



Robotic-Assisted Laparoscopic Radical Prostatectomy:

A Review of the Initial Liberty Hospital Experience

Justin M. Albani, MD

Janis Watkins, MS, RN, OCN, CHPN

Erin Salmon, RN, CTR

R

esponsible for more than 186,000 new cases and 28,000 deaths in 2008 alone, prostate cancer is the second most common malignancy affecting men in the United States.¹ Treatment options for patients diagnosed with this disease include active surveillance, radioactive seed implantation (brachytherapy), external beam radiotherapy and surgical removal. Surgical removal, also known as radical prostatectomy, is considered by many physicians as the preferred method of treatment for men with organ-confined, clinically significant disease with at least 10 years of life expectancy. This treatment has demonstrated a decrease in 10-year overall mortality, disease-specific mortality and risk of metastases.²

Since first described in 1905, open radical prostatectomy has remained the gold standard for long-term cure; however, it is often associated with significant side effects, including blood loss, prolonged recovery and difficulty with urinary control (continence) and erectile function

(potency).³ Many significant refinements have been made to the procedure over the last two decades, including the adoption of a laparoscopic approach.⁴ While this technique has been associated with less blood loss, a faster recovery and less pain, it has not been widely implemented due to its marked complexity and steep learning curve. With the development of the computer-assisted platform known as the da Vinci™ Surgical System (Intuitive Surgical,® Inc., Sunnyvale, Calif.), the first robotic-assisted laparoscopic prostatectomy was reported in 2000, thus ushering in a new era of minimally invasive surgery.⁵ This system provides the surgeon with a magnified three-dimensional view of the operative field, wristed instrumentation, ergonomic positioning, and intuitive motion, thus greatly facilitating the ability to perform complex laparoscopic procedures, such as laparoscopic prostatectomy. Within the last nine years, the robotic-assisted approach for prostate removal has been widely adopted with more than 1,100 surgical systems installed globally and more than 65% of all prostatectomies being performed using this technology (personal communication, Intuitive Surgical®, Inc.). Liberty Hospital embraced this technology after purchasing the da Vinci S™ Surgical System in October of 2006. Since that time, more than 120 robotic-assisted procedures have been performed to date. This technology has allowed Liberty Hospital to offer state-of-the-art urologic care for all patients of northwest Missouri with promising outcomes regarding blood loss, length of hospital stay,

rapid convalescence, continence, cancer control and potency. Here we review the preliminary outcomes of the first 95 robotic-assisted prostatectomies (RALP) performed at Liberty Hospital between October 2006 and December 2008.

Patient Characteristics

For a detailed overview of the patients treated at Liberty Hospital for prostate cancer, please refer to *Table 1*. Briefly, the median age of the prostatectomy patient in this cohort was 62 years of age, with a median PSA of 5.4 ng/ml. As expected in our population of PSA-screened individuals, most of the cancers detected were clinical T1 lesions, that is, detectable only by an elevated PSA followed by a prostate biopsy, confirming the diagnosis. While the majority of these diagnosed cancers were classified as less aggressive, Gleason 6 (57.9%), a significant portion were of intermediate grade, Gleason 7 (33.7%) and high-grade Gleason 8 and 9 (8.8%), suggesting that these cancers were clinically significant and warranted surgical treatment.

More than one-third of all patients treated were classified as morbidly obese (BMI >30 kg/m²) and more than 50% had significant preoperative erectile dysfunction.

Perioperative Outcomes

Recognizing the difficulty in providing meaningful data with such limited follow-up in this initial review, our early outcomes appear consistent with the reported literature. (Please refer to *Table 2*.)

Liberty Hospital Patient Characteristics

No. Patients:	95
Caucasian	92 (96.8%)
African American	2 (2.1%)
Asian & S. Asian	0 (0%)
Latin American	1 (1.1%)

