Transition from open to robotic-assisted radical prostatectomy is associated with a reduction of positive surgical margins amongst private-practice-based urologists

Ralph Madeb · Dragan Golijanin · Joy Knopf · Craig Nicholson · Stuart Cramer · Frederick Tonetti · Kelly Piccone · John R. Valvo · Louis Eichel

Received: 8 December 2006 / Accepted: 15 January 2007 / Published online: 23 February 2007
© Springer London 2007

Abstract Several recent studies have suggested that thought leaders in radical prostatectomy have decreased their own positive margin rates by switching from open to robot-assisted radical prostatectomy. Theoretically, this improvement is largely attributed to enhanced visualization of the deep pelvis and precision of dissection afforded by the instrumentation. To date, it has not been determined if this phenomenon exists amongst non-fellowship-trained urologists in private practice. Herein, we describe the positive margin rates of two non-fellowship-trained private-practice urologists who converted from open radical retropubic prostatectomy to robot-assisted radical prostatectomy. The margin positivity data from two non-fellowship-trained private-practice urologists (surgeon 1 and surgeon 2) were reviewed retrospectively. The last 50 cases of open radical retropubic prostatectomy from each surgeon were compared with the first 50 robotic prostatectomy cases of surgeons 1 and 2, respectively. A positive surgical margin was defined as tumor present at the inked margin of the prostate. There was a significant decrease in the overall and pT2 positive margin rates for both surgeons. The overall positive margin rate and pT2 positive margin rate for surgeon 1 dropped from 44 to 20% and from 37 to 5.7%, respectively, after changing from open to robotic prostatectomy. For surgeon 2, the overall positive margin rate changed from 26 to 18% and the pT2 positive margin rate changed from 27.5 to 7% after converting. Changing from open to robotic-assisted radical prostatectomy may improve the ability of urologists to obtain negative surgical margins. With proper training this phenomenon does seem to apply to non-fellowship-trained urologists in private practice and can be realized within the first 50 cases performed.

Keywords Radical prostatectomy · Prostate cancer · Robotic-assisted · Positive margins

Introduction

An ever-increasing number of prostatectomies are being performed using the da Vinci robotic system [1–4]. Multiple reports over the past five years have described the advantages that are characteristically seen with robotic surgery, including decreased blood loss, shorter hospital stay, and a shorter convalescence with a faster return to daily activities and work [5–10]. More recently, functional results with regard to potency and continence after robotic prostatectomy have also been reported and have demonstrated results that are equal to the open approach [11–16].

In addition to issues regarding expedited recovery and potential advantages with regard to urinary control and sparing of potency, the primary goal of cancer control still remains the primary goal of the operation [17]. For robotic prostatectomy to be considered an alternative to the open approach, cancer control must be equivalent or better [17–20]. Because robotic prostatectomy is a relatively new technique, long-term follow-up data regarding cancer control is not available.
An early marker for oncologic efficacy after radical prostatectomy is the positive surgical margin rate. Cancer at the inked margin suggests incomplete resection and may be associated with a worse prognosis. Although, this point can be debated, a growing body of investigators agree that a positive margin may adversely affect cancer control [17–27]. Several recent studies have suggested that leaders in robotic prostatectomy have decreased their own positive margin rates by switching from open to robotic radical prostatectomy [5, 28–31]. Theoretically, this improvement is largely attributed to enhanced visualization of the deep pelvis and precision of dissection afforded by the instrumentation. To date, it has not been determined if this phenomenon is transferable to non-fellowship trained urologists in private practice. Herein, we describe the positive margin rates of two non-fellowship trained private practice urologists who converted from open radical retropubic prostatectomy to robot-assisted laparoscopic radical prostatectomy.

Methods

 Patients and study design

Our study was a retrospective outcome analysis of radical prostatectomies performed by two non-fellowship-trained private practice urologists. Both surgeons (J.R.V. and F.W.T.) have performed over 1,000 prostatectomies over a 20-year period. Their method of choice until September 2004 for removal of the prostate for clinically localized prostate cancer was open radical retropubic prostatectomy. In September 2004 both surgeons changed to robotic prostatectomy for all radical prostatectomies. Operative and pathologic data was collected via retrospective chart review for the last 50 open radical prostatectomies performed by surgeons 1 and 2 and compared to similar data collected for the first 50 robotic prostatectomies. Table 1 compares the demographics of both cohorts.

