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Prostate Cancer

Cost Comparison of Robotic, Laparoscopic, and Open Radical Prostatectomy for Prostate Cancer

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Abstract

Background: Demand and utilization of minimally invasive approaches to radical prostatectomy have increased in recent years, but comparative studies on cost are lacking.

Objective: To compare costs associated with robotic-assisted laparoscopic radical prostatectomy (RALP), laparoscopic radical prostatectomy (LRP), and open retropubic radical prostatectomy (RRP).

Design, setting, and participants: The study included 643 consecutive patients who underwent radical prostatectomy (262 RALP, 220 LRP, and 161 RRP) between September 2003 and April 2008.

Measurements: Direct and component costs were compared. Costs were adjusted for changes over the time of the study.

Results and limitations: Disease characteristics (body mass index, preoperative prostate-specific antigen, prostate size, and Gleason sum score 8–10) were similar in the three groups. Nerve sparing was performed in 85% of RALP procedures, 96% of LRP procedures, and 90% of RRP procedures ($p < 0.001$). Lymphadenectomy was more commonly performed in RRP (100%) compared to LRP (22%) and RALP (11%) ($p < 0.001$). Mean length of hospital stay was higher for RRP than for LRP and RALP. The median direct cost was higher for RALP compared to LRP or RRP (RALP: $6752 [interquartile range (IQR): $6283–7369]; LRP: $5687 [IQR: $4941–5905]; RRP: $4437 [IQR: $3989–5141]; $p < 0.001$). The main difference was in surgical supply cost (RALP: $2015; LRP: $725; RRP: $185) and operating room (OR) cost (RALP: $2798; LRP: $2453; RRP: $1611; $p < 0.001$). When considering purchase and maintenance costs for the robot, the financial burden would increase by $2698 per patient, given an average of 126 cases per year.

Conclusions: RALP is associated with higher cost, predominantly due to increased surgical supply and OR costs. These costs may have a significant impact on overall cost of prostate cancer care.

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1. Introduction

Radical prostatectomy (RP) represents the most common treatment for prostate cancer (PCa) performed in the United States [1]. It has been reported that RP accounted for 50% of the $1.7 billion annual cost spent on PCa [2]. New technologies, such as laparoscopic RP (LRP) and robotic-assisted LRP (RALP), have been developed. The demand and utilization of these minimally invasive surgical treatments have increased in recent years, whereas utilization of open retropubic RP (RRP) has decreased [3].

Although minimally invasive approaches offer the benefit of decreased blood loss and shorter hospital stay [4], the need for more expensive equipment may have a significant impact on health economics. European studies found increasing costs for PCa care, caused by technological changes in the management of PCa [5,6]. We have previously shown that costs for LRP were higher than those for RRP, predominantly due to higher surgical supply and operating room (OR) costs [7]. Another study using a decision-analysis model found that RALP and LRP were more expensive than RRP, based on outcomes of a literature review and meta-analysis [8]. It is important to validate models using real-world data.

A careful evaluation of costs associated with RRP, LRP, and RALP is necessary for reasonable health care resource allocation. Given the lack of comparative studies on the costs of different approaches to RP, we evaluated direct costs using data from 643 consecutive patients recently treated at our institution.

2. Patients and methods

2.1. *Patient population*

This study was approved by the institutional review board of the University of Texas Southwestern Medical Center, Dallas, Texas, USA. A retrospective analysis was performed of consecutive patients undergoing RP for biopsy-proven PCa between September 2003 and April 2008. We included 643 patients: 262 underwent RALP (starting in January 2006), 220 underwent LRP, and 161 underwent RRP. We included only patients who underwent RP as a primary surgical approach with curative intent. None of the patients received neoadjuvant hormonal treatment.

2.2. *Surgical treatment*

All procedures were performed by academically based urologists who were experienced in their respective procedures and beyond their learning curves in RRP and LRP procedures. LRP was done by one surgeon (JAC), RALP by two surgeons (CGR and YL), and RRP by three different urologic oncologists. A learning curve was included in RALP patients; however, no significant difference in median operative time (226 min vs 215 min) and median length of hospital stay (LOS; 1 d in both groups) was observed between the 50 initially operated patients and the most recently treated 50 patients. Lymph node dissection and nerve-sparing techniques were performed at the discretion of the individual surgeon, taking into account the preoperative biopsy report and intraoperative findings. Hospital discharge was also at the discretion of the surgeon but was based on a standardized postoperative pathway for all prostatectomy patients, aiming at earliest possible discharge following RP, if medically justifiable. Patients were discharged when they met standard criteria, including adequate pain control, tolerating oral intake, ambulation, and flatus.