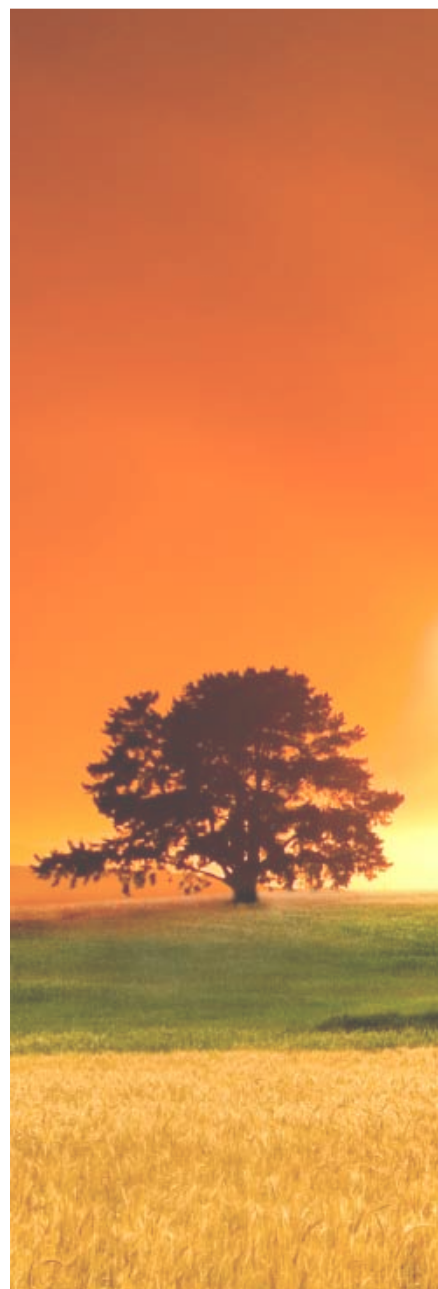
Median Age:	62 years	Range (46-76)
Median BMI:	28.9 kg/m ²	Range (20.1-50.6)
% Obese	34.7 %	
Median PSA:	5.4 ng/ml	Range (1.05-66.6)
% with Preoperative ED	50 (52.6%)	

Preoperative Staging		
T1a	1	(1.1%)
T1c	77	(81%)
T2a	16	(16.8%)
T2b	1	(1.1%)

Preoperative Gleason Score		
6	55	(57.9%)
7	32	(33.7%)
8	5	(5.3%)
9	3	(3.1%)

*Obesity defined by BMI > 30 kg/m²

Table 1.





Estimated Blood Loss and Transfusion Rate

Historically, open prostatectomy has been associated with higher estimated blood loss (EBL) and transfusion rates ranging from 200-1500 ml and 24-67%, respectively.^{6,7,8} Several studies have noted a markedly decreased blood loss and lower transfusion rates in laparoscopic and robotic-assisted laparoscopic cases with an EBL reported between 75-900 ml and averaging approximately 200 ml.⁷ This is attributed to the pneumoperitoneum (insufflation of carbon dioxide gas in the abdomen) during laparoscopy that exerts pressure and thus diminishes blood loss caused by venous bleeding. We report a median EBL of 125 ml with a range of 75 to 900 ml and a transfusion rate of 4.2%. This is comparable to most RALP series noting a mean transfusion rate of 2.9%.^{8,7}

Length of Hospital Stay

Length of stay (LOS) is often considered a measure of the patients' rate of recovery. Traditional LOS after open prostatectomy ranges between one and three days.^{7,9} Studies evaluating this in patients undergoing RALP note an average LOS of 1.1 to 1.2 days.⁷ Our median LOS is two days; however, early in our experience, we commonly observed patients for an additional day and our practice now is a standard discharge on postoperative day one.

Liberty Hospital Postoperative Pathologic Data

Median Prostate Size (g)	43 g (11-119)
Final Pathologic Staging	
pT2a.....	8 (8.4%)
pT2b	4 (4.2%)
pT2c.....	63 (66.3%)
pT3a.....	17 (17.9%)
pT3b	3 (3.2%)
No. Patients with (+) LN.....	3 (3.1%)
No. Patients with metastases.....	2 (2.1%)
No Patients with PSM ^v	
pT2.....	9 (12%)
pT3.....	10 (50%)
No. Pts treated w radiotherapy....	
Salvage	
pT2	4 (4.2%)
pT3	0 (0%)
Adjuvant	
pT2	1 (1.1%)
pT3	6 (6.3%)

^vPSM = positive surgical margin

Table 2.

Operative Time

The mean operative time reported in robotic series ranges from 141-540 minutes and decreases with increasing surgeon experience.^{7,10-13} Our initial median operative time was reported at 345 minutes. This could be largely attributed to the learning curve required in establishing the robotics program at this institution as our current total operative times are routinely less than 240 minutes.