The indications for robotic and open prostatectomy were identical. Patients with clinically localized prostate cancer were offered all standard treatment modalities including watchful waiting, hormonal ablation therapy, radical prostatectomy, and radiotherapy (brachytherapy and external beam). Previous abdominal surgery, including preperitoneal hernia repair with mesh, was not considered to be a contraindication for robotic prostatectomy. Open radical prostatectomy was performed as described by Walsh et al. [32, 33], while the robotic approach was performed as described by Ahlering et al. [5, 28]

Pathologic data

A positive surgical margin was defined as the presence of tumor at the inked margin of the specimen. The same pathologic teams evaluated the specimens and were aware of the switch from the open to robotic technique. The final first read of the specimen were used for evaluating positive surgical margins. No specimen required a re-read and none of the specimens were changed from their final read. In addition, there was no change in the method of sectioning or reporting methods during the study period.

Table 1: Characteristics of both surgeons’ last 50 open retropubic and first 50 robotic prostatectomies

| Characteristic             | Open cases | Robotic cases | P value |
|---------------------------|------------|---------------|---------|
| Number of cases (both surgeons) | 100        | 100           |         |
| Age 64.9                  | 62.6       | 0.03          |
| Pre-operative PSA (ng/ml)  | 8.51       | 7.33          | 0.3     |
| Gleason score (median)     | 6 6        | 0.4           |
| Mean prostate weight      | 51.0       | 42.3          | 0.01    |
| EBL (mean) (cc) 710       | 170        | 0.001         |
| Low-risk profile<10 PSA, Gleason score <6, stage T1c or T2A | 62 59 | 0.8 |
| Intermediate-risk profile  | 27 31      | 0.8           |
| High-risk profile>10 PSA, Gleason score ≥8, stage T2C | 9 10 | 0.8 |

*Low-risk profile = PSA < 10, Gleason score ≤ 6, clinical stage T1c or T2A
*Intermediate-risk profile = PSA 10–20, Gleason score 7, stage T2B
*High-risk profile = PSA >10, Gleason score ≥ 8, stage T2C

Results

The transition to robotic prostatectomy in our private-practice setting occurred on September 1, 2004. None of the robotic prostatectomies for either surgeon required conversion to open surgery. Since there was a transition point for a change in the surgical technique we do not feel that there is a selection bias between both groups as they represent all new-
comers to our practice. To ensure that the open surgery and robotic surgery groups were clinically comparable, the pre-operative clinical parameters were attained and are presented in Table 1. There were no significant differences between the groups with regard to age, pre-operative PSA or Gleason score. In addition, when stratified by risk profile there was no significant difference between the number of low-, intermediate-, and high-risk patients in each cohort (Table 1).

Table 2 compares the positive surgical margin rates in both groups of patients for both surgeons. The overall positive margin rate and pT2 positive margin rate for surgeon 1 dropped from 44 to 20% and from 37 to 5.7%, respectively, after changing from open to robotic prostatectomy. For surgeon 2, the overall positive margin rate decreased from 26 to 18% and the pT2 positive margin rate decreased from 37 to 7% after converting from open to robotic prostatectomy. A review of the locations for the positive margins in Table 3, demonstrates that the majority of positive margins for both surgeons in the open approach was at the apex, while for the robotic approach they were primarily at the bladder neck for one surgeon and posterolateral for the other.

### Discussion

Several studies have demonstrated that a positive surgical margin in a radical prostatectomy specimen is an independent predictor of disease recurrence, and the need to receive adjuvant therapy [17, 19, 21, 24–26, 34]. Therefore, prevention of positive surgical margins is a critical endpoint of radical prostatectomy. In a study performed by Eastham et al., it was demonstrated that the surgeon is an independent risk factor for positive surgical margins even after adjusting for various patient and disease characteristics. It was also found that surgeons with higher-volume practices have lower positive surgical margin rates [24]. Theoretically, the lower positive margin rates amongst high-volume surgeons is the result of technique refinement. The data has varied with regard to the impact of surgical technique on surgical margin status. A recent review of the open radical prostatectomy literature shows the incidence of positive surgical margins to ranges from 10 to 48% [24]. The positive margin rates for laparoscopic and robotic prostatectomy are relatively comparable and range between 5.7 and 29% [35–38].

