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Original Article

Trends in treatment for localized prostate cancer after emergence of robotic-assisted laparoscopic radical prostatectomy in Taiwan

Chien-Liang Liu [a], Chien-Chang Li [b], Chi-Rei Yang [b], Chung-Kuang Yang [b], Shian-Shiang Wang [b], Kun-Yuan Chiu [b], Chung-Kuang Su [b], Hao-Chung Ho [b], Chen-Li Cheng [b], Yen-Chuan Ou [b,*]

[a] *Division of Urology, Department of Surgery, Chi-Mei Medical Center, Tainan, Taiwan, ROC*
[b] *Division of Urology, Department of Surgery, Taichung Veterans General Hospital, Taichung, Taiwan, ROC*

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Abstract

Background: Radical retropubic prostatectomy remains the gold standard treatment for localized prostate cancer. However, new minimally invasive techniques have emerged, providing a less invasive approach. Robotic-assisted laparoscopic radical prostatectomy is the ideal technique, providing good oncologic and functional outcomes. We analyzed the impact of robotic surgical systems on practice patterns among urologists to explain changes in the value of radical retropubic prostatectomy, laparoscopic radical prostatectomy and robotic-assisted laparoscopic radical prostatectomy in a single institution in Taiwan.

Methods: We retrospectively reviewed the records of patients who received prostatectomy by one of the above procedures between January 2004 and November 2009. Decisions to perform these procedures were made by patient preference. Patients who received prostate biopsies at other hospitals were transferred to our hospital specifically for robotic-assisted prostatectomy.

Results: A total of 434 radical prostatectomies were performed, of which 141 (32.49%) were radical retropubic prostatectomies, 59 (13.59%) were laparoscopic radical prostatectomies and 234 (53.92%) were robotic-assisted laparoscopic prostatectomies. The overall number of prostatectomies has increased over time because of an increase in robotic-assisted procedures. No decreases were seen in the number of radical retropubic prostatectomies during the evaluation period. Changes in the ratio of robotic-assisted prostatectomies compared to radical retropubic and laparoscopic radical prostatectomies demonstrated a trend toward robotic-assisted procedures. The percentage of cases transferred from other hospitals also increased over time from 28.57% to 68.60%.

Conclusion: Our experience emphasizes the potential of robotic-assisted prostatectomy to become the mainstream treatment for localized prostate cancer in Taiwan.

Keywords: Laparoscopy; Prostate cancer; Radical prostatectomy; Robotics

1. Introduction

Prostate cancer is the most common malignant neoplasm and second leading cause of cancer deaths in the United States. The incidence and mortality rate of prostate cancer in Taiwan is lower than in western countries but is rising. Incidence increased from 8.58/100,000 per year in 1996 to 23.39/100,000 per year in 2005,[1] and it became the fifth most commonly diagnosed cancer. Prostate cancer is currently the seventh highest cause of cancer deaths (8.6/100,000 per year, 2007) in male patients in Taiwan.[2]

Widespread screening with serum prostate-specific antigen (PSA) and digital rectal examination (DRE) has allowed detection of localized prostate cancer. Options for surgical treatment of localized prostate cancer now include radical retropubic prostatectomy (RRP), laparoscopic radical

* Corresponding author. Dr. Yen-Chuan Ou, Division of Urology, Department of Surgery, Taichung Veterans General Hospital, 160, Section 3, Taichung-Kang Road, Taichung 407, Taiwan, ROC.
E-mail address: ycou@vghtc.gov.tw (Y.-C. Ou).

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prostatectomy (LRP) and robotic-assisted laparoscopic radical prostatectomy (RALP). These three surgeries each have different advantages and disadvantages.[3,4] RRP remains the gold standard procedure because it has demonstrated good long-term oncologic outcomes and acceptable functional outcomes. LRP offers reduction of blood loss (secondary to pneumoperitoneum with increasing abdominal pressure and better visualization), faster recovery, and better cosmetic outcomes. However, LRP is a technically challenging operation with a steep learning curve and poor ergonomics for surgeons.

