot is not only help in lymph nodes harvesting but also achieve curative surgery without open abdomen based on its perfect features. In some studies [4], [6], [11], [15] Robotic surgery, with many advantages over standard laparoscopic and laparotomy surgery in radical prostatectomy, radical cystectomy.

Training robotic surgeons and maintenance of an efficient robot system

According to Schachter [15], robotic surgeons need to be trained with a good proxy system that includes the following stages: (1) Establishing a robot surgery certification board; (2) Equal priority for open surgery. and standard endoscopy performed by robot; (3) Complete a special robot training course; (4) Perform Robotic surgery on experimental animals; (5) Observe the surgery of the robot being performed by mentor; (6) Working as a bedside surgery assistant in Robotic surgery; (7) Performing first robotic surgeries under the supervision of a proctorship and (8) continuing to monitor surgical results technique. With our experiences at Binh Dan hospital, selected surgeons are those who have many years of experiences in traditional laparoscopic surgeries including many specialties such as: Urology, Gastroenterology, Hepatology, Thoracic Surgery. Firstly, we learn online on the homepage of da Vinci company system (www.davincisurgerycommunity.com), learn mainly about hardware and familiarize with the functions of each department, then we take the exam and get certificate. Only online, then we get practical lessons on the model of assembling the tools into the robotic arms, learn to move the robot as well as practice exercises on surgery on the simulator (on the 3D screen assumes skills required in preparation for actual surgery) with the direct guidance of specialists from Singapore. After we completed the exercises with over 80% of the required expertise, we went to da Vinci's international robot training center in Seoul (Korea), where we learned and took a surgical exam. robot on animals (pig). After completing the course and passing the exam, we are awarded the console certification, which is valid worldwide. Returning

to Vietnam, our first surgeries were directly supported by specialists from Singapore, Korea or Japan, then we continued to perform surgery for the next cases and learn from experience. after each surgery to improve more and more skills and independent surgery to maximize the benefits of Robotic surgery.

In order to recruit Robotic surgery patients, it is necessary to clearly explain the advantages of Robotic surgery compared to standard endoscopy (difficult) and compared to open surgery (easier). Our own experience in recent times has found the need to combine the following elements: (1) Media effects (television, radio, seminars, posters, leaflets,...); (2) Surgeons 'reputation (trained in Intuitive Surgical® overseas training centers, surgical experience and seniority); (3) Surgeons' dedication to counseling. It makes it easy to convince patients to accept high-tech surgery.

Robotic surgery is a new method in the world, especially in Vietnam. Therefore, its difficulty is expensive with a specific group of patients. However, Binh Dan Hospital is government hospital. With poor patients who have correct indication of Robotic surgery, our hospital does as much as possible to bring great result for them.

Conclusion

Robotic surgery, with many advantages over standard laparoscopic surgery thanks to technological innovations (3D-HD monitor and optical system, robotic arms with wrists, the comfortable console table, precise surgical....) has helped the surgeons to perform the sophisticated procedures in the narrow space easily with shorter learning curves. Our initial series of 1030 procedures in 3 years have achieved encouraging outcomes.

References

1. Araul SEA et al (2014). Robotic surgery for rectal cancer, World J Gastroenterol, October 21; 20(39): 14359-14370.
2. Aron M., et al (2011). Robot-Assisted Radical and Partial Nephrectomy.Atlas of Robotic Urologic Surgery, Current Clinical Urology. Humana Press:133-141.
3. Baik S.H., Lee W.J., Rha K.H. (2008). Robotic total mesorectal excision for rectal cancer using four robotic arms.SurgEndosc; 22:792-7.
4. Bochner B.H., Dalbagni G. (2015). Comparing Open Radical Cystectomy and Robot-assisted Laparoscopic Radical Cystectomy: A Randomized Clinical Trial. EurUrol, Jun;67(6):1042-1050.
5. Cianchi F., Lami G. (2016). Robotic vs laparoscopic distal gastrectomy with D2 lymphadenectomy for gastric cancer: a retrospective comparative mono-institutional study. BMC Surgery, 16:65.
6. Du Y., Long Q., Guan B., Mu L., (2018). Robot-Assisted Radical Prostatectomy Is More Beneficial for Prostate Cancer Patients: A System Review and Meta-Analysis. Med SciMonit, 14;24: 272-287.
7. Ferrara F. et al (2016). Laparoscopy Versus Robotic Surgery for Colorectal Cancer L A Single-Center Initial Experience. Surgical Innovation 23: 374-380.
8. Guru K.A. Robot-assisted radical cystectomy / Anterior Exenteration with lymph node dissection. Anatomical foundation and description of surgical technique.Video presentation. Roswell Park Cancer Institute.
9. Huang X., et al (2017). Comparison of perioperative, functional, and oncologic outcomes between standard laparoscopic and robotic-assisted radical prostatectomy: a systemic review and meta-analysis. SurgEndosc; 31(3):1045-1060.
10. Kim M.C., Kim W., Kim H.H., Ryu S.W., Ryu S.Y., Song K.Y. (2008), Korean Laparoscopic Gastrointestinal Surgery Study (KLASS) Group. Risk factors associated with complication following laparoscopy-assisted gastrectomy for gastric cancer: a largescale Korean multicenter study", Ann SurgOncol; 15: 2692 – 2700.
11. Matsumoto K., Tabata K.I., Hirayama T., Shimura S., Nishi M., Ishii D., Fujita T., Iwamura M. (2017). Robot-assisted laparoscopic radical cystectomy is a safe and effective procedure for patients with bladder cancer compared to laparoscopic and open surgery: Perioperative outcomes of a single-center experience. Asian J Surg, Dec 15.
12. Nasir M, Ahmed J et al (2016). Learning Curves in Robotic Rectal Cancer Surgery: A literature Review. J Min im Invasive Surg Sci;5(4): e41196.
13. Pucci M.J. et al (2013). Use of Robotics in Colon and Rectal Surgery, Clin Colon Rectal Surg; 26(1): 39–46.
14. Pugliese R., Maggioni D., Sansonna F., Costanzi A., Ferrari G.C. (2010), "Subtotal gastrectomy with D2 dissection by minimally invasive surgery for distal

adenocarcinoma of the stomach: results and 5-year survival", SurgEndosc; 24: 2594-2602.

15. Schachter L.R., Kaufman M.R., Herrell S.D. (2008). Establishment of a Robotic Prostatectomy Program, Robotics in Urologic Surgery, Saunders, Elsevier, Copyright © by Saunders:79-84
16. Weber P.A., Merola S., Wasielewski A., Ballantyne G.H. (2002). Telerobotic-assisted laparoscopic right and sigmoid colectomies for benign disease. Dis Colon Rectum; 45:1689–94.