Several recent reports regarding surgical margin status in conjunction with the known advantages of robotic prostatectomy have demonstrated that expert open prostatectomists exhibit an improvement in their personal positive surgical margin rates after switching to the robotic approach [5, 7, 28–30, 39]. Ahlering et al. has shown with the use of the da Vinci robot, surgeons can potentially benefit from the advantages of minimally invasive surgery and also be able to markedly reduce the risk of iatrogenic positive margins in patients with pT2 prostate cancer. This phenomenon has been replicated at several centers of excellence, but it is not known if this phenomenon applies to the private-practice urologist and, if so, what may be the key factors governing the robotic benefit. We believe that that the superior positive margin rates obtained after converting to the robotic-assisted approach can be explained by two main factors. The most critical factor was that the individual surgeons made a concerted effort to retrain in how to perform the procedure by observing and emulating experts. Second, the magnified three-dimensional (3-D) view of the pelvis, the precision movements afforded by the articulating robotic instrumentation and the bloodless field secondary to the pneumoperitoneum fostered a more precise dissection of the prostate. In combination, these two factors seemed to make a marked difference with regard to the ability of these two surgeons to obtain surgical margins.

Of critical importance to the successful improvement of margins was the seamlessness of the transition
from open to robotic-assisted procedures. This was
facilitated by several factors. First, both surgeons were
proctored in their adoption of the robotic platform.
The most critical factor was that the individual sur-
guenes made a concerted effort to retrain in how to per-
form the procedure by observing and emulating experts. After attending a three-day training course at
University of California, Irvine, consisting of observation
and cadaver training in the laboratory, the two surgeons
returned to their institutions and made a
100% conversion from open to robotic prostatectomy.
Surgeon 1 had his first four cases proctored by an
expert in robotic prostatectomy that acted as the bed-
side assistant for the cases. This greatly aided in acquir-
ing proficiency at an early stage. Thereafter surgeon 1
was assisted by another robotic-trained but nonexpert
attending urologist or a robotic-trained chief urology
resident. Surgeon 2 also had 4 cases proctored by an
expert robotic surgeon who acted as a bedside assistant
but also had some additional training during the first 20
cases, during which an expert robotic surgeon acted as
the bedside assistant while giving real-time feedback
and input. Traditionally, the proctor for the first few
robotic prostatectomies does not scrub in as an assis-
tant; they give verbal instruction and advice. We feel
that having a hands-on expert proctor as the assistant
made a major difference with regard to achieving profi-
ciency more quickly. In addition to aforementioned
factors, the well-described advantages of the da Vinci
robotic system (magnified 3-D view of the pelvis, the
precision movements afforded by the articulating
robotic instrumentation) as well as the bloodless field
secondary to the pneumoperitoneum fostered a more
precise dissection of the prostate. Secondly, a dedi-
cated surgical staff was in place, including nurses and
technologists all of whom underwent thorough training
to familiarize them with the robot. And finally, the
bedside surgical assistants were all comfortable with
the robot, familiar with the surgery, and had them-
selves spent time at the console. With chief and senior
residents at our institution logging roughly 50 robotic
prostatectomies, and averaging 15 as primary surgeon,
the bedside assistants were clearly quite facile with the
entire procedure and greatly aided in making the tran-
sition as smooth as possible. All of these factors allow-
ing this ease of transition were made possible by
absolute dedication to the robotic platform. As was
previously noted, since the decision to adopt the robot
was made, only two case has been performed in the
open manner. This has allowed full personnel and insti-
tutional commitment to the robotic approach. The
wholehearted adoption allowed for rapid assimilation
of the knowledge and skills, which are evidenced by
the ability of these two surgeons to obtain negative sur-
gical margins.

The open and robotic-assisted groups were similar
with regard to preoperative characteristics and the
transition from 100% open to 100% robotic prostatec-
tomies was made abruptly in September of 2004 with
no mixing of techniques. Therefore, we do not believe
that the stated results can be explained by selection
bias.

It might be argued that the perceived improvement
in positive margin rates was attributable to the high
number of positive margins in the open group.
Although, the positive margin rates were high in the
open group for both surgeons (36.6 and 27.5%), they
are still within the reported range noted in a current
study [24]. Since most urologists do not routinely keep
track of their margin data, we believe that these high
rates may be reflective of many others. We feel
strongly that the process of retraining and taking
advantage of the robotic technology may help urolo-
gists improve their results markedly.

