2
Launching a Successful Robotic Program

Kenneth J. Palmer, Marcelo A. Orvieto, Bernardo M. Rocco, and Vipul R. Patel

Keywords Robotic surgery • Robotic surgical program • Marketing • Operating room setup • Training • Robotic surgical team

2.1 Introduction

Open radical prostatectomy remains the gold standard for management of organ-confined prostate cancer. However, recently there has been a trend toward the search and development of less invasive surgical options. Robotic-assisted laparoscopic prostatectomy (RALP) is rapidly becoming the most commonly performed surgical approach to treat these tumors. The most commonly used robot is the da Vinci® Surgical System (Intuitive Surgical, Sunnyvale, CA), which provides advantages like three-dimensional (3-D) vision, 10× magnification, motion scaling, and tremor filtration, allowing the surgeon a more feasible learning curve.

In spite of the substantial benefits of robotic surgery (RS) over standard laparoscopy, performing robotic surgery still requires for the surgeon to undergo a necessary learning curve (LC), in order to ensure the safe introduction of this technology. In this setting the adoption of RS at any institution requires the establishment of a well-structured plan and certain key elements to be in place to ensure successful implementation of a robotics program. A thorough initial design and implementation lead to the execution of clinical services, which meet previously established goals. Once the execution phase is established, the next step is to focus on maintenance and growth to maximize the benefits of the program.

In this chapter, we discuss the necessary phases for creating a successful robotic program, paying special attention to the aspects that allowed our facility to create a profitable robotic-assisted laparoscopic prostatectomy program.

2.2 Program Design

2.2.1 Business Plan Development

Due to the initial costs associated with RS, an economic model is crucial when building a robotic program. The development of the business plan requires an evaluation of the direct costs (such as buying the robotic system) and of the associated material, staff recruitment, and/or staff training. Possible operating room (OR) modifications could be necessary to support the console and the other equipment. A further necessary action is the need to recruit a leading surgeon versus training one.

Another key element is the evaluation of the growth potential. In this regard, a thorough market analysis will help to estimate growth potential of the new program. A study of the community, possible competing institutions sharing the market, and the analysis of reimbursements and payers are additional

V.R. Patel (ed.), *Robotic Urologic Surgery*,
DOI: 10.1007/978-1-84882-800-1_2, © Springer-Verlag London Limited 2012

aspects that conclude the evaluation. Indeed, an adequate surgical volume is a key for success, as it not only ensures the financial affordability of the program, but also allows for improved outcomes.

In our experience at Ohio State University, we estimated that three to five cases per week during the initiation of the program were necessary to obtain continuity in the LC. A 5-year plan was established by the institution, delineating the allocation of resources and growth based on financial feasibility. It was enthusiastically hypothesized that the program had the potential to grow almost 400% (150 cases from the traditional 40 cases per year) during the first year. After that, the growth of the project was to be more modest but consistent from years 2–5 at 200, 250, 300, and 350 cases a year, subsequently, for a total of 1,250 cases. Initial market share in our area was estimated to be 15%, allowing substantial room for growth. We noticed an increase in surgical volume since the introduction of the robotic program, from 40 to 350 cases per year within the first 5 years.[6]

2.2.2 Defining the Initial Robotic Program

The beginning of any robotic program can be challenging as multiple members of the team are learning the technology and their own personal roles on the team. It is essential to have a clear plan for which robotic procedures are to be done initially. This will facilitate patient recruitment, OR team development, lead surgeon proficiency, and an effective marketing strategy. The initial procedure may relate to the surgeon's prior robotic experience or surgical area of expertise. It may be the procedural area where the most growth can be anticipated based on planning committee expectations. In our experience, the lead surgeon (VRP) recruited had prior experience focused in robotic radical prostatectomy. Although in our experience the LC was not a significant variable given the prior experience of the lead surgeon, there are many aspects beyond the surgical act that need to be developed at the beginning of the experience. All the different individuals involved in the robotic program have their own LC; therefore it is of major importance to define which robotic procedures need to be performed at the beginning, since the main goal of a robotic team is to standardize the procedure as soon as possible.