2.3. *Data collection*

Patient charts were reviewed, and clinical and pathologic data were recorded in a computerized database. Preoperative parameters included patient age, body mass index (BMI), preoperative prostate-specific antigen (PSA) values, prostate size, and biopsy Gleason sum score. Operative features comprised performance (or not) of nerve sparing, transfusion rates, surgical and perioperative complications, and LOS.

For the cost analysis, detailed cost information was available from the hospital billing department for all patients. We specifically obtained direct cost and not charge data. Direct costs represent the costs generated by each department of the institution involved in patient care, including costs related to anesthesia (professional and nursing fees), radiology (computed tomography and plain x-ray), OR, surgical supplies (amount of equipment used for the operation), pathology, medication, laboratory (including blood transfusion), and room and board. Direct costs tend to reflect resource use more accurately because charge data incorporate profit margins for the institution.

Surgical supplies vary with the type of RP and the equipment used. The main determinants in LRP and RALP procedures included the use of routine disposable laparoscopic equipment (eg, trocars, specimen entrapment sac, Visiport device, suction irrigator, and clip appliers) and the use of adjunct technologies for hemostasis (FloSeal hemostatic matrix [Baxter Inc., Deerfield, IL, USA] and Surgicel fibrillar hemostat [Ethicon Inc., Somerville, NJ, USA]). The instruments used during RALP cases included the PlasmaKinetics (PK) sealer and the EndoWrist instruments (equipped with 7 *df*, 90° of articulation, intuitive motion and fingertip control, motion scaling, and tremor reduction).

RALP was performed with the da Vinci robot (Intuitive Surgical Inc., Sunnyvale, CA, USA) with four arms. Robot-specific surgical supply costs were for Hot Shears, two large needle drivers, grasper, forceps, and ProGrasp, each costing $220 per use (cost averaged over 10 uses). We also used the robotic PK device, which costs $250 per use (cost averaged over 10 uses). The surgical supplies for RRP were minimal and primarily included surgical drapes, suture, FloSeal, and Surgicel. The OR costs were dependent on the procedure time and included hospital costs for the anesthesia machines and OR overhead.

Due to the fact that costs changed over the study period, we normalized the costs to 2007 rates. This approach reduced bias because most prostatectomy procedures in 2006 and 2007 were RALP and LRP and most procedures from 2003 to 2005 were RRP. The rate for room and board was adjusted based on LOS, assuming that the cost of 1 night is $495 (2007 rate). To make OR cost (directly related to OR time) comparable among procedures performed during different years of the study period, OR cost was adjusted to $12.9 per minute or $772 per hour, which was the rate in the years 2006 and 2007. A mean recovery room cost of $270, based on a representative subgroup of patients, was fixed. All equipment costs were based on the purchase cost of the surgical supplies and averaged for purposes of the analysis.

The purchase and maintenance costs of the robot were not included in the comparison of direct costs. To determine additional expenses when considering purchase and maintenance costs, we calculated the average number of RALPs performed per year during the study period. The da Vinci robot costs $1.4 million, and maintenance costs are $140,000 per year. If an institution needs to amortize the robot over 7 yr, this results in an additional cost of $200,000 per year. Thus, purchase and maintenance costs would result in a total cost of $340,000 per year.

2.4. *Statistical analysis*

All statistical analyses were performed with SAS v.9.1 (SAS Institute Inc., Cary, NC, USA). Differences in categorical variables among groups were compared using the χ^2 test. Continuous variables in the RALP, LRP, and RRP groups were compared using the Kruskal-Wallis test. All reported *p*