Finally, upon reviewing the locations for the positive
margins, we learned that the majority of positive mar-
gins for both surgeons in the open approach was at the
apex, indicating a likely problem with visualization of
the deep pelvis, while during the robotic approach they
were primarily at the bladder neck for one surgeon and
posterolateral for the other. Since making this realiza-
tion both surgeons have made concerted efforts to fur-
ther refine their technique of dissection in these areas.
Although not routinely performed during the study
period, a video review of the cases with positive mar-
gins would have been helpful in this regard.

Conclusion

Changing from open to robotic-assisted radical prosta-
tectomy may improve the ability of urologists to obtain
negative surgical margins. This phenomenon does
seem to apply to non-fellowship-trained urologists in
private practice provided they undergo formal robotic
training, and can be realized within the first 50 cases
performed. Finally, it is only through the maintenance
of a surgical database that stark realizations such as the
results outlined in this paper can be realized.

References

1. Ahlering TE (2006) Robotic prostatectomy: is it the future?
Urol Oncol 24:1–3
2. Eichel L, Ahlering TE, Clayman RV (2004) Role of robotics in
laparoscopic urologic surgery. Urol Clin North Am 31:781–792
3. Hemal AK, Menon M (2004) Robotics in urology. Curr Opin Urol 14:89–93
4. Kaul S, Menon M (2006) Robotic radical prostatectomy: evolution from conventional to VIP. World J Urol 24:152–160
5. Ahlering TE, Skarecky D, Lee D, Clayman RV (2003) Successful transfer of open surgical skills to a laparoscopic environment using a robotic interface: initial experience with laparoscopic radical prostatectomy. J Urol 170:1738–1741
6. Menon M, Tewari A, Peabody J (2003) Vattikuti Institute prostatectomy: technique. J Urol 169:2289–2292
7. Menon M, Hemal AK (2004) Vattikuti Institute prostatectomy: a technique of robotic radical prostatectomy: experience in more than 1000 cases. J Endourol 18:611–619
8. Tewari A, Peabody J, Sarle R et al (2002) Technique of da Vinci robot-assisted anatomic radical prostatectomy. Urology 60:569–572
9. Tewari A, Menon M (2003) Vattikuti Institute prostatectomy: surgical technique and current results. Curr Urol Rep 4:119–123
10. Tewari A, Kaul S, Menon M (2005) Robotic radical prostatectomy: a minimally invasive therapy for prostate cancer. Curr Urol Rep 6:45–48
11. Ahlering TE, Eichel L, Skarecky D (2005) Rapid communication: early potency outcomes with cauter-y-free neurovascular bundle preservation with robotic laparoscopic radical prostatectomy. J Endourol 19:715–718
12. Ahlering TE, Eichel L, Chou D, Skarecky DW (2005) Feasibility study for robotic radical prostatectomy cauter-y-free neurovascular bundle preservation. Urology 65:994–997
13. Ahlering TE, Skarecky D, Borin J (2006) Impact of cautery versus cautery-free preservation of neurovascular bundles on early return of potency. J Endourol 20:586–589
14. Menon M, Hemal AK, Tewari A, Shrivastava A, Bhandari A (2004) The technique of apical dissection of the prostate and urethrovaginal anastomosis in robotic radical prostatectomy. BJU Int 93:715–719
15. Tewari A, Peabody JO, Fischer M et al (2003) An operative and anatomic study to help in nerve sparing during laparoscopic and robotic radical prostatectomy. Eur Urol 43:444–454
16. Tewari A, Takenaka A, Mtuie et al (2006) The proximal neurovascular plate and the tri-zenal neural architecture around the prostate gland: importance in the athermal robotic technique of nerve-sparing prostatectomy. BJU Int 98:314–323
17. Bianco F Jr, Riedel ER, Legg CB, Kattan MW, Scardino PT (2005) Variations among high volume surgeons in the rate of complications after radical prostatectomy; further evidence that technique matters. J Urol 173:2099–2103