2.2.3 Purchase of a Robotic System and Surgery Costs

The da Vinci robotic system has a significant cost associated with its purchase, ranging between $1.2–1.7 million USD depending upon the type of system purchased and the overhead charges from the local agent. Additionally, there is a per-instrument, per-case disposable fee of approximately $200 and a maintenance contract of $100,000 USD yearly per system.[1] These costs, in addition to the costs associated with OR time, represent fixed costs as opposed to variable costs, which are related to all those activities that are necessary to produce the surgical performance (such as disposable tools, medications, etc.). An increased use of the robot will necessarily have an impact in terms of reducing variable costs; hence, the best chance to increase surgical volume, and therefore to reduce costs, is to share the use of the da Vinci system with other specialties.

Finally, when launching the program, the costs related to training and recruitment of new staff, facility renovation, marketing, and patient education must be weighed. Depending on the level of expertise of the lead surgeon, one must also consider initial prolonged operative times, loss of work while training, and increased clinic time to adequately follow patients.[2–5]

2.2.4 Administrative Staff and Patient Care

A dedicated robotic program director is beneficial to provide a point person for necessary upkeep, training of new personnel, and coordination of the business and clinical aspects. Besides the clinical team, a dedicated robotic program manager is key to coordinate the administrative staff, in order to work as a liaison between clinicians and marketing, Website management, patient education, and other crucial applications. This way, the clinician can be more concentrated on surgical works and the program manager could accurately monitor the growth and all the other collateral activities. Minimization of side effects can further be supported by staff dedicated to erectile dysfunction and continence rehabilitation. Adequate office staff is necessary to facilitate easy patient referrals and play an important role in overall patient satisfaction.

2.3 Implementation

The initial goal is to implement the basic infrastructure necessary to build a successful program. This includes dedication of resources, renovating ORs, and training an OR team.

2.3.1 OR Design

Operating room modifications may be necessary to support the necessary console and ancillary equipment. Due to the limited life of many instruments, a requirement to keep an adequate stock is of paramount importance. Extra lenses and instruments are necessary to overcome potential malfunctions. In our experience, having a dedicated robot room(s) enhances productivity, quickens turnover time, and limits potential damage to the robot in transport. With these aspects in mind, at our institution, state-of-the-art operating theaters were designed to accommodate the specific needs of the surgical robot, OR team (often there are multiple assistants utilized in addition to the typical operating room staff), and the patient. These rooms provided incorporation of additional state-of-the-art imaging modalities and the ability to broadcast educational live surgical cases to training physicians worldwide.

2.3.2 The Robotic Team

2.3.2.1 The Leading Surgeon

An individual to champion the robotic procedures is essential. This person needs to dedicate time and effort to becoming proficient in performing a myriad of robotic procedures in order to educate the public, patients, and other physicians of the benefits of the robotic program. An individual with previous experience in robotics is ideal, as it will circumvent the necessary LC. This is especially important if the goal is to develop a top-tier program. Indeed, it is widely recognized that a surgeon's results improve with experience. More complex procedures, such as cardiac or neurosurgery, involve longer and more specialized training, reflecting the belief that mastering a difficult procedure requires additional experience. Despite the general view that LC exists in surgery, it is a very difficult benchmark to assess, as there is no accepted standard definition or means to accurately measure it.[7] In general, it is a "self-declared" time point at which the surgeon feels comfortable performing the procedure.[8] For robot-assisted radical prostatectomy (RARP), a basic proficiency learning curve requiring approximately 20 cases has been reported to occur before operative times and outcomes become consistent with a surgeon's prior laparoscopic or open surgery abilities. However, recently presented data suggest that even experts in the field of robotic surgery would claim many more cases are required to become comfortable with outcomes.[9] The impact of LC on oncologic, functional, and quality-of-life outcomes stresses the importance of having mechanisms and guidelines by which the trainee surgeon can achieve adequate skills without compromising safety during the initial LC.

The role of the leading surgeon is not just to perform the procedure but also to coordinate and to take care of the team and its training. A surgeon who starts a robotic program should involve other colleagues to promote the development of common scientific programs, to share the costs by increasing overall surgical volume, and to raise the visibility of the facility and therefore patients' recruitment. Surgical proficiency and ability to communicate and to create a scientific network are essential skills to run a program.

