Robotic radical prostatectomy: outcomes of 500 cases

Vipul R. Patel, Rahul Thaly and Ketul Shah

Center for Robotic and Computer Assisted Surgery, Division of Urology, Ohio State University, Columbus, OH, USA

Accepted for publication 3 November 2006

OBJECTIVE

To report the outcomes of 500 robotically assisted laparoscopic radical prostatectomies (RALPs), a minimally invasive alternative for treating prostate cancer.

PATIENTS AND METHODS

In all, 500 patients had RALP over a 30-month period. A transperitoneal six-port approach was used in each case, with the da Vinci robotic surgical system (Intuitive Surgical, Sunnyvale, CA, USA). Prospective data collection included quality-of-life questionnaires, basic demographics (height, weight and body mass index), prostate specific antigen (PSA) levels, clinical stage and Gleason grade. Variables assessed during RALP were operative duration, estimated blood loss (EBL) and complications, and after RALP were hospital stay, catheter time, pathology, PSA level, return of continence and potency.

RESULTS

The mean (range) duration of RALP was 130 (51–330) min; all procedures were successful, with no intraoperative transfusions or deaths. The mean EBL was 10–300 mL; 97% of patients were discharged home on the first day after RALP with a mean haematocrit of 36%. The mean duration of catheterization was 6.9 (5–21) days. The positive margin rate was 9.4% for all patients; i.e. 2.5% for T2 tumours, 23% for T3a and 53% for T4. The overall biochemical recurrence free (PSA level <0.1 ng/mL) survival was 95% at mean follow-up of 9.7 months. There was complete continence at 3 and 6 months in 89% and 95% of patients, respectively. At 1 year 78% of patients were potent (with or without the use of oral medications), 15% were not yet able to sustain erections capable of intercourse, and another 7% still required injection therapy.

CONCLUSION

RALP is a safe, feasible and minimally invasive alternative for treating prostate cancer. Our initial experience with the procedure shows promising short-term outcomes.

KEYWORDS

robotic, prostatectomy, outcome, laparoscopic

INTRODUCTION

Prostate cancer accounts for 33% of all newly diagnosed cancers in men; it is estimated that in 2004 in the USA the incidence of prostate cancer was 230,000 cases, with 29,900 deaths from the disease [1]. Most prostate cancers are localized, for which the current standard treatment is open retropubic radical prostatectomy. The technique for open radical prostatectomy has been refined over the last two decades and has significantly improved outcomes. It has been shown to decrease disease-specific mortality in patients with prostate cancer [2], but despite its efficacy, this form of treatment is invasive and associated with significant morbidity, e.g. pain, blood loss and prolonged recovery [3]. Because of this, many men seek other forms of treatment; one such treatment option is robotically assisted laparoscopic radical prostatectomy (RALP), using the da Vinci Surgical System (Intuitive Surgical, Sunnyvale, California), first used in 2000. Since then there has been a tremendous growth in the rate of adoption of the procedure worldwide, in both academic centres and private practices alike.

It is estimated that in 2005, 25% of all prostatectomies will be robotic and that 30,000 men have already had RALP (personal communication, Intuitive Surgical); here we present our initial experience with RALP.

PATIENTS AND METHODS

Over a 30-month period, 500 consecutive RALPs were performed by one surgeon; the patients’ demographics are presented in Table 1. The patient is placed supine in the low lithotomy position and held in place with a “bean bag” in a 30° Trendelenberg position. Our approach was transperitoneal in all cases, using a six-port technique as described by Menon et al. [4]. Our accessory non-robotic ports are placed higher on the abdomen at or above the level of the umbilicus, to avoid the robotic arms, giving the assistant maximal manoeuvrability. An anterior approach was taken to the procedure by first isolating and ligating the dorsal venous complex, followed by bladder neck dissection and mobilization of the seminal vesicles before ligating the prostatic pedicles and removing them. The anastomosis was made as described by Van Velthoven et al. [5].

After RALP the patients were allowed free access to drink and food; they ambulated soon after surgery and were prescribed anti-inflammatories with minimal narcotics. They were discharged once they were able to ambulate, tolerate a diet and in minimal discomfort, with a stable haematocrit. Patients returned 4–7 days after surgery for catheter removal.