18. Zincke H, Oesterling JE, Blute ML, Bergstrahl EJ, Myers RP, Barrett DM (1994) Long-term (15 years) results after radical prostatectomy for clinically localized (stage T2c or lower) prostate cancer. J Urol 152:1850–1857
19. Bianco F Jr, Scardino PT, Eastham JA (2005) Radical prostatectomy: long-term cancer control and recovery of sexual and urinary function (“trifecta”). Urology 66:83–94
20. Hull GW, Rabbani F, Abbas F, Wheeler TM, Kattan MW, Scardino PT (2002) Cancer control with radical prostatectomy alone in 1,000 consecutive patients. J Urol 167:528–534
21. Blute ML, Bostwick DG, Bergstrahl EJ et al (1997) Anatomic site-specific positive margins in organ-confined prostate cancer and its impact on outcome after radical prostatectomy. Urology 50:733–739
22. Catalona WJ, Smith DS (1994) 5-year tumor recurrence rates after anatomical radical retropubic prostatectomy for prostate cancer. J Urol 152:1837–1842
23. Chang SS, Cookson MS (2006) Impact of positive surgical margins after radical prostatectomy. Urology 68:249–252
24. Eastham JA, Kattan MW, Riedel E et al (2003) Variations among individual surgeons in the rate of positive surgical margins in radical prostatectomy specimens. J Urol 170:2292–2295
25. Karakiewicz PI, Eastham JA, Graefen M et al (2005) Prognostic impact of positive surgical margins in surgically treated prostate cancer: multi-institutional assessment of 5831 patients. Urology 66:1245–1250
26. Ohori M, Wheeler TM, Kattan MW, Goto Y, Scardino PT (1995) Prognostic significance of positive surgical margins in radical prostatectomy specimens. J Urol 154:1818–1824
27. Wieder JA, Soloway MS (1998) Incidence, etiology, location, prevention and treatment of positive surgical margins after radical prostatectomy for prostate cancer. J Urol 160:299–315
28. Ahlering TE, Eichel L, Edwards RA, Lee DI, Skarecky DW (2004) Robotic radical prostatectomy: a technique to reduce pT2 positive margins. Urology 64:1224–1228
29. Ahlering TE, Woo D, Eichel L, Lee DI, Edwards R, Skarecky DW (2004) Robot-assisted versus open radical prostatectomy: a comparison of one surgeon’s outcomes. Urology 63:819–822
30. Menon M, Tewari A, Baize B, Guillonneau B, Vallancien G (2002) Prospective comparison of radical retropubic prostatectomy and robot-assisted anatomic prostatectomy: the Vattikuti Urology Institute experience. Urology 60:864–868
31. Tewari A, Srivasatava A, Menon M (2003) A prospective comparison of radical retropubic and robot-assisted prostatectomy: experience in one institution. BJU Int 92:205–210
32. Reiner WG, Walsh PC (1979) An anatomical approach to the surgical management of the dorsal vein and Santorini’s plexus during radical retropubic surgery. J Urol 121:198–200
33. Walsh PC, Lepor H, Eggleston JC (1983) Radical prostatectomy with preservation of sexual function: anatomical and pathological considerations. Prostate 4:473–485
34. Epstein JI (1996) Incidence and significance of positive margins in radical prostatectomy specimens. Urol Clin North Am 23:651–663
35. Guillonneau B, el-Fettouh H, Baumert H et al (2003) Laparoscopic radical prostatectomy: oncological evaluation after 1,000 cases a Montsouris Institute. J Urol 169:1261–1266
36. Katz R, Salomon L, Hoznek A, de la TA, Antiphon P, Abbou CC (2003) Positive surgical margins in laparoscopic radical prostatectomy: the impact of apical dissection, bladder neck remodeling and nerve preservation. J Urol 169:2049–2052
37. Secin FP, Karanikolas N, Kuroiwa K, Vickers A, Touijer K, Guillonneau B (2005) Positive surgical margins and accessory pudendal artery preservation during laparoscopic radical prostatectomy. Eur Urol 48:786–792
38. Turk I, Deger S, Winkelmann B, Schonberger B, Loening SA (2001) Laparoscopic radical prostatectomy. Technical aspects and experience with 125 cases. Eur Urol 40:46–52
39. Patel VR, Tully AS, Holmes R, Lindsey J (2005) Robotic radical prostatectomy in the community setting—the learning curve and beyond: initial 200 cases. J Urol 174:269–272