Table 1 – Comparison of descriptive characteristics of the patients

Variables	*n*	RALP	*n*	LRP	*n*	RRP	*p*
Age, yr (median [IQR])	262	61 (57–66)	220	59 (54–63)	161	61 (56–65)	0.001*
BMI, (median [IQR])	262	28 (25–30)	211	27 (26–30)	156	27 (25–30)	0.91*
Preop PSA, ng/ml (median [IQR])	260	5.3 (4.2–7)	211	5 (4.1–6.5)	150	5.3 (4.3–7)	0.29*
Prostate volume, cm^3 (median [IQR])	257	46 (36–58)	205	46 (40–59)	154	45 (37–59)	0.39*
Biopsy Gleason sum score, *n* (%)	–		–		–		0.007†
≤6		128 (48.9)		120 (55.8)		102 (64.1)	
7		118 (45.0)		77 (35.8)		43 (27.0)	
8–10		16 (6.1)		18 (8.4)		14 (8.8)	
Length of stay, d	262		220		161		<0.0001*
Median (IQR)		1 (1–2)		2 (1–2)		2 (2–3)	
Mean (SD)‡		1.56 (1.53)		1.76 (0.83)		2.51 (1.37)	

BMI = body mass index; IQR = interquartile range; LRP = laparoscopic radical prostatectomy; PSA = prostate-specific antigen; RALP = robotic-assisted laparoscopic radical prostatectomy; RRP = retropubic radical prostatectomy; SD = standard deviation.
* Kruskal-Wallis test.
† χ^2 test.
‡ A formal statistical comparison of means was not performed for this variable because it was not normally distributed.

values are two-sided. Statistical significance in this study was set at $p \leq 0.05$.

3. Results

The baseline clinical and pathologic data of the patients are shown in Table 1. The ages of the patients in the three groups were similar (median: 61 yr [RALP and RRP groups] vs 59 yr [LRP]), but the slight difference was statistically significant ($p = 0.001$). BMI, preoperative PSA level, and prostate size were comparable among the three groups (Table 1). Percentage of patients with biopsy Gleason sum 8–10 was similar in the three groups (RALP: 6.1%; LRP: 8.4%; RRP: 8.8%; $p = 0.5$), but there were more patients with Gleason 7 in the RALP group.

Nerve sparing was performed in 85% of RALP procedures (192 of 225 patients for whom information on the performance of nerve sparing was available), in 96% (210 of 219) of LRP procedures; and in 90% (137 of 152) of RRP procedures ($p < 0.001$). A lymph node dissection was more commonly performed in conjunction with RRP (100%) than with LRP (22%) and RALP (11%) ($p < 0.001$). Blood transfusions were utilized in 21% (32 of 154) of patients who underwent RRP compared to 4.6% (12 of 262) of those who underwent RALP and 1.8% (4 of 220) of those who underwent LRP ($p < 0.001$). The LOS was longer for RRP compared to RALP and LRP (Table 1; $p < 0.0001$).

The comparison of overall direct costs and the individual cost domains among the different types of RP are reported in Table 2. The median direct cost was highest for RALP ($6752 [interquartile range (IQR): $6283—7369]); cost for LRP was $5687 (IQR: $4941–5905), and RRP was the cheapest procedure ($4437 [IQR: $3989–5141]; overall $p < 0.001$). The main difference was in surgical supply costs for each procedure ($2015 for RALP, $725 for LRP, $185 for RRP) and OR costs ($2798 for RALP, $2453 for LRP, $1611 for RRP; $p < 0.001$). Additional costs for purchase and maintenance (total of $340 000 per year when amortized over a 7-yr period) of the robot would result in $2698 per patient undergoing RALP, given an average of 126 cases performed per year.

Table 2 – Comparison of the overall direct cost (in US dollars) and the individual cost domains for the three types of radical prostatectomies

Variables	RALP	LRP	RRP	*p**
Direct cost, median (IQR)	6752 (6283–7369)	5687 (4941–5905)	4437 (3989–5141)	<0.0001
Surgical supply cost (fixed)**	2015	725	185	–
Operating room cost, median (IQR)	2798 (2493–3175)	2453 (2130–2778)	1611 (1491–1995)	<0.0001
Anesthesia cost, median (IQR)	419 (378–464)	365 (297–411)	234 (189–297)	<0.0001
Medication cost, median (IQR)	297 (247–353)	271 (213–332)	272 (231–331)	0.0008
Lab cost, median (IQR)	295 (246–350)	386 (321–558)	659 (435–860)	<0.0001
Room and board cost				<0.0001
Median (IQR)	495 (495–990)	990 (495–990)	990 (990–1485)	
Mean (SD)‡	778 (758)	873 (409)	1242 (678)	