After obtaining Institutional Review Board approval, prospective data were collected using the Expanded Prostate Cancer Index Composite questionnaire at 1, 3, 6, 9 and 12 months before surgery, and then yearly afterward. Other data collected included Sexual Health in Men (SHIM) scores, AUA symptom scores, height, weight and body mass index (BMI), clinical stage, histopathology, operative duration, PSA level, estimated blood loss (EBL), continence, potency status, duration of catheterization, hospital stay, and complications (during and after RALP).
RESULTS

The mean (range) operative duration from skin incision to fascial closure (the time that the surgeon was present) was 130 (51–330) min (Table 1), and the mean EBL was <100 (10–300) mL. The operative duration and EBL both decreased as the surgeon’s experience increased; the mean for the first 50 cases was 202 min and for the last 100 was <100 min. There were no transfusions during RALP and the rate after RALP was 0.4%. No patient required open conversion after the initial two cases. However, one patient required conversion to standard laparoscopy after malfunction of the da Vinci system.

During surgery there were two complications (0.4%), both rectal injuries during the initial 25 cases. The injuries were small, occurring during the dissection of the left lateral border of the prostate towards the apex. The injuries were recognized during RALP and as the bowel had been fully prepared beforehand the lacerations were closed laparoscopically in three layers. Neither patient had any adverse effect from the injury after surgery.

After RALP most patients fared well; the mean change in haematocrit was 3.1% (Table 1) with a mean haematocrit on discharge of 36%. Of the 500 patients, 97% were discharged home on the first day after RALP. The mean duration of catheterization was 6.9 (4–21) days, with catheter removal only after a cystogram showed healing of the anastomosis.

Complete continence, defined as the use of no absorbent pads, was achieved in 89%, 95% and 97% of patients at 3, 6 and 12 months; 27% of patients were immediately continent and 97% of patients at 3, 6 and 12 months; absorbent pads, was achieved in 89%, 95% and 97% of patients at 3, 6 and 12 months; respectively. Overall, for organ-confined (pT2) the PMR was 2.5%, and 31% for extraprostatic disease. At a mean follow-up of 9.7 months, 95% of patients had undetectable PSA levels (<0.1 ng/mL).

Pathologically, a positive margin rate (PMR) was defined by the presence of cancer cells at the inked margin. The overall PMR (for patients n–N in the series) was 9.4%, i.e. 13% (1–100), 8% (101–200), 13% (201–300), 5% (301–400), and 8% (401–500). The location of PMs varied, with 56% of all occurring posterolaterally; 23%, 8.5%, 8.5% and 4% were multifocal, apical, bladder neck and seminal vesicle, respectively. Most PMs (53%) were in patients with pT4 disease. The PMR for pT3b, pT3a, pT2 tumours were 46%, 23% and 2.5%, respectively. Overall, for organ-confined tumours (T2) the PMR was 2.5%, and 31% for extraprostatic disease. At a mean follow-up of 9.7 months, 95% of patients had undetectable PSA levels (<0.1 ng/mL).

DISCUSSION

The application of robotic technology in surgery provides certain inherent advantages, which include binocular three-dimensional visualization, ×10 magnification, tremor filtration, motion scaling, and wristed instrumentation with six degrees of surgical freedom. These technical innovations have the potential to provide urological surgeons with significant advantages while working within the confines of the male pelvis. This technology is therefore ideally suited for radical prostatectomy.

As we adopted the technique early, our initial objective was to ascertain whether RALP was a safe and feasible treatment option for patients with prostate cancer. In addition, our goal was to obtain information about the experience required, progression of technique and patient outcome. Our estimated initial number of procedures for training was 20–25, at which point we were comfortable with the technical aspects of the procedure and the surgical outcomes. The major challenges during our initial experience were related to
the lack of haptic feedback, inexperience with the technical aspects of the robotic approach, and the novelty of the remoteness of the surgeon from the patient. The lack of haptic feedback was overcome with surgical experience, as the improved visual acuity and dexterity of the instrumentation soon outweighed the lack of tactile feeling. The technical aspects of the procedure improved with study of videotapes from our cases and from other institutions. Repetition and frequency of cases were also found to be important in gaining sufficient experience. Finally, the concept of a ‘remote surgeon’ was overcome as the team became familiar with the procedure and developed a sense of unity and trust.