Currently, no guidelines are available for the training of personnel who will be involved in the use of robotic equipment in surgery. Unless an individual institution has developed internal guidelines on restricting the use of robotic equipment only to those who have undergone formal training, it is at the discretion of the surgeon's hospital to schedule a robotic case without the need for verification of sufficient training or competence. Despite this lack of guiding principles, it seems clear that training in RS encompasses two phases: a first and more generic one, which includes getting familiarized with the equipment and troubleshooting; and a second phase, which includes learning specific skills in order to be able to safely and proficiently perform a specific surgical procedure.[10,11] Currently, Intuitive Surgical Inc. (the manufacturer of the da Vinci surgical system) requires that any surgeon willing to utilize the robot must go through a certification process. This includes basic concepts on how to manipulate and troubleshoot the robot, as well as hands-on training on inanimate and animal models. Additionally, the trainee is strongly advised to go through didactic teaching by watching cases performed by an expert surgeon, followed by a period of supervised training under an experienced surgeon – so-called proctoring. Unfortunately, the pool of proctors is also very heterogeneous. For example, in the field of urology, Intuitive Surgical only requires a total of 20 completed robotic prostatectomies to become a proctor.[1]

Following a complete training, patient selection is the key. The leading surgeon, possibly discussing with the anesthesiologist, should select the appropriate patients. Body mass index (BMI), prostate volume and morphology, comorbidities, and preoperative sexual function need to be carefully evaluated at the beginning of any surgical experience.

2.3.3 The OR Team

The individuals necessary for a successful operating room team vary depending on the program's goals and resources. When setting up the OR team, it is important to remember that because of the physical presence of the robot, communication between surgeon and staff is somewhat impaired and that the surgical team does not have the luxury of 3-D imaging as does the surgeon. A proper OR setup includes at least two surgeons, a scrub nurse, and anesthesia personnel.[11] Our experience has utilized a primary surgeon, anesthesia personnel, an experienced first assistant, a scrub tech, and at least one nurse. The first assistant is an individual who must have forethought into the procedure to ensure timely and efficient cooperation. Our first assistant is either a physician assistant or fellow. The physician assistant plays an important role in the education of new fellows as they begin to learn the procedure. Initially, a second assistant was often recommended, but we have since found the use of a four-arm robot to be equally effective.

Of paramount importance is the understanding of the procedure by the team. Efficiency and decreased learning time will be facilitated with a devoted, well-trained, and consistent team. Initial consistency will increase efficiency and facilitate education of future team members. We have developed multiple teams of scrub techs and nurses well versed in RALP, colorectal surgery, hysterectomies, and bariatric surgery, as well as managing issues related to the operation of the robot.

2.4 Marketing

There are multiple aspects related to the marketing of a robotic program to maximize patient education and profitability. The marketing team is often charged with expanding the referral base. This requires approaches aimed at referring physicians, known patients with disease, and the general public. An educational Website is essential for providing contact information and potential advantages of the technology. The media is often interested in the idea of a new "robot" in town. This media exposure may be most beneficial after the initial LC has been conquered and local results can be emphasized.

A grassroots effort was undertaken at the beginning of our robotic program. This consisted of hospital outreach to establish lectures attended in person by the OR team and lead surgeon at local hospitals. Many urology and oncology offices in the region were visited in person by the team and referral information was left with key individuals. These efforts even included a personal call to each new physician at the time of their first referral.

2.5 Maintenance

2.5.1 Data Collection

An appropriate and prospective data collection and a frequent update and audit regarding efficiency, outcomes, and patient satisfaction is a key part of a robotic program. This allows tracking of outcomes and seeking for further improvement. In addition, it is desirable to present the experience with colleagues during meetings and scientific events or reporting it as peer-reviewed papers in order to improve quality and to share knowledge and findings.

A simple, easy-to-read database should include all the information; validated self-administered questionnaires should be used as evaluation methods, and strict follow-up should be carried out, particularly for oncological diseases. In our experience performing RARP, perioperative data was collected along with long-term cancer, continence, and potency data. The EPIC (Expanded Prostate Index of Cancer) questionnaire is a validated quality-of-life questionnaire specific for prostate cancer. This was used to evaluate the quarterly progress of the patients. It was performed prior to surgery and then at 1, 3, 6, 9, and 12 months after the surgery, and annually thereafter. Other data collected included SHIM (Sexual Health Inventory of Males) scores; American Urologic Association (AUA) urinary symptom scores; height, weight, and BMI; clinical stage; histopathology; operative time; prostate-specific antigen (PSA); estimated blood loss; continence; potency status; catheter time; length of hospital stay; and complications (intra- and postoperative). Outcomes should be monitored regularly. A comparison with the previous adopted technique will be useful to evaluate possible advantages due to the advent of the new technique.[12] Clinically, it is also helpful to record each of the early cases and review them with the team to evaluate progress and plan a common approach to the procedure. A complete collection of video-recorded surgical procedures is mandatory for surgical audits and for training of fellows and residents.