The introduction of the *da Vinci* Surgical System (Intuitive Surgical Inc., Sunnyvale, CA, USA) in urology in 1999 caused a revolution in surgical approaches for localized prostate cancer. RALP preserves the benefits of minimally invasive surgery and overcomes the drawbacks of LRP. The robotic system provides several advantages, including three-dimensional stereoscopic viewing, tenfold optical magnification, computerized elimination of tremor and intuitive finger-controlled movement with the use of an endo-wrist instrument with seven degrees of freedom of movement. In addition, the ergonomic design of the robotic control console appears to reduce the muscle strain and fatigue of surgeons. The learning curve for RALP is faster than that for LRP. Ahlering et al. reported that the learning curve of a non-laparoscopic surgeon performing RALP is just 12 cases.[5] In our previous report, the console time was significantly decreased from 262 minutes to 190 minutes after 30 cases' experience, and the preliminary functional outcomes were also well accepted.[6]

In Taiwan, the first RALP was performed at Tri-Service General Hospital, Taipei in 2004. At that time, more and more patients were receiving RALP. Currently, five hospitals in Taiwan have a *da Vinci* Surgical System, and a total of 507 RALP surgeries were performed between 2004 and 2009 (Table 1) (data provided by the Double Success Limited Company). The annual case numbers increased from 3 to 192 in a 6-year period. A total of 234 cases (45.1%) were performed at Taichung Veterans General Hospital (TCVGH) in the same time period.

This study examined the impact of robotics on radical prostatectomy at a single institution (TCVGH) in central Taiwan over a 6-year period (2004 to 2009). We emphasize that the surgical treatment trend for localized prostate cancer will shift to RALP.

Table 1
Current *da Vinci* robotic-assisted laparoscopic radical prostatectomies in Taiwan

	2004	2005	2006	2007	2008	2009
TSGH	3	9	16	23	34	41
CGMH			13	29	31	61
CHGH		2	6		1	
TPVHG						4
TCVGH		7	28	50	63	86
Total ($N = 507$)	3	18	63	102	129	192

CGMH = Chang Gung Medical Hospital; CHGH = Cheng Hsin General Hospital; TCVGH = Taichung Veterans General Hospital; TPVGH = Taipei Veterans General Hospital; TSGH = Tri-service General Hospital.

2. Methods

This study was a retrospective review of the surgical database of TCVGH. We reviewed and analyzed the records of patients who received RRP, LPR or RALP between January 2004 and November 2009. All patients had pathologically confirmed prostate cancer, and surgeries were performed either by transrectal ultrasonic biopsy or transurethral resection of the prostate. Also, prostate magnetic resonance imaging and whole-body bone scans were performed to exclude nodal and distant metastasis. Decisions to perform RRP, LRP or RALP were made according to patient preference after each patient had discussed the risks and benefits of each approach with the attending surgeon. TCVGH is the only hospital in central Taiwan that has a *da Vinci* Surgical System. Patients who had received prostate biopsies at other hospitals and were transferred to TCVGH for surgery were identified and included in our study. Most of them had requested RALP as the surgical approach. We carried out a survey of the source of RALP in patients who were referred from other hospitals in the year 2009. We also conducted a survey about motivations for undergoing robotic surgery including/examining eight issues (1) postoperative continence rate; (2) cancer control; (3) erection function preservation; (4) minimal invasion and less pain; (5) less blood loss without transfusion; (6) short hospital stay; (7) less care burben for family; (8) private health insurance coverage among 74 patients. Patients were asked to answer each issue with a score from 1 to 8, from the issue of greatest/most concerning issue with score 8 to the least concerning issue with score 1.