Oncologic Outcomes

While acknowledging that our limited follow-up in this initial review makes a durable oncologic evaluation difficult, positive surgical margins may be considered an early indicator of cancer control. The rates of positive surgical margin rates are quite variable and have been reported from as low as 2% to as high as 59%.¹⁴ Most series, however, report overall rates ranging from 6% to 26.4%.^{6,7,15} This rate is also dependent on the pathologic stage of the cancer, as more aggressive disease with extraprostatic extension (pT3) will certainly be associated with a greater percentage of positive margins. In our early experience, we report an overall positive margin rate of 20% (12% for pT2 disease, and 50% for pT3 disease), which is consistent with that reported in the literature (See Table 2). The majority of tumors removed were organ-confined pT2 cancers (78.9%) while 21.1% were pT3 or greater. At the end of this initial review, 93.7% of the patients were cancer-free (no detectable PSA) and 11 patients (11.6%) were treated with either salvage (4.2%) or adjuvant (7.4%) radiotherapy (Table 2 and Figure 1). Salvage radiotherapy was performed for those patients with a detectable and rising PSA > 0.1 ng/ml anytime after surgery, and adjuvant radiotherapy was recommended for patients with either high-grade (Gleason 4+3 = 7 or greater) disease with a positive surgical margin or T3a or greater pathologic staging with no evidence of metastases.

Surgical Complications

As with any procedure, patients are at risk for both major and minor complications from the surgical removal of the prostate. In our series, a major complication was defined as any condition within 90 days of the surgery requiring hospitalization, including wound infections, deep vein thromboses, renal failure, myocardial infarction, pulmonary embolus, et cetera. This was noted in 2.1% of our patients. More commonplace, less-severe complications are typically related specifically to the genitourinary tract, including postoperative urinary retention due to hematuria with clots (1.1%), urine leak (1.1%), urethral stricture formation (1.1%), and urinary retention after the catheter is removed (3.2%) (Table 2). Fortunately, these events are rare,

and these rates are consistent to that reported in the literature.^{8,7}

Continence

As perhaps the most important factor determining of quality of life after prostatectomy, continence in our study was strictly defined as requiring no pads to stay dry. This was evaluated by both physician inquiry as well as a patient self-reported questionnaire. We noted 8.4% of patients were dry immediately after the urinary catheter was removed 1 week after surgery.

Patients reported complete continence rates of 21.7%, 44.3%, 60.8%, 69.8%, 90.9% at 1, 3, 6, 9, 12 months after surgery. Additionally, 96.4% reported wearing 0 to 1 pad per day, usually

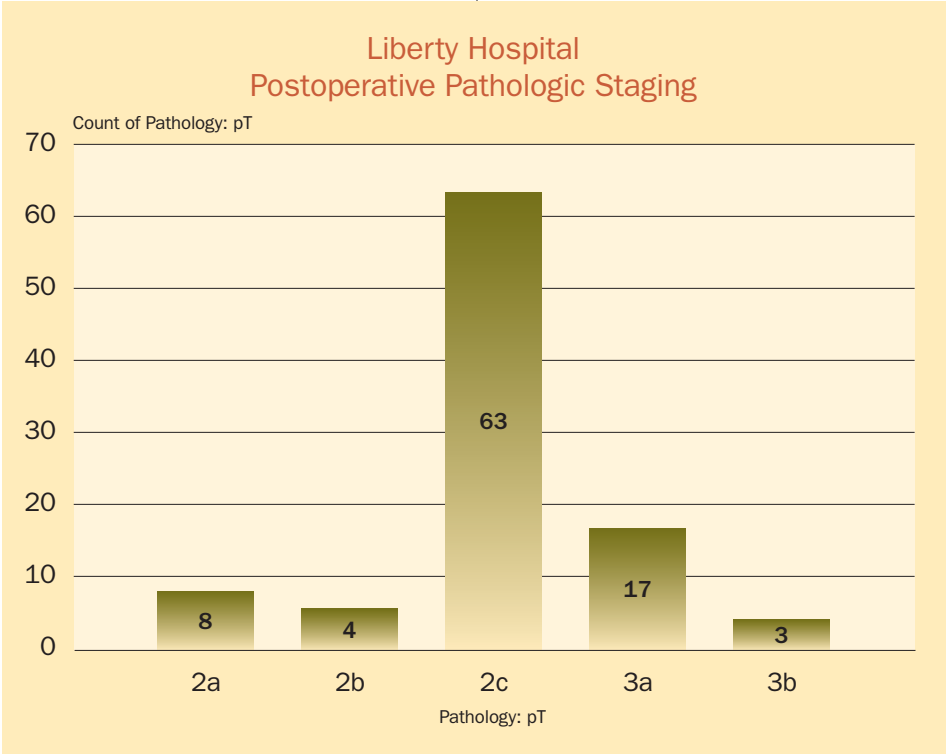


Figure 1.