2.5.2 Further Evaluation of Economics

In our experience at Ohio State University, our program enlisted collaboration with the local Department of Economics to evaluate the cost structure of our program. We analyzed the cost of robotic prostatectomy and the variables influencing it at a single institution.[13] Data pertaining to cost details and outcomes of 354 robotic prostatectomies performed from July 2005 to June 2006 were analyzed. Average direct and total costs per case for room and board, operating room services, medical and surgical supplies, medications, and investigations were determined, and the sensitivity of total average cost to each of these parameters was studied. Average direct cost of a procedure was found to be $4,971 and the average total cost was $9,536 (these included indirect costs). Based on the analyzed data, it was found that the cost of medical and surgical supplies, including the cost of instruments, accounted for 45% of total average direct cost and approximately one-third of average total cost. Operating room services and, therefore, duration of OR utilization accounted for almost 30% of total average direct costs and 35% of the total cost per procedure, respectively (Table 2.1). Projecting an increase in the number of procedures performed per year from 100 to 500 reduced costs by around 18%, based on the cost of the robot, and maximal change in costs were seen in increasing volumes from 20 to 100 cases

Table 2.1 Cost analysis of robotic prostatectomy

Components of total average cost per procedure for RALP

The Ohio State University Medical Center – The James Cancer Hospital and Solove Research Institute

July 2005 to June 2006
N = 354

	Average direct cost per procedure[a]		Average total cost per procedure[b]	
Room and board	$529	(11%)	$1,102	(12%)
Pharmacy + IV meds.	$212	(4%)	$349	(4%)
Med/surg. supplies	$2,241	(45%)	$3,151	(33%)
OR services	$1,439	(29%)	$3,372	(35%)
Anesthesia/recovery	$458	(9%)	$1,371	(14%)
Investigations	$64	(1%)	$144	(2%)
Other	$28	(1%)	$47	(0%)
Total	$4,971	(100%)	$9,536	(100%)

[a]Direct cost: Relative to the procedure (including robot + instruments); Indirect cost: Overhead
[b]Total cost: Direct + Indirect costs

per year. Total cost of a procedure was found to be sensitive to and dependent upon a number of variables: Increasing the number of RALP procedures per year, reducing OR time per case, and decreasing the costs of medical and surgical supplies are the most important parameters that ultimately reduce total cost of the procedure.

2.5.3 Continued Training and Education

At a university setting, education plays a critical role in incorporating robotic surgical procedures. A structured program designed to advance residents from basic skills to completion of an entire procedure has been followed at our institution. A junior level resident is responsible for reading and evaluation of the literature. Technical videos are available for review. As experience is gained, each resident undergoes observation of and assistance with approximately 20 cases. With proficient knowledge of the steps, and after taking a required 1-day training program, residents start performing small portions of the procedure, slowly building to the ability to perform an entire case as an upper level resident. Education may also extend to outside teams wishing to observe. Our program has trained approximately 200 practicing urologic surgeons and 19 international teams. This consists of a 2-day program of didactic and wet/dry lab training on a research robot.

2.6 Program Growth

All the aspects involved in the robotic program need to be checked periodically. Together with the program manager, the lead surgeon needs to assess the economic sustainability of the program; a breakdown of all parameters allows for an accurate check of materials and waste assessment. Considering the elevated costs, a reduction in OR time is one of the most important items to be checked in order to increase the economic feasibility of the project. Certainly, the most important aspect of growth is the periodic evaluation of clinical outcomes. Only if the auto-assessment reveals satisfactory outcomes, a further increase of the activity with new investments in terms of materials (another robot) and/or human resources (surgeons, PA, etc.) can be considered. Nonetheless, an accurate market analysis needs to be renewed before the investment occurs, to match the chance of offering much more surgical volume with the actual needs in the community.