IQR = interquartile range; LRP = laparoscopic radical prostatectomy; RALP = robotic-assisted laparoscopic radical prostatectomy; RRP = retropubic radical prostatectomy; SD = standard deviation.
* Kruskal-Wallis test.
‡ A formal statistical comparison of means was not performed for this variable because it was not normally distributed.
** Equipment for LRP included routine disposable laparoscopic equipment (eg, trocars, specimen entrapment sac, Visiport device, suction irrigator, and clip appliers) and adjunct technologies for hemostasis (FloSeal and Surgicel). Robot-specific surgical supply costs were for Hot Shears, two large needle drivers, grasper, forceps, and ProGrasp, each costing $220 per use (cost averaged over 10 uses). We also used the robotic PlasmaKinetics sealer device, which costs $250 per use (cost averaged over 10 uses). The surgical supplies for RRP included surgical drapes, suture, FloSeal, and Surgicel.

4. Discussion

Financial resources in national health care systems are limited, and high pressure is constantly applied to make procedures cost effective. Economic considerations are particularly important when new technologies are introduced. These need to be evaluated in terms of new costs and potential benefits for patient care. Demand and utilization of minimally invasive surgical techniques are increasing and open RRP is less commonly performed, but the impact on cost has not been well evaluated. In a previous study, we used decision-analysis models and a meta-analysis of the published literature to compare costs of RALP, LRP, and RRP, and we projected that RALP is the most expensive approach [8]. Using actual cost values from our institution, we now report the largest comparison of RALP, LRP, and RRP costs to date.

We found that RALP resulted in the highest costs, despite excluding the costs of purchasing and maintaining the robot. Costs were significantly higher than for the other approaches and exceeded the median costs for LRP by more than $1000. RRP was the cheapest procedure, with a cost advantage of $1250 and $2315 over LRP and RALP, respectively. The main component leading to the higher cost of RALP was the high surgical supply costs, which were not overcome by reduced room and board costs.

Another cost disadvantage of RALP was the higher OR cost. OR costs are a direct reflection of OR time, and RALP and LRP OR costs were higher than those for RRP due to longer operating times. At the same time, even assuming equivalent operating time, RALP would still cost at least $1000 more than RRP based on high surgical equipment costs. Our previous analysis of RRP, RALP, and LRP reports in the literature found no significant advantage of one approach over another in terms of operative time [8]. If a surgeon is dramatically faster at one approach over another, that could affect the cost effectiveness of that particular surgeon at performing prostatectomy, but such nuances probably are not generalizable.

LRP had an intermediate cost between RALP and RRP. The higher cost compared to RRP was due to higher equipment costs of LRP ($725 vs $185) and a higher OR cost due to longer surgical times. These findings are in line with a prior report from our institution showing that actual LRP costs were significantly higher than the costs for RRP due to higher surgical supply and OR costs [7]. Although LRP is less expensive that RALP, it is a technically challenging procedure, and most laparoscopic prostatectomy procedures in the United States are performed using the robot-assisted approach.

Can the robot become cost competitive with the other approaches? One direct way to lower costs would require a significant decrease in surgical supply costs [8]. Reduction of operative time is possible if resident teaching is eliminated, but it also should be assumed that RRP times would decrease if residents were not involved. As noted above, with equivalent OR times, the equipment costs still drive the higher cost of RALP. It is also unlikely that cost savings can be achieved by lowering the LOS, which was 1.5 d for RALP. Even a half-day reduction will only reduce costs by $250, and it is unlikely that minimally invasive RP will be routinely performed in an outpatient setting. Regarding time to convalescence, one recent study showed that patients who underwent RALP had shorter postoperative hospital stays and less need for paid sick leave than patients who had RRP [9]. Shorter convalescence following RALP may reduce the cost burden to society but needs to be confirmed prospectively.

We excluded the robot purchase costs ($1.5–1.75 million) and maintenance fees ($112 000–150 000 per year, depending on model and year of purchase) from our cost comparison, but based on our clinical volume, this expense would add almost $2700 per case. Many institutions do not have donors who can provide a robot. Thus, purchase and maintenance of a robot increases cost of RALP, especially during the learning curve, and depends on case volume [10]. Annual maintenance cost would add $1000 per case if 150 cases were performed each year and $500 if 300 cases were performed annually, which likely is the logistical limit of cases for one robot.