for safety, 1 year after surgery. These findings are consistent with the literature quoting continence rates of 89-98% for patients wearing no pads or a single pad for security.^{7,8} These outcomes and those reported of other robotic prostatectomy series are similar to the open prostatectomy outcomes at 12 months; however, it appears that the rate of return to continence may be much more rapid in the robotic-assisted series. This is believed to be due to the ability of the surgical platform (with magnification and wristed instruments) to significantly preserve functional urethral length important in the recovery of continence in these patients.

Potency

Erectile function after prostatectomy is contingent upon several preoperative factors: a patient's preoperative erectile function, his age and comorbidities, and the ability of the surgeon to preserve or protect the neurovascular bundles (nerve and vascular tissue) responsible for innervation of the erectile pathways. In many instances, this may not be possible or preferred if the patient has high-volume or high-grade disease as these nerve fibers are often intimately related to the prostate itself, and sparing this tissue could result in sparing cancer and thus fail to cure the patient of his disease. Outcomes thus must be stratified for those patients who have undergone what is known as a "nerve-sparing approach" where this tissue is carefully teased away from the prostate in appropriately selected patients. In our series, this technique could only safely be applied in 66.3% of patients. Additionally, with more than 52.6% of the patients in

our study reporting significant preoperative erectile dysfunction, even preservation of these structures could not guarantee adequate potency. Accurately reporting preoperative and postoperative erectile function has been difficult as the definition of potency is often not well defined. We attempted to evaluate this objectively with a validated questionnaire, but as this is understandably an intensely personal area of interest, response rates were poor and thus unreliable for reporting. Anecdotally, we have seen some young men (age < 55 years of age) report erections sufficient for intercourse as early as two weeks after surgery while others have reported recovery up to two years after surgery. The published literature regarding postoperative erectile function including both open and robotic series is equally frustrating as several others report potency as merely having an erection rather than by any objective means. The data for most robotic series are somewhat immature but are reported as anywhere between 38-80% for all men of all ages.^{6,8} Despite the lack of mature data in the literature regarding postoperative function in robotic prostatectomies, most surgeons believe and are reporting equivalent or improved potency rates at earlier time points. This again is believed to be due to the surgical platforms' ability to offer a magnified view of the surgical field as well as articulating instruments that facilitate careful dissection that would allow maximal preservation of the nerve tissue responsible for erections when possible.

Safety

As with any mechanical or electrical system, technical problems can occur but are extremely rare. The da Vinci™ Surgical System has been constructed with a significant degree of redundancy, making it an extremely safe instrument. However, system malfunctions do occur, and in our initial experience, this led to cancellation in 2.1% of our patients. This is consistent to that reported in the literature where a multi-institutional study of more than 6,400 cases reported a 2.2% failure rate.⁷

Conclusions

Open radical prostatectomy remains the gold standard for the treatment of localized prostate cancer and has well-established oncological and functional outcomes. However, it is often associated with significant side effects including blood loss, prolonged recovery and difficulty with urinary control (continence) and erectile function (potency). The adoption of the laparoscopic approach in the late 1990s attempted to maximize these outcomes while improving patient quality of life, yet it was not embraced due to its marked complexity and steep learning curve. Robotic-assisted laparoscopic prostatectomy using the da Vinci™ Surgical System now allows the surgeon to offer again the benefits of minimally invasive surgery, coupled with the optimal outcomes reported with the open approach. A review of our initial experience with this technology at Liberty Hospital and of the literature suggest that this approach is associated with less blood loss, lower

transfusion rates, a shorter hospitalization, and less pain than the open approach with functional and oncologic outcomes that appear equivalent and potentially even superior. Although this technology is still in its infancy and no long-term follow-up studies are currently available, many series suggest that there may be an earlier return of continence and potency in patients undergoing this surgical approach. With its continued implementation and the availability of more long-term data, robotic-assisted surgery may soon become the new standard of care not only for surgery of the prostate but for all urologic diseases as well.