3. Results

From January 2004 to November 2009, 434 radical prostatectomies were performed at TCVGH. Of the 434 cases, 141 (32.49%) were RRPs, 59 (13.59%) were LRPs and 234 (53.92%) were RALPs. The first RALP was performed in December 2005, and after that, the percentage of RALPs gradually increased from 14% to 70.79% in 2008 and remained at 69.69% in 2009 (Fig. 1). The changes in ratio of RALP to RRP and LRP demonstrated a trend toward RALP. In addition, the total number of radical prostatectomy cases also increased after the emergence of the *da Vinci* Surgical System. In 2005, we performed 40 radical prostatectomies, however, in 2009, the total number rose to 123. Of the 234 RALPs, we found that the percentage of transferred cases also increased from 28.57% in 2006 to 68.60% in 2009 during the same time period (Fig. 2). In 2009, 59 patients who received RALP were transferred from other hospital due to doctor's reference (71.2%), website or news (15.2%) and family/friends' recommendation (13.6%). The five major concerns of patient motivation were cancer control (score 6.59 ± 1.71), postoperative continence rate (6.35 ± 1.48), minimal invasion and less pain (5.97 ± 1.30), less blood loss without transfusion (5.16 ± 1.54) and erection function preservation (4.22 ± 1.77). Economic consideration for the private health insurance coverage was the issue of least concern with score 1.24 ± 0.93.

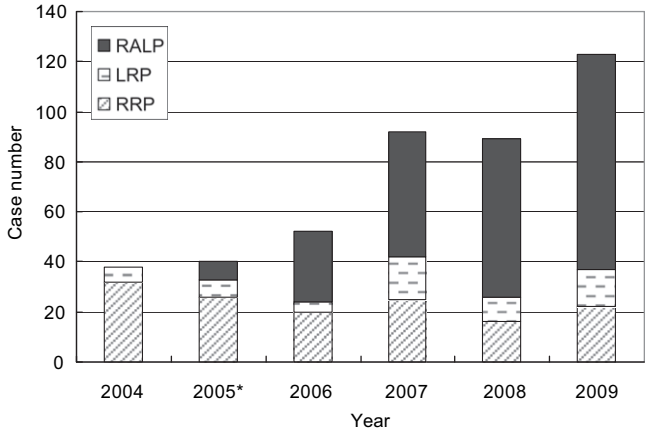

Fig. 1. Number of RRP, LRP and RALP procedures performed at TCVGH from 2004 to 2009. LRP = laparoscopic radical prostatectomy; RALP = robotic-assisted laparoscopic radical prostatectomy; RRP = radical retropubic prostatectomy; TCVGH = Taichung Veterans General Hospital.

4. Discussion

Many studies have documented a trend toward RALP being the choice of treatment for localized prostate cancer. In the United States, currently, more than 550 *da Vinci* Surgical Systems are in operation. In 2006, RALPs constituted only 10% of the total number of radical prostatectomies performed by American urologists, however, the proportion had increased to more than 65% in 2008 through 2009.[7] The same phenomenon was also noted in Korea, where RALPs gradually increased from 8% to 77% (from 2005 to 2008). This gradual country-to-country increase is called the "halo effect".[8] We found the same phenomenon to be true at TCVGH; cases have increased from year to year since the introduction of RALP. Of the 243 patients in this study, 141 (58.02%) were diagnosed at other hospitals and transferred to our hospital specifically for RALP. This conforms to the "halo effect" described above.

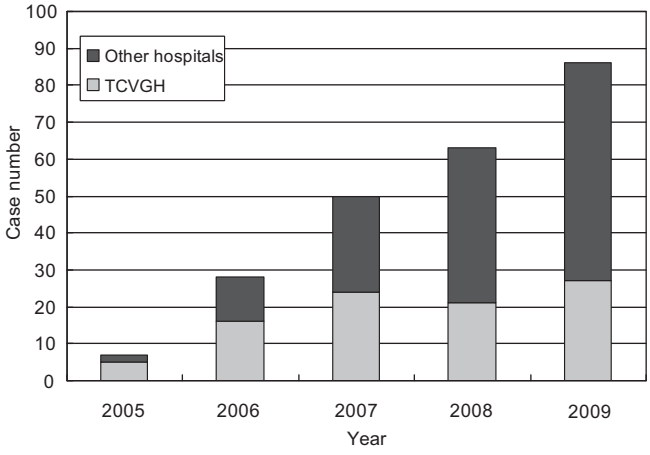

Fig. 2. Patients with prostate cancer receiving RALP were diagnosed at TCVGH and other hospitals from 2005 to 2009. RALP = robotic-assisted laparoscopic radical prostatectomy; TCVGH = Taichung Veterans General Hospital.