Only evidence for improved patient care when performing RALP could justify the high costs for this procedure. A recent systematic review of the literature for prostatectomy procedures identified 37 comparative studies [4]. LRP and RALP were more time consuming than RRP, especially in the initial steps of the learning curve, but blood loss, transfusion rates, length of stay, and complication rates all favored minimally invasive approaches (LRP and RALP). The available studies were not sufficient to prove the superiority of any surgical approach in terms of functional and oncologic outcomes. Minimally invasive RP results in lower transfusion rates and more rapid convalescence with shorter LOS [11–16]. Transfusion rates for open RRP, however, tend to be low [17,18], and the higher transfusion rates associated with RRP had no major impact ($<$15% of overall costs of RRP) in the present study.

The decrease in pain and LOS has been questioned in several studies that used similar pathways to discharge for RALP and RRP [19,20]. Webster et al prospectively compared postoperative pain scores among 314 patients who underwent RALP or RRP and found no differences in pain or analgesic use [20]. Most important, the adoption of new technology should improve continence and potency rates following RP. Unfortunately, no randomized trials compared outcomes for different surgical approaches to RP, and no significant advantages in functional outcomes and cancer control for the RALP approach have been observed to date [17,18,21,22].

One recent report by Hu et al showed a significantly increased use of salvage radiation or hormone therapy within 6 mo following surgery in patients who underwent minimally invasive RP (LRP or RALP) compared to RRP [23]. This finding was especially true for low-volume surgeons. In contrast, a study from a center of excellence showed that the overall incidence of positive surgical margins was significantly lower among patients who underwent RALP compared to RRP (15% vs 35%, $p < 0.001$) [24]; however, lower PSA, clinical stage, and Gleason scores were present in the RALP group. Long-term oncologic outcomes are not yet available.

The few studies comparing costs of RALP and other approaches to RP all found that the robotic approach was more expensive [8,25,26]. The high utilization of RALP is partially driven by patient and physician demand, but the cost effectiveness of RALP ultimately will be determined with functional and oncologic outcomes. To date, there is not enough evidence of a significant improvement in patient care with RALP to justify the high added cost. From a patient perspective, it has been reported that those who underwent RALP were more likely to be dissatisfied with their outcome, possibly because of higher expectations for a new and "better" procedure [27]. Prospective studies should be performed to determine whether RALP offers a significant advantage over other approaches to RP to justify the added expense.

Our analysis has several limitations. One limitation is that costs of the procedures can vary among institutions; however, our costs were similar to other publications focusing on the cost of RP [25,28,29]. The procedures in our series were performed by experts in their fields. The costs will be higher for surgeons with less experience and longer operative times. Moreover, costs may vary geographically at different centers and may not be applicable to all institutions. The costs of any salvage therapy are not included in our analysis. Additionally, given the relatively short follow-up period for patients who underwent RALP, we were unable to include data on biochemical recurrence rates and associated costs of any palliative hormonal treatment. Finally, this study was done primarily from a hospital perspective; if there is evidence for other cost advantages such as earlier return to work, then those results may make LRP and RALP more effective from a societal perspective.

5. Conclusions

RALP is associated with significantly higher costs compared to LRP and RRP, predominantly due to increased surgical supply and OR costs. Our clinically derived cost comparison confirmed the computer model–based predictions of high RALP costs. These costs may have a significant impact on overall cost of PCa care. Evidence for functional and oncologic superiority will be needed to justify the high costs of this new technology.

Author contributions: Yair Lotan had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Roehrborn, Lotan.
Acquisition of data: Bolenz, Hotze, Ho, Lotan.
Analysis and interpretation of data: Bolenz, Gupta, Cadeddu, Roehrborn, Lotan.
Drafting of the manuscript: Bolenz, Lotan.
Critical revision of the manuscript for important intellectual content: Gupta, Hotze, Ho, Cadeddu, Roehrborn.
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References

[1] Cooperberg MR, Lubeck DP, Meng MV, et al. The changing face of low-risk prostate cancer: trends in clinical presentation and primary management. J Clin Oncol 2004;22:2141–9.