We performed an interim analysis of our business plan and clinical goals at 18 months from initiation of our program. Specifically, for RARP procedures, the initial business plan estimated that 150 prostatectomies could be performed at year 1 if the program was successful, representing a growth of almost 400% from the prior year. This was anticipated to peak at 350 cases at the end of the 5-year business plan. In actuality, 150 robotic prostatectomies were performed within the first 6 months. A total of 490 robotic prostatectomies were performed in 2006, beating the 5-year goal within the first year. Clinical revenue also significantly exceeded expectations by 288%, making the program profitable at year 1.

2.6.1 Recruitment or Training of Surgeons

A multispecialty approach further facilitates promotion of public interest and presents the image of the institution as being technologically advanced. Other usages for the robot allow the cost of purchase and maintenance to be distributed. The hospital can use the attention garnered to promote non-robotic programs and potentially increase market share in other unrelated areas. This aspect of marketing is one area to maximize the advantageous nature of the robotic program to ensure overall profitability, even if losses are incurred through specific surgical procedures. To facilitate a multispecialty approach, the lead surgeon is essential to either recruit or train surgeons in other fields.

2.7 Conclusion

The true success and durability of RS will depend on long-term outcomes. For individual programs, a thorough infrastructure is necessary to approach overall profitability and efficiency. Initial planning is dependent on a risk/benefit analysis, economic model, and lead surgeon. Realistic early expectations often require a substantial initial investment to be made in establishing the program prior to the return of many benefits.

Our experience of overall profitability in year 1 is unusual and likely reflects the benefit of recruiting an expert robotic surgeon as the lead surgeon. Still, it is reflective of a well-planned infrastructure with multimodal focused marketing efforts. An OR team, hospital administration support, possible OR modification, and continued marketing become the next agenda. Each focus area should be established prior to the launch of the program. Finally, it is important to frequently review the goals of the program in the initial phase because early identification of problem areas, possible changes to improve efficiency or outcomes, and justification for the risk/cost of a program can all be obtained and handled ahead of time.

References

1. http://investor.intuitivesurgical.com/phoenix.zhtml?c=122359&p=irol-irhome
2. Singh I, Hemal AK. Robot-assisted pyeloplasty: review of the current literature, technique and outcome. *Can J Urol*. 2010;17(2):5099-5108.
3. Benway BM, Bhayani SB, Rogers CG, et al. Robot-assisted partial nephrectomy: an international experience. *Eur Urol*. 2010;57(5):815-820. Epub 2010 Jan 22.
4. Pruthi RS, Smith A, Wallen EM. Evaluating the learning curve for robot-assisted laparoscopic radical cystectomy. *J Endourol*. 2008;22(11):2469-2474.
5. Kramer BA, Whelan CM, Powell TM, Schwartz BF. Robot-assisted laparoscopic sacrocolpopexy as management for pelvic organ prolapse. *J Endourol*. 2009;23(4):655-658.
6. Palmer KJ, Lowe GJ, Coughlin GD, Patil N, Patel VR. Launching a successful robotic surgery program. *J Endourol*. 2008;22(4):819-824.
7. Herrell SD, Smith JA Jr. Robotic-assisted laparoscopic prostatectomy: what is the learning curve? *Urology*. 2005;66(5 Suppl):105-107.
8. Patel V, Tully A, Holmes R, Lindsay J. Robotic radical prostatectomy in the community setting – the learning curve and beyond: initial 200 cases. *J Urol*. 2005;174:269.
9. Lavery H, Thaly R, Patel V. The advanced learning curve in robotic prostatectomy: a multi-institutional survey. *J Urol*. 2007;177:269.
10. Sahabudin R, Arni T, Ashani N, Arumuga K, et al. Development of robotic program: an Asian experience. *World J Urol*. 2006;24:161.
11. Steers W, LeBeau S, Cardella J, Fulmer B. Establishing a robotics program. *Urol Clin N Am*. 2004;31:773.
12. Finkelstein J, Eckersberger E, Sadri H, Taneja SS, Lepor H, Djavan B. Open versus laparoscopic versus robot-assisted laparoscopic prostatectomy: the European and US Experience. *Rev Urol*. 2010 Winter; 12(1):35-43.
13. Palmer KJ, Coughlin G, Patel VR, et al. Examining the financial costs of robotic-assisted laparoscopic radical prostatectomy. *Urology*. 2007;70(Supplement 3A):97.

http://www.springer.com/978-1-84882-799-8

Robotic Urologic Surgery
Patel, V. (Ed.)
2012, XIX, 541 p., Hardcover
ISBN: 978-1-84882-799-8