Not only do patients receive RALP as their treatment of choice, but also there are more urologic surgeons shifting from RRP to RALP. In 2006, only 3% of surgical residents believed that laparoscopic robotic prostatectomy was the surgical gold standard for treating localized prostate cancer.[9] Recently, in a multi-national, questionnaire-based study, 40% of participants considered RALP to be the gold standard.[10] Although only 21% of respondents were currently performing RALP, 78% of respondents felt it was required or beneficial to have training in robotic-assisted surgery, and 61% believed they would perform robotic-assisted surgery.[10]

Coelho et al.[11] reviewed current outcomes of RALP, including 16 larger and more serious cases among more than 9,000 cases. They emphasized perioperative data, surgical complications, positive margin rate continence and sexual potency; the last three are the so-called "trifecta" outcomes. Generally, comparative studies have shown that RALP is associated with less blood loss, a lower transfusion rate and shorter hospital stays when compared to open radical prostatectomy.

With regard to oncologic outcomes, the overall positive surgical margin (PSM) rate was 15.2% after RALP, ranging from 9.3% to 33%.[11] Ficarra et al.[12] reported that the PSM rate ranged from 11% to 37% after RRP and from 11% to 30% after LRP. No significant differences were found between these three groups. The PSM rate is influenced by the PSA level, Gleason score and tumor stage. In Patel and coworkers' review, the PSM rate range was 0–20% for patients at T2 and 0–75% for T3.[13]

Excellent functional outcomes were reported in several large series. RALP with modified technique may enhance early continence. Nguyen et al.[14] reported that posterior reconstruction of Denonvilliers' musculofascial plate may enhance early continence after RALP and LRP. Significantly higher early continence rates were seen compared to the control group at 3 days (34% *vs.* 3%) and at 6 weeks (56% *vs.* 17%). The authors also described that reconstruction restored the length of the transected membranous urethra by a mean of 2 mm. Tewari et al.[15] described a novel technique for total reconstruction of the vesico-urethral junction (including anterior and posterior reconstruction). This group had continence rates of 38%, 83%, 91%, and 97% at 1, 6, 12, and 24 weeks, respectively. In the group that received either no or partial reconstruction, the continence rates were significantly lower less ($p < 0.01$). Early postoperative sexual potency seems to be better with RALP than with RRP and LRP. Kaul et al.[16] reported that 69% of patients had normal erections after RALP with bilateral nerve sparing. Potdevin et al.[17] performed nerve sparing surgery with athermal intrafascial robotic (AIR) approach, which improved the potency rate from 66.7% to 90.9% within 9 months. Another issue that arises in comparing the different surgical treatments for localized prostate cancer is the cost. According to American surgeons who use the robot, robotic technology might add $1,000 to the surgical cost of radical prostatectomy, and a total cost of for RRP is about $24,000.[18] In Taiwan, we have national health insurance and prostate cancer is categorized as a major illness, which has the benefit of copayment exemptions. LRP needs additional payment of about NT$50,000 (~$1,550) and

RALP needs about NT$200,000 (∼$6,200). This is because of higher RALP costs relative to the purchase and maintenance of operative equipment. Nevertheless, RALP is continuing to grow in popularity because of patient interest, benefits and demand. In our patients received RALP, economic consideration of private health insurance coverage is the least concerning/important issue. The two main reasons for choosing RALP were cancer control and postoperative continence rate.

Currently, many new minimally invasive technologies are available for treating localized prostate cancer. Four modalities appear to have the greatest clinical promise, including cryotherapy, radiation therapy, high-intensity focused ultrasound, and photodynamic therapy.[19] These ablative technologies can deliver a minimally invasive, one-day surgical treatment with effective early cancer control and low genitourinary morbidity.[20] These minimally invasive surgeries offer more options for patients who are not candidates for radical surgery.

In conclusion, RRP is the gold standard for surgical treatment of localized prostate cancer. LRP and RALP provide minimally invasive surgery, while RALP has conquered the disadvantages of LRP, including the steep learning curve, longer operative time and ergonomic discomfort for surgeons. The impact of robotics is obvious in our institution. The annual case number of radical prostatectomies is increasing and RALP surgeries occupy the major portion of that increase. Our experience emphasizes the potential of RALP to become the mainstream treatment for localized prostate cancer in Taiwan.

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