[2] Gardner TA, Bissonette EA, Petroni GR, et al. Surgical and postoperative factors affecting length of hospital stay after radical prostatectomy. Cancer 2000;89:424–30.

[3] Box GN, Ahlering TE. Robotic radical prostatectomy: long-term outcomes. Curr Opin Urol 2008;18:173–9.

[4] Ficarra V, Novara G, Artibani W, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. Eur Urol 2009;55:1037–63.

[5] Koopmanschap MA, van Roijen L, Bonneux L, et al. Current and future costs of cancer. Eur J Cancer 1994;30A:60–5.

[6] Sennfält K, Carlsson P, Varenhorst E. Diffusion and economic consequences of health technologies in prostate cancer care in Sweden, 1991–2002. Eur Urol 2006;49:1028–34.

[7] Anderson JK, Murdock A, Cadeddu JA, et al. Cost comparison of laparoscopic versus radical retropubic prostatectomy. Urology 2005;66:557–60.

[8] Lotan Y, Cadeddu JA, Gettman MT. The new economics of radical prostatectomy: cost comparison of open, laparoscopic and robot assisted techniques. J Urol 2004;172:1431–5.

[9] Hohwu L, Akre O, Pedersen KV, et al. Open retropubic prostatectomy versus robot-assisted laparoscopic prostatectomy: a comparison of length of sick leave. Scand J Urol Nephrol 2009;43:259–64.

[10] Steinberg PL, Merguerian PA, Bihrle III W, et al. The cost of learning robotic-assisted prostatectomy. Urology 2008;72:1068–72.

[11] Bhayani SB, Pavlovich CP, Hsu TS, et al. Prospective comparison of short-term convalescence: laparoscopic radical prostatectomy versus open radical retropubic prostatectomy. Urology 2003;61: 612–6.

[12] Anastasiadis AG, Salomon L, Katz R, et al. Radical retropubic versus laparoscopic prostatectomy: a prospective comparison of functional outcome. Urology 2003;62:292–7.

[13] Roumeguere T, Bollens R, Vanden Bossche M, et al. Radical prostatectomy: a prospective comparison of oncological and functional results between open and laparoscopic approaches. World J Urol 2003;20:360–6.

[14] Rassweiler J, Seemann O, Schulze M, et al. Laparoscopic versus open radical prostatectomy: a comparative study at a single institution. J Urol 2003;169:1689–93.

[15] Tewari A, Srivasatava A, Menon M. A prospective comparison of radical retropubic and robot-assisted prostatectomy: experience in one institution. BJU Int 2003;92:205–10.

[16] Guillonneau B, Vallancien G. Laparoscopic radical prostatectomy: the Montsouris technique. J Urol 2000;163:1643–9.

[17] Berryhill Jr R, Jhaveri J, Yadav R, et al. Robotic prostatectomy: a review of outcomes compared with laparoscopic and open approaches. Urology 2008;72:15–23.
[18] McCullough TC, Barret E, Cathelineau X, et al. Role of robotics for prostate cancer. Curr Opin Urol 2009;19:65–8.
[19] Nelson B, Kaufman M, Broughton G, et al. Comparison of length of hospital stay between radical retropubic prostatectomy and robotic assisted laparoscopic prostatectomy. J Urol 2007;177:929–31.
[20] Webster TM, Herrell SD, Chang SS, et al. Robotic assisted laparoscopic radical prostatectomy versus retropubic radical prostatectomy: a prospective assessment of postoperative pain. J Urol 2005;174:912–4, discussion 914.
[21] Wilt TJ, MacDonald R, Rutks I, et al. Systematic review: comparative effectiveness and harms of treatments for clinically localized prostate cancer. Ann Intern Med 2008;148:435–48.
[22] Frota R, Turna B, Barros R, et al. Comparison of radical prostatectomy techniques: open, laparoscopic and robotic assisted. Int Braz J Urol 2008;34:259–68, discussion 268–9.
[23] Hu JC, Wang Q, Pashos CL, et al. Utilization and outcomes of minimally invasive radical prostatectomy. J Clin Oncol 2008;26:2278–84.
[24] Smith Jr JA, Chan RC, Chang SS, et al. A comparison of the incidence and location of positive surgical margins in robotic assisted laparoscopic radical prostatectomy and open retropubic radical prostatectomy. J Urol 2007;178:2385–9, discussion 2389–90.
[25] Scales Jr CD, Jones PJ, Eisenstein EL, et al. Local cost structures and the economics of robot assisted radical prostatectomy. J Urol 2005;174:2323–9.
[26] Burgess SV, Atug F, Castle EP, et al. Cost analysis of radical retropubic, perineal, and robotic prostatectomy. J Endourol 2006;20:827–30.
[27] Schroeck FR, Krupski TL, Sun L, et al. Satisfaction and regret after open retropubic or robot-assisted laparoscopic radical prostatectomy. Eur Urol 2008;54:785–93.
[28] Mouraviev V, Nosnik I, Sun L, et al. Financial comparative analysis of minimally invasive surgery to open surgery for localized prostate cancer: a single-institution experience. Urology 2007;69:311–4.
[29] Zeliadt SB, Etzioni R, Ramsey SD, et al. Trends in treatment costs for localized prostate cancer: the healthy screenee effect. Med Care 2007;45:154–9.