RALP is a relatively recent invention; in May 2000, Binder and Kramer [6] performed the first procedure in Frankfurt, followed by the group at the Henry Ford institute [7] who performed the first RALP at the Vattikuti Institute in October 2000. Since these initial pioneering experiences there have been many published series. The largest is from Menon et al. [8] who recently reported their experience of over 1100 procedures. The operative duration was 70–160 min and the EBL was 50–250 mL. No patient required an intraoperative blood transfusion, >95% of patients were discharged within 24 h, and the complication rate was 5%. Total continence, defined as using no pads, was achieved in 96% of patients at the 6-month follow-up. Of patients potent before surgery, 82% aged <60 years had a return of some sexual activity, and 64% had had sexual intercourse at the 6-month follow-up. Chien et al. [9] also recently reported their results with a modified clipless antegrade approach to nerve-preserving RALP; they reported a return to baseline potency rates of 47%, 54%, 66% and 69% at 1, 3, 6 and 12 months, respectively.

The true success and durability of RALP will undoubtedly depend on the long-term oncological outcomes. PSA recurrence-free survival is the ultimate endpoint to measure the oncological efficacy of the procedure. Currently, there is little long-term PSA data for patients who have had robotic prostatectomy. A surrogate endpoint that is sometimes used to estimate oncological outcome is the PMR. It is well known that PMRs are an independent risk factor for PSA recurrence. Weider and Soloway [10] reported a mean (range) PMR after retropubic radical prostatectomy of 28 (0–77)% in reviewed series. In that review they also reported a mean PMR for T2a disease of 17%, 36% for T2b, and 53% for T3 disease. In the present series of 500 patients the overall PMR was 9.4% and that for T2, T3a and T4 disease was 2.5%, 23% and 53%, respectively. These results compare favourably with other current series. Menon et al. [8] reported an overall PMR of 9%, while the European experience with RALP reported PMR of 22% [11]. Ahlering et al. [12] compared open and robotic prostatectomy results from one institution and found no statistical difference between the groups in PMR. While PMRs give some insight into oncological efficacy, long-term survival data are needed to definitively confirm the efficacy of RALP. The present overall biochemical recurrence-free (PSA level <0.1 ng/mL) survival was 95% at a mean follow-up of 9.7 months. Of these patients, 173 are ≥1 year after RALP (mean 15.7 months) and 95% have a PSA level of <0.1 ng/mL. There were 19 PMs in this group and only four had evidence of recurrence. Ten patients (2%) had early biochemical recurrence requiring further therapy. No patient in the present series with organ-confined (T2) disease or focal T3a disease has any evidence of recurrence at present.

While the initial ‘learning curve’ was short we found that as we increased the level of complexity of the cases additional training was needed. Patients with a greater BMI (≥35 kg/m²), a history of TURP, and prostates of >100 g provided continual challenges. The technical modifications to our procedure, which included better appreciation of the nuances of the bladder neck and posterior dissection, allowed us to improve our technique. In addition, for the nerve sparing we quickly developed a non-thermal approach. With experience, our anastomosis improved to become watertight. As experience accumulated, we were able to successfully navigate these parts of the procedure with increased speed and precision, leading to quicker surgery and better patient outcomes.

The present study has some limitations; the mean follow-up was short, at only 9.7 months. Also, based on our data, the oncological outcomes can only be evaluated at present using surrogate endpoints, e.g. the PMR. True oncological outcomes can only be evaluated based on long-term PSA recurrence-free survival data. However, at present we can verify that patients have the benefits of minimally invasive surgery and short-term outcomes comparable to those from the open and standard laparoscopic approach.

While the robotic revolution has seen a change in the treatment of prostate cancer, it is still a relatively new procedure under development. In a 5-year period 30% of surgical treatments for prostate cancer have become robotic; this trend will undoubtedly continue as more surgeons become familiar with the procedure and strong, increasingly mature data continue to be published.

In conclusion, we think that RALP is a safe and feasible option for treating prostate cancer. While gaining the initial experience is challenging this can be surmounted by practice. In experienced hands the procedure provides satisfactory results. RALP allows the patient the benefits of minimally invasive surgery with functional and oncological results comparable to those from open and standard laparoscopic surgical procedures.

CONFLICT OF INTEREST

None declared.

REFERENCES

6 Binder J, Kramer W. Robotically-assisted
laparoscopic radical prostatectomy. *BJU Int* 2001; 87: 408–10


Correspondence: Vipul R. Patel, Division of Urology, Ohio State University, 538 Doan Hall, 410 West 10th Avenue, Columbus, OH 43210–1228, USA. e-mail: Patel.914@osu.edu

Abbreviations: RALP, robotically assisted laparoscopic radical prostatectomy; SHIM, Sexual Health in Men; BMI, body mass index; EBL, estimated blood loss; PM(R), positive margin (rate).