Liberty Hospital Perioperative Outcomes

Mean Follow up:.....	7.7 mo	(0-24.7)
Intraoperative:		
Median EBL	125 ml	
No. Pts with PLND	45 (47%)	
No Pts w Nerve Sparing Surgery.....	63 (66.3%)	
Postoperative:		
Median Length of Stay	2 days	
Blood Transfusion Rate.....	4.2%	
Median ↓ Hgb on discharge.....	2.6 g	
Median Duration of Catheter.....	7 days	
Major Complication Rate.....	2.1%	
GU Complication Rate.....	6.3%	
Bladder Neck Contracture.....	1.1%	
Clot Retention.....	1.1%	
Urine Leak	1.1%	
Urinary Retention.....	3.2%	

No. Biochemical disease free 93.7%

*Complete Urinary Continence at 12 mo..... 90.9%

^vEBL = estimated blood loss; PLND = pelvic lymph node dissection;* Continence = 0 pads

Table 3.





References

1. American Cancer Society. www.cancer.org (accessed 4 April 2009).
2. Alibhai SM, Gogov S. Radical prostatectomy for early prostate cancer improves long term survival. *Cancer Treat Rev* 2005;31(8):640-3.
3. Young H. The early diagnosis and radical cure of carcinoma of the prostate: being a study of 40 cases and presentation of a radical operation which was carried out in 4 cases. *Bull Johns Hopkins Hosp* 1905;16:315-21.
4. Schuessler WW, Schulam PG, Clayman RV, Kavoussi LR. Laparoscopic radical prostatectomy: initial short-term experience. *Urology* 1997;50(6):854-7.
5. Abbou CC, Hoznek A, Salomon L, et al. [Remote laparoscopic radical prostatectomy carried out with a robot. Report of a case]. *Prog Urol* 2000;10(4):520-3.
6. Hegarty NJ, Kaouk JH. Radical prostatectomy: a comparison of open, laparoscopic and robot-assisted laparoscopic techniques. *Can J Urol* 2006;13 Suppl 1:56-61.
7. Patel VR, Shah K, Palmer KJ, Thaly R, Coughlin G. Robotic-assisted laparoscopic radical prostatectomy: a report of the current state. *Expert Rev Anticancer Ther* 2007;7(9):1269-78.
8. Berryhill R, Jr., Jhaveri J, Yadav R, et al. Robotic prostatectomy: a review of outcomes compared with laparoscopic and open approaches. *Urology* 2008;72(1):15-23.
9. Tewari A, Srivasatava A, Menon M. A prospective comparison of radical retropubic and robot-assisted prostatectomy: experience in one institution. *BJU Int* 2003;92(3):205-10.
10. Menon M, Tewari A. Robotic radical prostatectomy and the Vattikuti Urology Institute technique: an interim analysis of results and technical points. *Urology* 2003;61(4 Suppl 1):15-20.
11. Bentas W, Wolfram M, Jones J, Brautigam R, Kramer W, Binder J. Robotic technology and the translation of open radical prostatectomy to laparoscopy: the early Frankfurt experience with robotic radical prostatectomy and one year follow-up. *Eur Urol* 2003;44(2):175-81.
12. Wolfram M, Brautigam R, Engl T, et al. Robotic-assisted laparoscopic radical prostatectomy: the Frankfurt technique. *World J Urol* 2003;21(3):128-32.
13. Ahlering TE, Skarecky D, Lee D, Clayman RV. Successful transfer of open surgical skills to a laparoscopic environment using a robotic interface: initial experience with laparoscopic radical prostatectomy. *J Urol* 2003;170(5):1738-41.
14. Sim HG, Yip SK, Lau WK, Tan JK, Cheng CW. Early experience with robot-assisted laparoscopic radical prostatectomy. *Asian J Surg* 2004;27(4):321-5.
15. Perrotti M, Moran ME. Robotic prostatectomy outcomes. *Urol Oncol* 2005;23(5):341-5.



mission

The Oncology program will fulfill the mission of Liberty Hospital by incorporating its values into ongoing efforts to provide high-quality cancer care. A multidisciplinary team approach is used to provide high-quality, community service, partnership, professionalism and efficiency throughout the continuum of care.