Editorial Comment on: Cost Comparison of Robotic, Laparoscopic and Open Radical Prostatectomy for Prostate Cancer

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In this paper, Bolenz and coworkers present a detailed cost analysis of the various surgical approaches for radical prostatectomy (RP) [1]. The message of this study is clear: Robotic-assisted RP (RALP) is by far the most expensive surgical approach "on the market." The authors calculated additional costs of US$2315 for each case done with the robot, but this calculation still does not reflect "real life urology," as the purchase costs (US$1.5–1.75 million) and the maintenance fees (US$112 000–150 000 per year) were not included in this calculation. Bolenz et al stated that including these costs would add another US$2698 per case. Even though cost analyses differ from hospital to hospital and between health systems, the fact that RALP is extraordinarily more expensive than open RP will not change, regardless of how the calculations are done.

Are these extra costs justified? Maybe yes, if an advantage for RALP over other approaches were documented, but this is not currently the case. In a collaborative review article by Ficarra et al comparing results of the various approaches, it was surgical volume that mattered, and RALP was not superior to conventional laparoscopy or open RP [2]. In a population-based study (which reflects daily routine much better than the results of extra-high-volume surgeons), Hu et al [3] showed that the likelihood of a salvage therapy due to cancer recurrence increased when minimally invasive approaches were used. In other words, in this large-scale study, cancer-control rates were compromised when the robot was used.

What about functional outcome? Mulhall and coworkers showed that many Web sites advertise RALP with the promise of better potency and urinary continence rates (usually without having data) [4]. A recently published *JAMA* paper, however, reported that patients who underwent RALP had worse functional outcome compared to open RP [5]. Furthermore, Schroeck and coworkers showed that the likelihood of regretting a treatment decision was higher when patients underwent RALP compared to open RP [6].

Robotic surgery is a fascinating approach, and we use a robot in our hospital with results that are comparable to open surgery; however, a growing body of evidence shows that the results of RALP are not superior to other surgical approaches. It is certainly up to urologists to give the patient a realistic view of what he can expect when prostate surgery is performed. Furthermore—and this is what the paper from Bolenz et al emphasizes—we must be aware of our responsibility to society and to our patients to deliver the best possible care at justifiable cost.

References

[1] Bolenz C, Gupta A, Hotze T, et al. Cost comparison of robotic, laparoscopic, and open radical prostatectomy for prostate cancer. Eur Urol 2010;57:453–8.
[2] Ficarra V, Novara G, Artibani W, et al. Retropubic, laparoscopic, and robot-assisted radical prostatectomy: a systematic review and cumulative analysis of comparative studies. Eur Urol 2009;55:1037–63.
[3] Hu JC, Wang Q, Pashos CL, et al. Utilization and outcomes of minimally invasive radical prostatectomy. J Clin Oncol 2008;26:2278–84.
[4] Mulhall JP, Rojaz-Cruz C, Müller A. An analysis of sexual health information on radical prostatectomy websites. BJU Int. In press.
[5] Hu JC, Gu X, Lipsitz SR, et al. Comparative effectiveness of minimally invasive vs open radical prostatectomy. JAMA 2009;302:1557–64.
[6] Schroeck FR, Krupski TL, Sun L, et al. Satisfaction and regret after open retropubic or robot-assisted laparoscopic radical prostatectomy. Eur Urol 2008;54:785–93.

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